



Federal Aviation
Administration

Final Programmatic Environmental Assessment for Front Range Airport Launch Site Operator License, Spaceport Colorado

August 2018



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FINAL PROGRAMMATIC ENVIRONMENTAL ASSESSMENT FOR FRONT RANGE AIRPORT LAUNCH SITE OPERATOR LICENSE, COLORADO

AGENCY: Federal Aviation Administration (FAA), lead Federal agency.

DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION: The FAA evaluated the Board of County Commissioners (the BOCC) of Adams County, Colorado's proposal to operate a commercial space launch site, called "Spaceport Colorado," at the Front Range Airport (FTG), in Watkins, Colorado, which would require the FAA to issue a launch site operator license. FTG is a 3,200-acre general aviation airport located in the northeast quadrant of the Denver metropolitan area and approximately 5 miles southeast of the Denver International Airport in Adams County, Colorado. Under the Proposed Action, the FAA would issue a launch site operator license to the BOCC, which would authorize the BOCC to offer Spaceport Colorado to commercial launch providers to conduct launch operations of horizontal take-off and horizontal landing reusable launch vehicles (RLVs). The FAA would also conditionally approve FTG's modified Airport Layout Plan (ALP) showing the launch site boundary. The Proposed Action does not include the approval of any launches. Any future application for a launch license would be subject to a separate environmental review, as explained in the Final PEA. The Final PEA evaluated the potential environmental impacts of the Proposed Action and the No Action Alternative. Under the No Action Alternative, the FAA would not issue a launch site operator license to the BOCC for the operation of Spaceport Colorado, FTG would not be available to potential RLV launch operators, and there would be no need for conditional approval of the FTG ALP.

CONTACT INFORMATION: Questions regarding the Final PEA can be addressed to Stacey Zee, Environmental Protection Specialist, Federal Aviation Administration, 800 Independence Avenue, SW, Suite 325, Washington, DC 20591; phone (202) 267-9305; email Spaceport_Colorado_PEA@icf.com.

After careful and thorough consideration of the facts contained herein and following consideration of the views of those Federal agencies having jurisdiction by law or special expertise with respect to the environmental impacts described, the undersigned finds that the Proposed Federal Action is consistent with existing national environmental policies and objectives as set forth in section 101(a) of the National Environmental Policy Act of 1969. This environmental assessment becomes a federal document when evaluated, signed, and dated by the responsible FAA official.

Responsible FAA Official:



Kelvin Coleman

Acting Associate Administrator for
Commercial Space Transportation

Date: Aug. 14, 2018

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DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Office of Commercial Space Transportation
Finding of No Significant Impact/Record of Decision
for
Final Programmatic Environmental Assessment for Front Range
Airport Launch Site Operator License, Spaceport Colorado

Summary

The Federal Aviation Administration (FAA) prepared the attached Final Programmatic Environmental Assessment (PEA) to analyze the potential environmental impacts of issuing a launch site operator license to the Adams County Board of County Commissioners (the BOCC) to operate a commercial space launch site at Front Range Airport (FTG) in Watkins, Colorado. The PEA was prepared 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 Regulations [CFR] parts 1500 to 1508); FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*.

After reviewing and analyzing available data and information on existing conditions and potential impacts, the FAA has determined the Proposed Action will not significantly affect the quality of the human environment. Therefore, the preparation of an Environmental Impact Statement is not required, and the FAA is issuing this Finding of No Significant Impact (FONSI) and Record of Decision (ROD). The FAA has made this determination in accordance with applicable environmental laws and FAA regulations. The Final PEA is incorporated by reference into this FONSI/ROD.

For any questions or to request a copy of the PEA, contact the following FAA Environmental Specialist. A copy of the PEA may also be obtained from the FAA's website:

https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_progress/front_range/

Stacey Zee
Environmental Specialist
Federal Aviation Administration
800 Independence Ave., SW, Suite 325
Washington DC 20591
Stacey.Zee@faa.gov
(202) 267-9305

Purpose and Need (Section 1.3 of the PEA)

The purpose of the FAA's Proposed Action in connection with the Adams County BOCC's request for a launch site operator license is to fulfill the FAA's responsibilities as authorized by Executive Order 12465, Commercial Expendable Launch Vehicle Activities (49 FR 7099, 3 CFR, 1984 Comp., p. 163) and the Commercial Space Launch Act (51 U.S.C. Subtitle V, ch. 509, §§ 50901-50923) for oversight of commercial space launch activities, including licensing launch activities. The need for FAA's Proposed Action results from the statutory direction from Congress under the U.S. Commercial Space Launch Competitiveness Act of 2015 to, in part, "promote commercial space launches and reentries by the private sector; facilitate Government, State, and private sector involvement in enhancing U.S. launch sites and facilities; and protect public health and safety, safety of property, national security interests, and foreign policy interests of the United States." Pub. L. 114-90, § 113(b). Additionally, Congress has determined the Federal Government is to "facilitate the strengthening and expansion of the United States space transportation infrastructure, including the enhancement of United States launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of United States space-related activities." 51 U.S.C. § 50901(b)(4).

The purpose of the Adams County BOCC's proposal to operate a commercial space launch site at FTG is to allow the Adams County BOCC to offer FTG to customers interested in conducting commercial space launch operations. It is the Adams County BOCC's belief that operation of such a launch site at an existing GA airport could bring commercial launch operators and supporting economic clusters to FTG, thus potentially enhancing the revenue potential of the existing airport (and/or tax revenue to the County). The Adams County BOCC's need for the proposed commercial space launch site is to capitalize

on the emerging economic opportunities in aerospace, advanced manufacturing, and related research and development activities closely related to commercial space operations.

Proposed Action (Section 2.1 of the PEA)

The Adams County BOCC's Proposed Action is to operate a commercial space launch site at FTG in Adams County, Colorado, and offer the site to one or more commercial launch operators for the operation of a horizontal take-off and horizontal landing RLV. To operate a commercial space launch site, the Adams County BOCC must obtain a launch site operator license from the FAA. The FAA's Proposed Action is to (1) issue a launch site operator license to the Adams County BOCC for the operation of a commercial space launch site at FTG, and (2) conditionally approve the modified ALP that shows the launch site boundary.¹ Conditional ALP approval is not a final FAA action.²

Alternatives (Chapter 2 of the PEA)

Alternatives analyzed in the PEA 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 the Adams County BOCC for the operation of a commercial space launch site at FTG. The No Action Alternative provides the basis for comparing the environmental consequences of the Proposed Action. The No Action Alternative would not meet the stated purpose and need.

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 the Adams County BOCC and FTG bear sole responsibility for compliance with the assurances. The Adams County BOCC and FTG are 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.

² Conditional ALP approval is not a final FAA action. As stated in FAA Order 5050.4B, Paragraph 202c(1) "(1) This approval signals that: (a) The proposed ALP depicts features that are safe and efficient for airport operations and airport use. (b) ARP has not yet completed its review of the environmental impacts the features depicted on the ALP would cause. ARP has not done so because the features are not yet needed and are not ripe for decision (see "tiering" paragraph 1403 of this Order for more information). or (c) The approving FAA official has not authorized the airport sponsor or project proponent to begin building the facilities shown on the conditionally approved ALP. The sponsor or proponent may start building those facilities only after the ARP completes its environmental analysis of those facilities and the approving FAA official issues an unconditional approval of the ALP depicting those facilities."

Public Involvement (Section 1.4 of the PEA)

In accordance with FAA Order 1050.1F paragraph 6.2.2.c, scoping is optional for EAs. For this PEA, the FAA conducted scoping by contacting agencies in 2013 via a scoping letter sent on September 30, 2013. Due to subsequent changes to the Adams County BOCC's proposal since the scoping letters were distributed, the FAA re-initiated scoping in June 2017 for this PEA. The FAA held a public scoping meeting on June 13, 2017, as well as stakeholder meetings in June, November, and December of 2017. Further information about scoping activities for this project is presented in Section 1.4.1 of the PEA and Appendix E, *Scoping Materials*.

On April 18, 2018, the FAA published the Draft PEA for a 30-day public comment period ending May 25, 2018. In response to preliminary comments received on the Draft PEA, the FAA extended the comment period from May 25, 2018 to June 15, 2018. The FAA also held a stakeholder meeting during the day and an evening public meeting on May 17, 2018 to solicit comments from stakeholders and the general public concerning the Draft PEA. At both the public meeting and stakeholder meeting, the FAA described the Proposed Action and No Action Alternative, potential impacts of the Proposed Action, and the environmental review process. The public meeting included a public statement period in which members of the public provided up to three-minute statements. Statements were recorded as public comments and are included in the public meeting transcript Appendix K of the PEA. In total, 129 public comments were received. As a result of the comments received, the FAA made minor revisions to the PEA and developed three new appendices. Appendix I provides a summary of the comments received and FAA's responses. Appendix J provides a copy of correspondence with Congressional representatives and the FAA. Appendix K includes copies of the comments received from the public.

Environmental Impacts

The potential environmental impacts from the Proposed Action and No Action Alternative were evaluated in the attached Final PEA for each environmental impact category identified in FAA Order 1050.1F. Chapter 3 of the Final PEA describes the affected environment and regulatory setting. In addition, Chapter 3 identifies those environmental impact categories that were not analyzed in detail, explaining why the Proposed Action would have no potential effect on those impact categories. Those categories are Coastal Resources; Department of Transportation Act, Section 4(f); Farmlands; Children's Environmental Health and Safety Risks; and Wild and Scenic Rivers.

Chapter 4 of the Final PEA provides evaluations of the potential environmental consequences of each alternative for each of the environmental impact categories analyzed in detail and documents the finding that no significant environmental impacts would result from the Proposed Action. The potential impacts analyzed include those associated with assumptions made regarding future launches and launch site related infrastructure as explained in chapters 1 and 2 of the PEA and in Appendix A. For purposes of the analysis conducted in the PEA, the FAA made these assumptions based upon the type of vehicle most likely to be proposed for launch at FTG (the conceptual reusable launch vehicle (RLV)) and the infrastructure needed to accommodate the conceptual RLV. These assumptions were based on the operational parameters set forth in Section 1.0 of the PEA. Thus, in this section the term “Proposed Action” should be interpreted to include those assumptions.

In addition, Chapter 4 addresses the requirements of special purpose laws, regulations, and executive orders.

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

- **Air Quality**, Final PEA, Section 4.1. Construction operations would include excavation and grading, asphalt demolition, gravel work (including truck delivery), concrete work (including truck delivery), utility trenching, and construction of the water tank. The primary emission sources during construction are standard types of heavy-duty diesel construction equipment and highway trucks that would deliver construction materials to the site. Emissions are expected to be substantially lower than the General Conformity Rule *de minimis* thresholds and therefore are not significant.

Operational emissions from the spaceport include emissions from launches, pre-launch run-up tests, static hot-fire engine testing on the mobile test stand, commuter emissions, and emissions from delivery vehicles. The pollutant with the largest quantity of emissions as a result of conceptual RLV operations would be carbon monoxide (CO). The annual CO emissions from 52 launches, 100 static hot-fire engine tests, and commuter emissions for 20 additional workers at FTG are estimated to be 52.23 tons per year, which is well under the General Conformity Rule *de minimis* threshold of 100 tons per year for CO. The remaining pollutant emissions are very small compared to the remaining conformity thresholds and the 2011 County emissions. The

estimated PM_{2.5}³ emissions, for example, are expected to be less than 0.03% of the 2011 Adams County PM_{2.5} emissions. Comparison of the emissions to the General Conformity Rule *de minimis* thresholds and regional emissions indicates that expected emissions from operations would be below threshold levels; therefore, they would not result in any National Ambient Air Quality Standard violations and would not be significant.

- **Biological Resources (including Fish, Wildlife, and Plants)**, Final PEA, Section 4.2. No federally or state listed species occur at the FTG and by implementing the Best Management Practices covered in the Erosion Control and Storm Water Quality Guide, the impacts to vegetation associated with the construction of the Proposed Action is expected to be minimal.

During operation, no impacts to vegetation are expected. Impacts to wildlife will be reduced by implementing the FTG Wildlife Hazard Management Plan, which will reduce the presence of wildlife on or near the runway. In addition, given that no state or federally listed species occur at FTG, no impact is expected. Sonic booms have the potential to disturb wildlife; however, because booms would be infrequent, of short duration, and similar to the sound of a thunder clap, no significant impacts are expected.

The FAA consulted with the U.S. Fish and Wildlife Service (USFWS) on impacts to federally listed species and determined that the project “*may affect, but is not likely to adversely affect*” the Preble’s meadow jumping mouse. The FAA sent a letter dated April 11, 2018 to USFWS requesting concurrence with this determination and the USFWS concurred with the FAA on June 4, 2018. Copies of the consultation letters are included in Appendix F, *Agency Consultation and Tribal Coordination* of the PEA. Based on the above reasons, the FAA determined the Proposed Action would not result in significant impacts to biological resources.

- **Climate**, Final PEA, Section 4.3. Construction and operation would produce greenhouse gas emissions; however, these emissions when combined with emissions from other FTG operations would be extremely small in the context of regional, national and global emissions. Therefore, any impact would be minimal.
- **Hazardous Materials, Solid Waste, and Pollution Prevention**, Final PEA, Section 4.4. No known contaminated sites exist in the vicinity of FTG so the likelihood of encountering contaminated

³ Fine particulate matter 2.5 microns or less in diameter.

media during construction is low. Any generated solid wastes will be hauled off-site for recycling or disposal at the nearest facilities and will not exceed local capacities.

While an increase in hazardous materials will occur during operation at FTG due to fuel, propellants and oxidizers required for launch operations, by ensuring compliance with all applicable federal, state and local regulations, including, but not limited to, EPA 40 CFR Part 112, Spill Prevention Control and Countermeasure Rule and the Emergency Planning and Community Right-to-Know Act, risks will be minimized. All hazardous pre-flight ground operations would be conducted in a specified location, for which appropriate safety clear zones would be established in accordance with FTG and launch operator licenses. Any hazardous waste generated as a result of operations would be required to be disposed of at licensed, permitted hazardous waste treatment, storage, and disposal facility in accordance with applicable regulations.

In the event of launch failure, the debris impacts would be expected to be contained within a FAA-approved hazard area. Due to limited number of launches per year and the low volume of propellants and other hazardous materials on board each RLV, the risks of impact due to a launch anomaly would be minimal. For each flight track and vehicle, FTG would work with the launch operator and the FAA to establish hazard areas to ensure public safety according to regulations in 14 CFR Part 431. Should a failure occur, the commercial launch operator would work with FTG and local response and regulatory agencies, as required, to ensure the area of impact be identified, characterized, and cleaned up. By implementing these actions, the potential for hazardous material impacts from construction and operations is low.

- **Historical, Architectural, Archaeological, and Cultural Resources**, Final PEA, Section 4.5. The State Historic Preservation Office (SHPO) previously concurred with the finding of no historic properties affected on January 6, 2016. In this correspondence, the SHPO noted that if any unidentified archaeological resources are discovered during construction, work must be interrupted until the resources have been evaluated in terms of National Register of Historic Places criteria. No impacts to historical, architectural, archaeological and cultural resources are expected as a result of the Proposed Action.

Due to changes in the FAA's proposal since the January 2016 letter, the FAA reinitiated consultation with the SHPO in a letter dated April 11, 2018. In accordance with 36 CFR § 800.4(d), the FAA made a finding of "*no historic properties affected.*" The SHPO provided

concurrence with this finding in a letter dated May 3, 2018. Copies of the consultation letters are included in Appendix F, *Agency Consultation and Tribal Coordination* of the PEA.

- **Land Use**, Final PEA, Section 4.6. The Proposed Action would not result in a change in land use designations or result in a land use that is inconsistent or incompatible with its zoning designation. Therefore, the Proposed Action would not have an impact on land use.
- **Natural Resources and Energy Supply**, Final PEA, Section 4.7. Given the small quantities of materials required, the construction of the proposed spaceport-related facilities would not result in any shortages of materials or energy in the Denver metropolitan area. During operation, kerosene, liquid oxygen (LOX) and minor quantities of other fuels and oxidizers would increase; however, due to proximity to distributors in the area, no impact upon chemicals or fuels is expected to the wider region. Therefore, no impacts to natural resources and energy supply are expected as a result of the Proposed Action.
- **Noise and Noise-Compatible Land Use**, Final PEA, Section 4.8. During construction, any noise impacts will be temporary and not expected to be audible beyond the airport property. While the highest potential for construction noise impacts would stem from trucks delivering construction materials and supplies to the site, these truck numbers are expected to average 5-10 per day, with 20-30 on high volume days. These volumes would result in moderate levels of increased noise during construction. To minimize the impact, trucks would be restricted to daylight hours and routed along Manila Road.

Operational noise would consist of take-off, flight, descent and static hot-fire tests, however, because the rocket engine would be ignited at 45,000 feet, the engine noise at ground level would be far below FAA significance criteria and well below any conventional human noise annoyance standard. Upon descent, the sonic boom produced by the RLV would be similar to a clap of thunder and substantially lower than FAA's significance criteria. The majority of the area within the sonic boom area is sparsely populated agricultural land. Other activities associated with the Proposed Action would not result in a significant noise impact since all annual day-night average (DNL) 65 dB contours are on airport property and the increase is less than 1.5 A-weighted decibels (dBA).

- **Socioeconomics and Environmental Justice**. Final PEA, Section 4.9. Construction and operation is expected to have limited impacts on population, employment, and housing in the area of the

Proposed Action. Minor positive impacts on the surrounding area would be likely due to a minor increase in employment, number of visitors, and the associated boost to the economy. No impact is anticipated in any environmental resource category for environmental justice given there are very few residential properties nearby and none of them would be impacted by the Proposed Action. As FTG has its own Aircraft Rescue and Firefighting Facility staff, no impacts to emergency services are expected.

Transportation impacts during construction are expected to be minor and only for the short duration of construction (3 months). The proposed access roads to and from the property would be well below capacity and no peak hour impacts are expected. The impacts from operation are anticipated to result from visitors coming to witness launches. These impacts are expected to be moderate and short-term as visitors arrive and depart within the same limited timeframes. FTG personnel have experience with these volumes for other events and have an event traffic management plan. FTG operations personnel would review traffic flow before and after the launches and make adjustments to the event traffic management plan as necessary.

- **Visual Effects (including Light Emissions)**, Final PEA, Section 4.10. The visual effects of the Proposed Action during construction and operation would be minor and incremental. These minor effects would be the addition of tanks and structures to the existing facilities on the property with some additional fencing and lighting. The RLVs would be visible during takeoff and landing, but given the low frequency and the current use of the site as an airport, any visual impacts would be negligible.
- **Water Resources (including Wetlands, Floodplains, Surface Waters, and Groundwater)**, Final PEA, Section 4.11. No wetlands or floodplains are present on the site. Surface water and ground water could be impacted by transport of sediment and contaminants and spills or leaks from construction equipment during construction; however, given the use of Best Management Practices required by state and local permits, any potential risks would be minimized. During operation, surface waters would likely only be impacted by fueling or storage failures. To minimize this risk, all storage and fueling would be in accordance with applicable regulations and in the event of a failure, FTG would utilize their Spill Prevention, Control and Countermeasures Plan.

Impacts to ground water would also be negligible. Water for operations would be obtained from a well 1,000 feet to the north and, due to the infrequent nature of launches, is not expected to

impact ground water supplies. Due to the low volume of impervious area being added, impacts to recharge rates are also expected to be minor.

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

Chapter 5 of the Final PEA 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.

Agency Finding and Decision Statement

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 PEA 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 PEA. In contrast, the No Action Alternative fails to meet the purpose and need identified in the Final PEA. 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 Final PEA and all its related materials, the undersigned has carefully considered the FAA's goals and objectives in relation to various aspects of the launch activities described in the Final PEA, including the purpose and need to be met, the alternative means of achieving them, the environmental impacts of these alternatives and the costs and benefits of achieving the stated purpose and need.

After careful and thorough consideration of the facts contained herein, the undersigned finds that 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.

APPROVED: 

DATE: Aug. 14, 2018

Kelvin Coleman
Acting Associate Administrator for Commercial Space Transportation

Decision and Order

Spaceport Colorado at the Front Range Airport (FTG) in Watkins, Colorado

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 spaceport at Front Range Airport 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 action be taken under the authority of 51 U.S.C. §§ 50901 et seq.:

Federal environmental approval for the issuance of a launch site operator license to the Adams County BOCC for the operation of a commercial space launch site at FTG. This environmental approval is subject to the environmental mitigation/avoidance measures identified in the Final PEA.

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.

Right of Appeal

This FONSI/ROD constitutes a final order of the FAA Administrator and is subject to exclusive judicial review under 49 U.S.C. § 46110 by the Courts of Appeal of the United States for the District of Columbia Circuit or in the Court of Appeals of the United States 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 filing a petition for review in the appropriate U.S. Court of Appeals no later than 60 days after the order is issued in accordance with the provisions of 49 U.S.C. § 46110.

Issued on: Aug. 14, 2018

A handwritten signature in black ink, appearing to read 'K. Coleman', written over a horizontal line.

Kelvin Coleman
Acting Associate Administrator for Commercial Space Transportation

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ACRONYMS AND ABBREVIATIONS

AIZ	Airport Influence Zone	ILS	instrument landing system
ALP	Airport Layout Plan	IPaC	Information, Planning, and Conservation System
APA	Centennial Airport	lb	pound
APE	Area of Potential Effects	lbf	pounds force
APEN	Air Pollution Emission Notice	LL	lower lead
ARFF	Aircraft Rescue and Firefighting Facility	LOA	Letter of Agreement
ARP	Office of Airports	LOX	liquid oxygen
ATC	Air Traffic Control	µg/m ³	micrograms per cubic meter
AV	Aviation	MSAT	Mobile Source Air Toxic
BJC	Rocky Mountain Metropolitan Airport	N ₂ O	nitrous oxide
BKF	Buckley Air Force Base	NAAQS	National Ambient Air Quality Standards
BOCC	Board of County Commissioners	NAS	National Airspace System
BMP	Best Management Practice	NEPA	National Environmental Policy Act
CPW	Colorado Parks and Wildlife	NLR	Noise Level Reduction
CEQ	Council on Environmental Quality	NO ₂	nitrogen dioxide
CFR	Code of Federal Regulations	NO _x	nitrogen oxide
CH ₄	methane	NOTAM	Notice to Airmen
CO	carbon monoxide	NRHP	National Register of Historic Places
CO ₂	carbon dioxide	O ₃	ozone
CO ₂ e	carbon dioxide equivalent	PEA	Programmatic Environmental Assessment
CST	Commercial Space Transportation	PM ₁₀	particulate matter less than or equal to 10 microns aerodynamic diameter
dB	decibel	PM _{2.5}	fine particulate matter less than or equal to 2.5 microns aerodynamic diameter
dba	A-weighted decibel	ppb	parts per billion
DEN	Denver International Airport	ppm	parts per million
DNL	Day-Night-Average Sound Level	psf	pounds per square foot
EA	Environmental Assessment	PUD	Planned Use Development
EIS	Environmental Impact Statement	RLV	Reusable Launch Vehicle
EO	Executive Order	ROI	Region of Influence
EPA	U.S. Environmental Protection Agency	SF ₆	sulfur hexafluoride
ESA	Endangered Species Act of 1973	SHPO	State Historic Preservation Officer
FAA	Federal Aviation Administration	SO ₂	sulfur dioxide
FNL	Fort Collins - Loveland Municipal Airport	SSC	State Special Concern
ft	feet	U.S.	United States
FTG	Front Range Airport	U.S.C.	United States Code
GA	general aviation	USFWS	U.S. Fish and Wildlife Service
GHG	greenhouse gas	VOC	volatile organic compound
GXY	Greeley-Weld County Airport	WWTP	Waste Water Treatment Plant
HAP	hazardous air pollutant		
I-70	Interstate 70		
IFR	Instrument Flight Rules		

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1.0 INTRODUCTION

The Board of County Commissioners (the BOCC) of Adams County, Colorado, proposes to operate a commercial space launch site, called “Spaceport Colorado,” at the Front Range Airport (FTG), located in Watkins, Colorado (Exhibit 1-1). FTG is located just east-southeast of Denver International Airport (DEN), with a distance of just under 5 statute miles from the westernmost runway end at FTG to the southeasternmost existing runway end at DEN. The Adams County BOCC would offer the site to one or more commercial launch operators for the operation of horizontal take-off and horizontal landing reusable launch vehicles (RLVs).

To operate a commercial space launch site, the Adams County BOCC must obtain a launch site operator license from the Federal Aviation Administration (FAA). The FAA is preparing a Programmatic Environmental Assessment (PEA) for this action. Under the Proposed Action addressed in this PEA, the FAA would:

- Issue a launch site operator license to the Adams County BOCC for the operation of a commercial space launch site at FTG; and
- Conditionally approve FTG’s modified Airport Layout Plan (ALP) showing the launch site boundary.¹

If approved, a launch site operator license would be issued to FTG in 2018 and would remain in effect for a 5-year term. After the initial 5-year term, FTG may apply for a license renewal (see Section 1.2.1, *FAA Licenses*, for further discussion of licensing).

The Proposed Action is subject to environmental review under the National Environmental Policy Act (NEPA) as amended (42 United States Code [U.S.C.] § 4321, *et seq.*). The Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] Parts 1500-1508) (CEQ Regulations) allow for federal agencies to prepare programmatic NEPA documents for broad federal actions (40 CFR § 1502.4). A programmatic document is a type of general, broad NEPA review from which subsequent NEPA documents can be tiered,

¹ Conditional ALP approval is not a final FAA action. As stated in FAA Order 5050.4B, Paragraph 202c(1) “(1) This approval signals that: (a) The proposed ALP depicts features that are safe and efficient for airport operations and airport use. (b) ARP has not yet completed its review of the environmental impacts the features depicted on the ALP would cause. ARP has not done so because the features are not yet needed and are not ripe for decision (see “tiering” paragraph 1403 of this Order for more information). or (c) The approving FAA official has not authorized the airport sponsor or project proponent to begin building the facilities shown on the conditionally approved ALP. The sponsor or proponent may start building those facilities only after the ARP completes its environmental analysis of those facilities and the approving FAA official issues an unconditional approval of the ALP depicting those facilities.”

focusing on the issues specific to the subsequent action (40 CFR § 1502.2). Programmatic NEPA documents may be prepared for broad federal actions, such as a proposed program, policy, plan, or suite of projects, which address actions occurring over large areas or systems and may include groupings of similar actions or repeating actions over longer periods of time than other NEPA reviews.² The FAA has recognized that a programmatic review and tiering may be appropriate “to sequence environmental documents from the early stage of a proposed action (e.g., need for the action and site selection) to a subsequent stage (e.g., proposed construction) to help focus on issues that are ripe for decision and exclude from consideration issues not yet ripe or already decided.” See Paragraph 3-2, FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

Given that FTG does not have a commitment from a launch operator at this time, the applicant has requested the use of a conceptual RLV for the analyses in this PEA. In addition, the FAA is basing the PEA analyses on assumptions provided by the applicant regarding conceptual project components, including the location of propellant storage, mission preparation activities and related facilities, and the surface movement of RLVs associated with operation of a horizontal RLV at FTG. Using these components, the FAA intends to conservatively assess the potential environmental impacts of launch vehicle operations at FTG. The FAA is not approving these conceptual components as part of the Proposed Action in this PEA, and this information does not necessarily reflect the exact launch vehicle(s) that would operate at FTG or the exact type of facilities that would be needed to support the launch vehicle. Instead, it defines the scope (or bounds) of the analysis. If a prospective launch operator applies for a license to operate a launch vehicle at FTG, a separate environmental document, tiering off this PEA, would be required to support the following potential FAA actions at the site:

- Issuance of a launch license to a prospective launch operator.
- Unconditional approval of changes to the ALP from development needed to support launch operations.³

The tiered environmental document would be a more detailed analysis based on vehicle specific operations. Additional information on the programmatic process and how it applies to this project is further explained in Appendix A, *Using this Programmatic EA to Tier Future NEPA Reviews*.

² Council on Environmental Quality’s December 2014 guidance, *Effective Use of Programmatic NEPA Reviews* states “In the absence of certainty regarding the environmental consequences of future proposed actions, agencies may be able to make broad program decisions and establish parameters for subsequent analyses based on a programmatic review that adequately examines the reasonably foreseeable consequences of a proposed program, policy, plan, or suite of projects.”

³ As stated in FAA Order 5050.4B, Paragraph 202c(2) “This approval signals that: (a) The proposed ALP depicts features that are safe and efficient for airport operations and airport use and that the features are ripe for federal decision. (b) ARP has completed the environmental review process this Order requires for the near-term and immediate-term development that is ripe for decision. and (c) The approving FAA official has authorized the airport sponsor or project proponent to begin building the facilities or equipment depicted on the unconditionally approved ALP.”

The successful completion of the environmental review process does not guarantee the FAA would issue a launch site operator license to the Adams County BOCC or provide ALP approval. The project must also meet FAA safety requirements per 14 CFR Part 420.

Operational Parameters

Adams County has included the following operational parameters in its application for a launch site operator license:

- Launch operators would conduct launch operations from FTG using the conceptual horizontal launch vehicle described under the Proposed Action (see Section 2.1.1, Operation of Conceptual Horizontal Take-Off and Horizontal Landing RLV at FTG).
- Launch operators would launch once per week, for a total of 26 launches in Year 1 and 52 launches per year beginning in Year 2 of the license term. Under 14 CFR 400, launch operators would apply to the FAA for a separate launch license in order to conduct launch operations.
- Launch operators would conduct their rocket engine operations within an FAA-approved designated 50 x 100-mile RLV Operating Area and during an FAA-approved day and time.

Accordingly, the FAA will limit the range of alternatives for future launches analyzed in this PEA using these operational parameters. Should a launch operator be identified, these parameters may be adjusted as necessary to account for any unique aspects of the launch operator's proposal. The FAA will prepare a separate, tiered NEPA document to evaluate those operations.

To facilitate ALP modification, and after consultation with the FAA's Office of Airports and Air Traffic Organization, Adams County agreed to implement the following additional operational parameters during future launch operations from FTG to maintain the safety, utility, and efficiency of airports in accordance with 49 U.S.C. § 47107(a)(16):

- FAA Air Traffic would work with the launch operator to minimize the effect of a proposed launch operation on DEN traffic flows as well as traffic flows in en-route airspace.
- Operations would not result in the closure of any airport during any part of the operation nor so severely restrict the use of the surrounding airspace as to limit access to an airport.
- RLV pre-launch or launch operations, including the storage and dispensing of RLV fuels, would not adversely affect the tenants or other users of FTG.
- At least one runway at FTG would remain open at all times and FTG tenants would have access to their leaseholds at all times. Any closure of public areas would be temporary, pre-approved by the FAA and subject to conditions and terms required by the FAA.

These additional operational parameters would be required for any future launch, and they will also serve as assumptions for the purposes of this PEA.

1.1 Background

1.1.1 Board of County Commissioners of Adams County

FTG is owned and operated by Adams County and is governed by the Adams County BOCC. The BOCC are constitutional officers who act collectively as the governing board of the county. The BOCC consists of five members, each elected to 4-year terms. The BOCC is statutorily obligated to manage the operational and financial affairs of the county. FTG is a county entity reporting directly to the County Manager. The Adams County BOCC is seeking to develop the “Spaceport Colorado” at FTG as a nationally recognized aerospace and technology park for aerospace companies and a global hub for commercial space transportation. The BOCC intends for this initiative to integrate the combined resources of the Denver region in aviation and aerospace technology to create an economic development engine benefitting the entire state.

1.1.2 Front Range Airport

FTG is a 3,200-acre general aviation (GA) airport located in the northeast quadrant of the Denver metropolitan area and east-southeast of DEN in Adams County, Colorado (Exhibit 1-2). The current Draft FTG Airport Master Plan provides the following projections for aircraft operation demand through 2035 (Front Range Airport 2016).

- 2015: 66,577 aircraft operations
- 2020: 67,831 aircraft operations
- 2025: 74,697 aircraft operations
- 2030: 82,274 aircraft operations
- 2035: 90,633 aircraft operations

In 2016, there were approximately 84,345 aircraft operations conducted at FTG and in 2017, there are projected to be 110,739 aircraft operations (D. Ruppel, personal communication, 2018). Most of these are Aircraft Design Group (ADG) I and II, light civil and corporate aircraft. Approximately one third of the operations are associated with helicopter training conducted by Air Methods, one of the largest air medical and medical transport operators in the country, in conjunction with their training operation located at FTG. In addition to approximately 400 aircraft based at the airport, FTG provides transient aircraft services for approximately 11,500 aircraft annually. FTG owns and manages the Fixed Base Operator (Premier Fixed-Based Operator) and provides aircraft servicing, refueling, hangar leasing, and pilot, crew, and passenger support for both based and transient operators.

FTG is the most recently constructed GA airport in Colorado and is one of the largest land mass GA airports in the United States (U.S.). It is surrounded by a 6,000-acre, non-residential, master planned industrial complex and tens of thousands of acres of dry land farming in all directions (Exhibit 1-3).

Airfield

FTG’s two runways, Runway 8/26 and Runway 17/35, are 8,000 feet (ft) long, 100 ft wide, and constructed of asphalt with the potential to extend to 10,000 ft and 12,000 ft, respectively (Exhibit 1-4, 1-5). Runway 8/26 is the primary runway and is equipped with High Intensity Lighting and an Instrument Landing System (ILS) for precision instrument approaches. The FAA-reported strength of Runway 8/26 is 28,000 pounds

(lbs) for aircraft with Single Wheel Gear and 40,000 lbs for Dual Wheel Gear. Approximately 80% of annual operations take place on Runway 8/26 (D. Ruppel, personal communication, 2017). Runway 17/35, on the east side, is the secondary runway and is equipped with Medium Intensity Runway Lighting and a primary and secondary ILS. The FAA-published strength of Runway 17/35 is 52,500 lbs for Single Wheel Gear and 75,000 lbs for Dual Wheel Gear. Approximately 20% of annual operations take place on Runway 17/35 (D. Ruppel, personal communication, 2017). Runway 17/35 has the greatest long-term growth potential because the runway has earth work in place to expand it to 10,000 ft and sufficient land is owned north of the Airport to expand it to its master-planned length of 12,000 ft. Three Category I ILS approaches, which enable pilots to land in adverse weather conditions such as fog and rain, are located on the airfield.

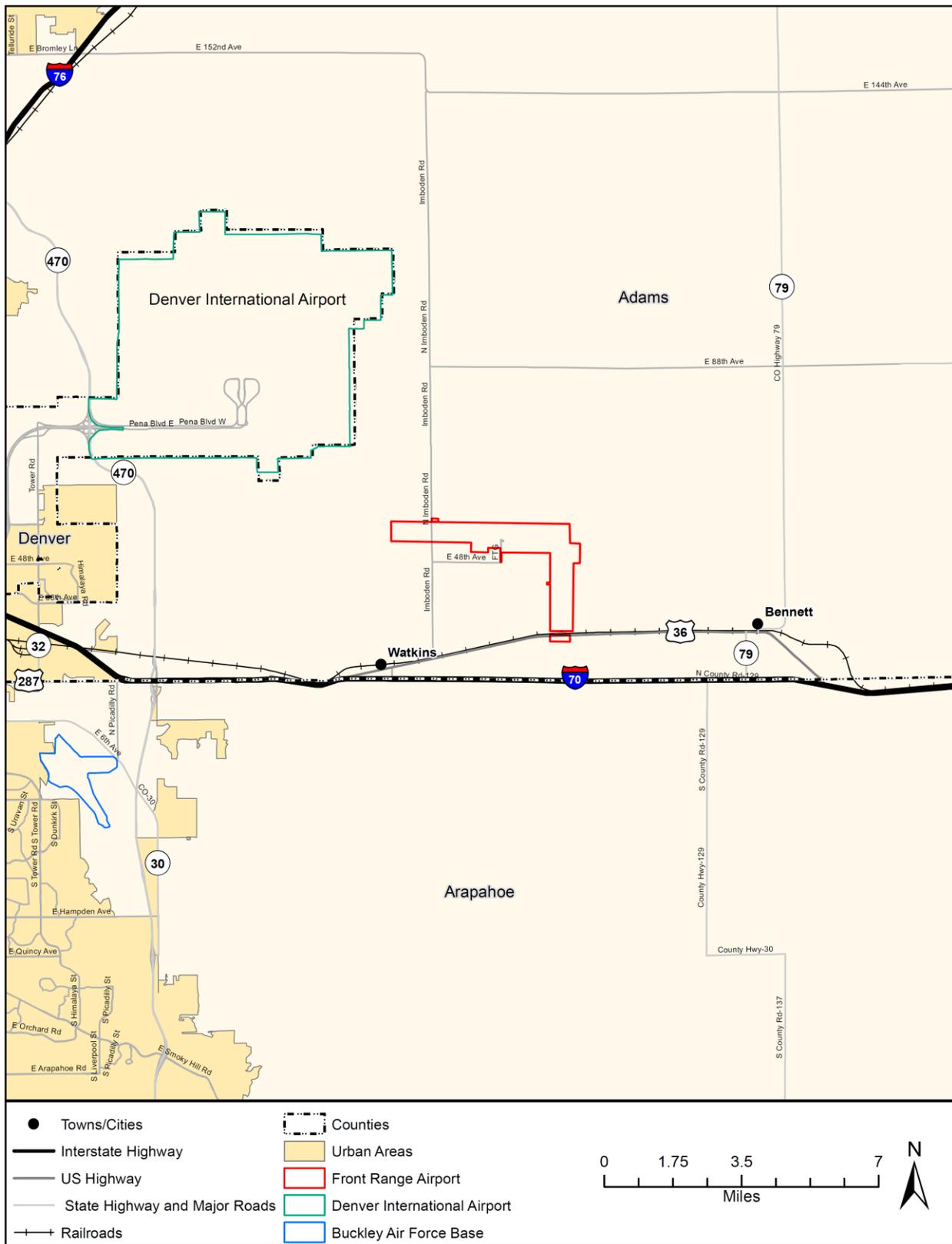


Exhibit 1-2. Location of Proposed Launch Site



Exhibit 1-3. Front Range Airport and Its Environs

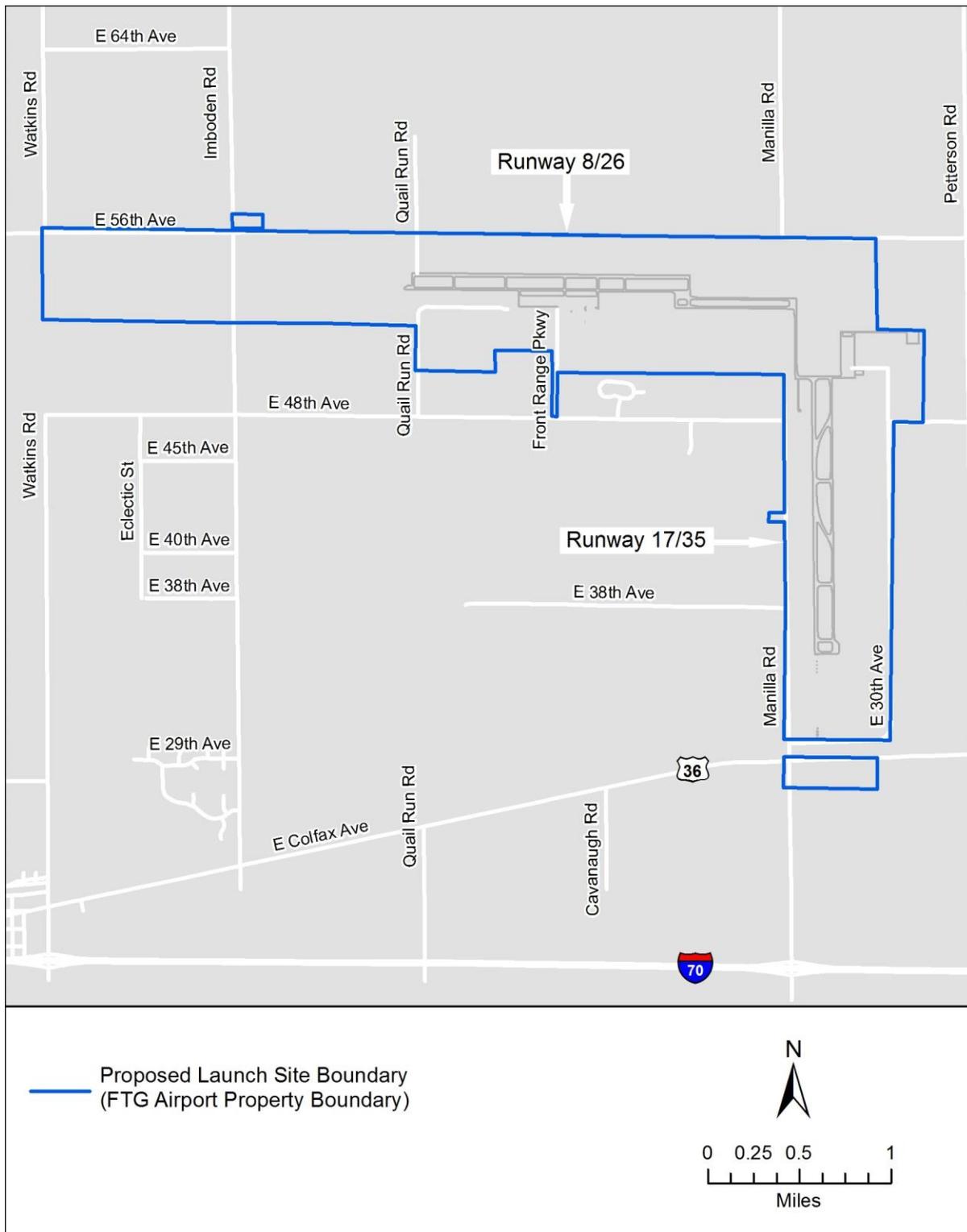


Exhibit 1-4. Proposed Launch Site Boundary at FTG



Exhibit 1-5. Existing Airfield and Facilities at FTG

Airspace

Controlled airspace is a generic term that covers the different classifications of airspace and dimensions within which the FAA provides Air Traffic Control (ATC) service in accordance with the airspace classification. Controlled airspace consists of Class A, Class B, Class C, Class D, and Class E. FTG operates in a “cutout” in DEN's 10 nautical mile Class B Airspace (see Appendix G, *Airfields and Airspace* for further information). The cutout provides air Visual Flight Rules traffic with a means of departing FTG to the east and south without entering the Class B restriction area. Additionally, DEN's airspace encompasses FTG with a Class E Airspace, which restricts Visual Flight Rules traffic from operating when meteorological conditions are less than 1 mile and restricts Visual Flight Rules aircraft to 700 feet above ground level. Airspace coordination procedures are in place between DEN and FTG because FTG airport traffic control tower has management oversight by FAA Denver Terminal Radar Approach Control Facility. On an Instrument Flight Rule (IFR) basis, FTG runways are treated as if they are an extension of DEN runways. In addition to the airspace coordination procedures at DEN, the Denver metro area is also home to an Air Route Traffic Control Center known as the “Denver Center” or “ZDV” which is one of 22 Air Route Traffic Control Centers that are part of the FAA’s national air traffic control system. The primary responsibility of the Denver Center is sequencing and separation of over-flights, arrivals, and departures in order to provide safe, orderly, and expeditious flow of aircraft filed under IFRs.

Landside Facilities

FTG property contains various facilities, including an airport traffic control tower, Aircraft Rescue and Firefighting Facility (ARFF), Airport Operated fixed base operator, Electric Substation, Group II Hangars, a community solar farm, and an airport owned and operated waste water treatment plant (WWTP) (Exhibit 2-2). The WWTP treats only domestic waste water under Permit #: CO-0047741. The WWTP does not treat industrial waste water and does not treat any offsite waste water with the exception of the waste from the Colorado Army National Guard – 5th Battalion, 19th Special Forces Group (Airborne) complex located adjacent to the FTG boundary.

In addition, a National Oceanic and Atmospheric Administration Weather Radar Facility is located at FTG. A Doppler radar system for Local TV Channel 31 is also installed. The FAA operates a vehicle maintenance facility on airport property and the Airborne has their armory located off FTG property, but adjacent to the FTG boundary. Colorado Department of Transportation, Division of Aeronautics is based at FTG. The following businesses also operate at FTG:

- Aerial Surveys, an aerial Photography/Mapping Survey company.
- Alliance Flight Training, specializing in aircraft rental, ground school, flight training, and simulator rental.
- Aviator Bar & Grill, providing aircraft and event catering.
- EK Composites, Inc., conducting commercial aeronautical activities.
- Executive Air East Inc., an aircraft maintenance repair and inspection facility.
- Front Range Aircraft Maintenance, providing aircraft maintenance and repair part 43.
- Front Range Airport Fixed-Based Operator, a full service Fixed-Based Operator and Worldfuel Services Dealer.
- Grov-Air, Inc., a builder's assistance company dedicated to supporting builders of the Van's Aircraft RV series.
- Immaculate Flight Rocky Mountain LLC, specializing in interior and exterior aircraft cleaning.
- Mile High Aircraft Services, LLC, providing airframe power plant repair.
- TWS Aviation Fuel Systems, a mechanical contractor specializing in aviation fuel systems.
- Windchaser Hangars, LLC, providing hangar rentals and sales.
- Reaction Engines, Inc., operating high-temperature airflow ground testing facility.

Aviation and automotive vehicle fuels are presently stored in bulk quantities in several locations on FTG. Fuel is delivered to the FTG fuel farm by over-the-road tankers. The fuel is then pumped into FTG fuel trucks via pumps and above ground piping. The fuel farm area contains three underground storage tanks, consisting of two 15,000-gallon tanks containing Jet A fuel and one 20,000-gallon tank containing 100 low lead (LL) fuel (Exhibit 2-2). Each tank is equipped with a leak detection system. In addition, FTG maintains a two-compartment double-walled aboveground tank with the capacity to store 1,000 gallons of unleaded automotive gasoline and 1,000 gallons of diesel fuel. An aboveground 10,000-gallon self-serve tank containing 100 LL fuel is located near the existing terminal which is filled from the over-the-road tanker or FTG 100 LL refueler (Exhibit 2-2). FTG also maintains fuel trucks, including: a 5,000-gallon Jet A refueler, a

2,000-gallon back-up Jet A refueler, a 1,500-gallon 100 LL refueler, a 750-gallon trailer-mounted back-up 100 LL refueler, and a 2,000-gallon equipment diesel refueler.

1.2 Role of the FAA

The FAA is the lead federal agency preparing this PEA in accordance with NEPA, the CEQ Regulations, FAA Order 1050.1F, and FAA Order 5050.4B, *NEPA Implementing Instructions for Airport Actions*. This PEA evaluates the potential direct, indirect, and cumulative environmental effects that may result from the Proposed Action.

As authorized by Executive Order (EO) 12465, *Commercial Expendable Launch Vehicle Activities* (49 Federal Register 7099, 3 CFR, 1984 Comp., p.163), and chapter 509 of Title 51 of the U.S. Code, the FAA Office of Commercial Space Transportation (AST) licenses and regulates U.S. commercial space launch and reentry activity, as well as the operation of non-federal launch and reentry sites. AST's mission is to ensure protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch or reentry activities, and to encourage, facilitate, and promote U.S. commercial space transportation.

The Office of Airports (ARP) within the FAA is responsible for ensuring the national airport system is safe, efficient, and environmentally responsible while meeting the needs of the traveling public. The office has responsibility for facilitating the Airport and Airway Improvement Act of 1982 (Public Law 97-248); all programs related to airport safety; developing standards for airport design, construction and operation; and ensuring compliance with grant assurances and other federal obligations. Under the current federal airport aid program (the Airport Improvement Program), Adams County, as the sponsor of FTG, has entered into agreements with the FAA for the acceptance of federal funds for airport development projects and land acquisition, per 49 U.S.C. § 47101 *et seq.* In accepting over \$47.6 million in Airport Improvement Program funds since 1982, Adams County has agreed to specific federal obligations, including (but not limited to) the obligation to preserve and operate FTG in a safe and efficient manner, per FAA regulations and standards, and maintain a current FAA-approved ALP.

1.2.1 FAA Licenses

The FAA's decision to issue launch site operator licenses and launch licenses to commercial launch operators is considered a federal action under NEPA. The FAA is responsible for analyzing the potential environmental impacts associated with licensing the operation of launch sites and operation of commercial launch vehicles.

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. As part of the launch site operator license, the applicant is required to prepare an Explosive Site Plan (14 CFR § 420.63) and obtain a Letter of Agreement (LOA) with ATC (14 CFR § 420.31). Section 1.2.3, *Letter of Agreement*, provides more information on the LOA process. Please refer to 14 CFR § 420.17 for bases for issuance of a license.

Issuance of a launch site operator license does not relieve a licensee of its obligation to comply with any other laws or regulations, nor does it confer any proprietary, property, or exclusive rights in the use of airspace or outer space (14 CFR § 420.41). A launch site operator license remains in effect for 5 years from the date of issuance unless surrendered, suspended, or revoked before the expiration of the term and is renewable upon application by the licensee (14 CFR § 420.43). A licensee shall apply to the FAA for modification of the license if it changes any representation contained in the license application that is material to public health and safety (14 CFR § 420.47). After the initial 5-year term, the Adams County BOCC may apply to renew the 5-year launch site operator license. During the 90-day renewal process, the FAA would evaluate the launch site operator license renewal application and re-evaluate this PEA to determine if there is potential for additional environmental impacts or other federal actions that would require supplemental analysis under NEPA.

The FAA issues separate licenses for the operation of launch vehicles. Therefore, launch operators would need to obtain individual launch licenses (14 CFR Part 431) from the FAA before launching from FTG. An additional environmental review, tiering off this PEA, would be required to fully analyze the environmental impacts of the launch license.

1.2.2 Airport Layout Plan

The Airport and Airway Improvement Act of 1982 directs the Secretary of Transportation to maintain a plan (the National Plan of Integrated Airport Systems) for developing public use airports (49 U.S.C. Chapter 471). An airport owner/operator who accepts federal grant in aid funding, or surplus land, is known as a sponsor. An airport sponsor is obligated to maintain a current ALP of the airport. The ALP must depict the following:

- Boundaries and proposed additions of all areas owned or controlled by the sponsor.
- The location and nature of existing and proposed airport facilities and structures.
- The location of existing and proposed non-aviation areas and improvements.

The ALP serves as a critical planning tool that depicts both existing facilities and planned future development for an airport. 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 a federally obligated airport, reflected in the ALP revision or modification, do not adversely affect the safety, utility, or efficiency of the airport. Under the Proposed Action, as described in Chapter 2, *Proposed Action and Alternatives*, the ALP for FTG would require revision to reflect the launch site boundary (see Exhibit 1-4).

Approval of the ALP modifications described in Chapter 2, *Proposed Action and Alternatives*, is a federal action under NEPA. As part of the ALP review process, ARP initiates coordination of aeronautical studies with other FAA Lines of Business, including, but not limited to the Air Traffic Organization and the Office of Aviation Safety Flight Standards Service, and other agencies, and coordinates with the airport sponsor to resolve outstanding issues. Following the satisfactory resolution of any outstanding issues, ARP may approve the ALP, with conditions stipulated as necessary (i.e., for further environmental review and/or

further analysis as required to ensure the safety, capacity, access, and utility of the affected National Plan of Integrated Airport Systems airports).

1.2.3 Letter of Agreement (LOA)

As part of the launch site operator license application process, and in accordance with FAA Order 7210.3, *Facility Operation and Administration*, and FAA Order 7400.2, *Procedures for Handling Airspace Matters*, FTG will need to negotiate and enter into an LOA with the ATC facilities with jurisdiction over the airspace to be used. The FAA's Air Traffic Organization provides ATC services for all NAS users, including prospective Front Range commercial launch operators.

ATC has conducted an airspace analysis using the conceptual RLV described in Section 2.1.1, *Operation of Conceptual Horizontal Take-Off and Horizontal Landing RLV at FTG*. The analysis took into consideration the characteristics and flight profile of the conceptual RLV as well as the potential effect on traffic flows arriving/departing DEN and en route air traffic overflying the Denver area.

The ATC airspace analysis identified multiple potential operating areas within which future RLV operations could take place in accordance with the assumptions described in the Proposed Action. However, this analysis did not consider the location of other airports nor the impact on other airports. Exhibit 1-6 shows the potential operating areas as red polygons. Many of these operating areas may not be feasible due to potential effects on other airports and/or airspace. The specific operating area to be used for each launch would be determined during the evaluation of the launch operator's license application when the specific vehicle parameters would be defined. For the purposes of facilitating a representative analysis in this PEA, Adams County has designated an approximate 50-by-100-mile flight corridor (referred to as the RLV Notional Operating Area (Exhibit 1-7)). This RLV Operating Area is representative of the airspace operating areas that a launch license applicant could propose in a future launch license applications.⁴

⁴ The current airspace analysis is the result of local ATC reviewing a conceptual flight trajectory and navigational information provided by FTG. The resulting conceptual RLV Operating Area reflects the trajectory and navigational performance as well as typical IFR airspace scale.

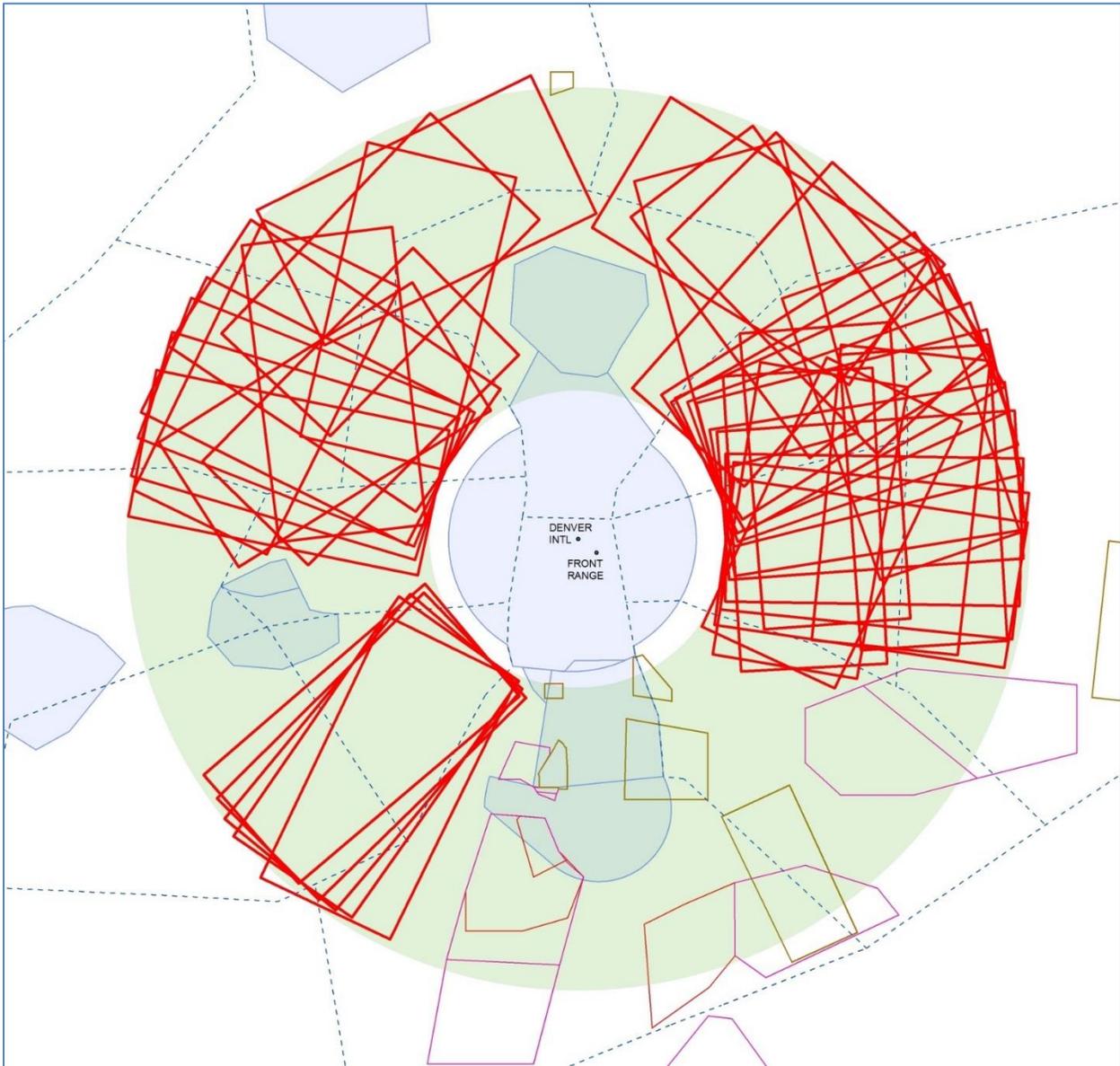


Exhibit 1-6. Potential Operating Areas between 50 and 150 Miles from the Denver International Airport

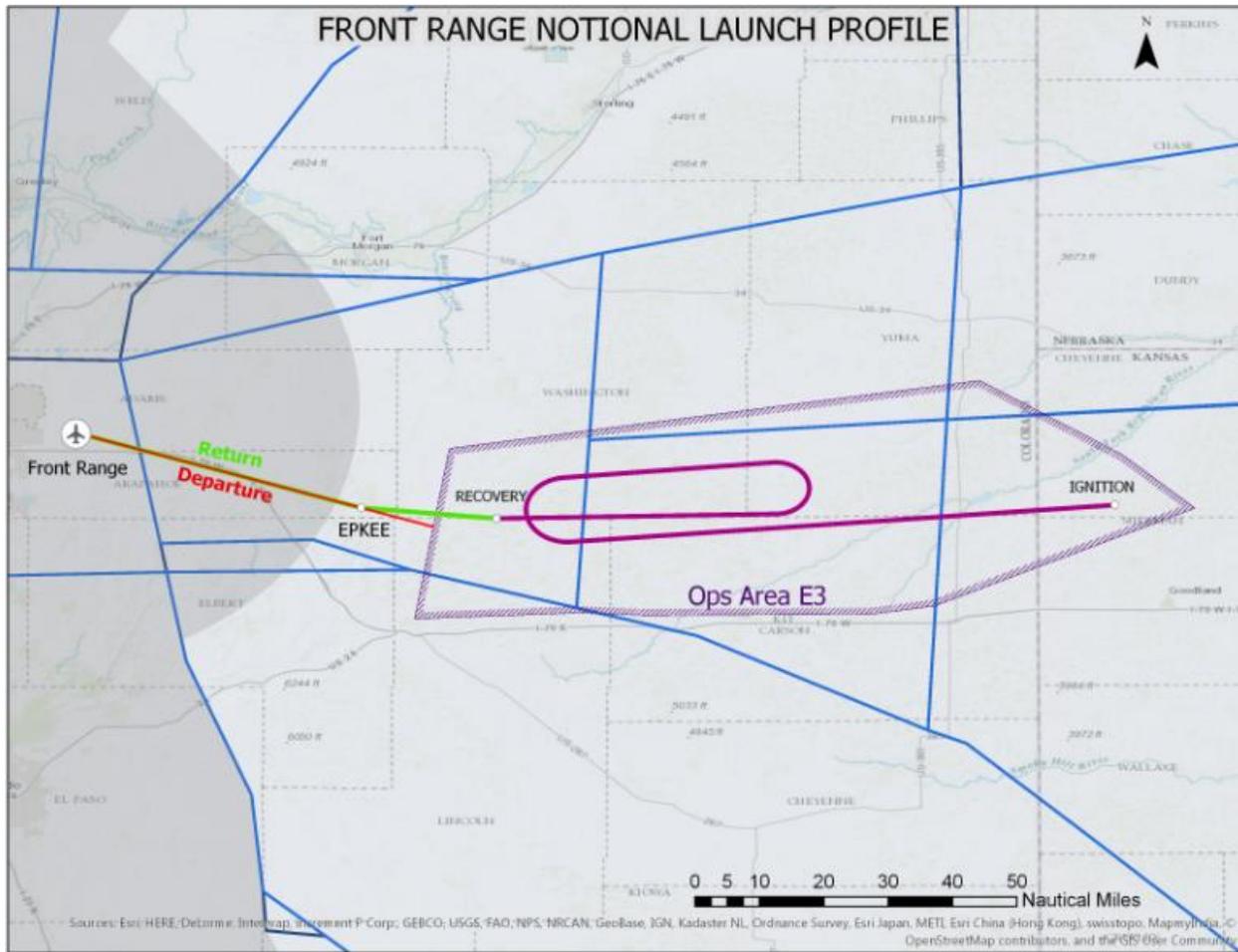


Exhibit 1-7. RLV Notional Operating Area and Notional Conceptual RLV Flight Profile

1.3 Purpose and Need

1.3.1 FAA Purpose and Need

The purpose of FAA’s Proposed Action in connection with the Adams County BOCC’s request for a launch site operator license is to fulfill the FAA’s responsibilities as authorized by EO 12465 and Chapter 509 of Title 51 of the U.S. Code for oversight of commercial space launch activities, including licensing launch activities. The need for FAA’s Proposed Action results from the statutory direction from Congress under the U.S. Commercial Space Launch Competitiveness Act of 2015 to, in part, “promote commercial space launches and reentries by the private sector; facilitate Government, State, and private sector involvement in enhancing U.S. launch sites and facilities; and protect public health and safety, safety of property, national security interests, and foreign policy interests of the United States.” Pub. L. 114-90, § 113(b). Additionally, Congress has determined the Federal Government is to “facilitate the strengthening and expansion of the United States space transportation infrastructure, including the enhancement of United States launch sites and launch-site support facilities, and development of reentry sites, with Government,

State, and private sector involvement, to support the full range of United States space-related activities.” 51 U.S.C. § 50901(b)(4).

1.3.2 Adams County BOCC's Purpose and Need

The purpose of the Adams County BOCC's proposal to operate a commercial space launch site at FTG is to allow the Adams County BOCC to offer FTG to customers interested in conducting commercial space launch operations. It is the Adams County BOCC's belief that operation of such a launch site at an existing GA airport could bring commercial launch operators and supporting economic clusters to FTG, thus potentially enhancing the revenue potential of the existing airport (and/or tax revenue to the County). The Adams County BOCC's need for the proposed commercial space launch site is to capitalize on the emerging economic opportunities in aerospace, advanced manufacturing, and related research and development activities closely related to commercial space operations.

1.4 Public Involvement

1.4.1 Scoping

In accordance with FAA Order 1050.1F paragraph 6.2.2.c, scoping is optional for EAs. For this PEA, the FAA conducted scoping by contacting agencies via a scoping letter sent on September 30, 2013. The scoping letter described the Proposed Action and requested agency comments and concerns regarding the Proposed Action. Due to subsequent changes to the Adams County BOCC's proposal since the scoping letters were distributed, the FAA re-initiated scoping in June 2017 for this PEA. Copies of the scoping letters sent to these agencies and their responses are included in the Scoping Report in Appendix E, *Scoping Materials*.

The FAA also provided federally recognized tribes with a description of the Proposed Action and an opportunity to provide comments in 2013 and June 2017. Three tribes provided responses: the Cheyenne & Arapaho Tribes of Oklahoma, the Northern Arapaho tribe, and the Pawnee Nation of Oklahoma. Copies of the letter distributed to tribes, the full tribal distribution list are included in Appendix E. All responses received are included in Appendix F, *Agency Consultation and Tribal Coordination*.

The FAA held a public scoping meeting on June 13, 2017 at FTG to provide more information about the project, the FAA environmental review process, and to solicit input from the public on what should be analyzed and studied in the PEA. Members of the public were invited to review materials presented on the FAA website and submit comments via mail and email.

In addition to the public scoping meeting, the FAA held a stakeholder scoping meeting on the morning of Tuesday, June 13, 2017 at FTG. Participants included representatives from the FAA, FTG, airline industry, elected officials, DEN, and other local airports. A summary of these meetings, comments received from scoping and a description of how they will be considered in the PEA is presented in Appendix E, *Scoping Materials*.

Following these scoping meetings, the FAA held two additional meetings with the stakeholder group: an in-person meeting on November 14, 2017, and a teleconference on December 15, 2017, to discuss and respond to comments made during the scoping process.

1.4.2 Draft PEA Public Involvement

In accordance with NEPA, the CEQ Regulations, FAA Order 1050.1F, and FAA Order 5050.4B, the FAA released the Draft PEA for public review on April 18, 2018 and asked the public to provide comments by May 25, 2018. In response to preliminary comments received on the Draft PEA, the FAA extended the comment period from May 25, 2018 to June 15, 2018.

The FAA also held a stakeholder meeting and a public meeting on May 17, 2018 to solicit comments from the public concerning the Draft PEA. At the public meeting, the FAA described the proposed action and no action alternative, potential impacts of the proposed action, and the environmental review process. There was also a public statement period in which members of the public provided up to three-minute statements.

In preparing this Final PEA, the FAA considered internal and external comments received on the Draft PEA. A summary of comments received on the Draft PEA, organized by topic, along with the FAA's responses to substantive comments, are included in Appendix I, *Summary of Comments Received on Draft PEA and FAA Responses*. Copies of correspondence between Congressional representatives and the FAA are included in Appendix J. Copies of all the comments received on the Draft PEA, including the public meeting transcript, are included in Appendix K. In addition to changes noted in the response to comments (Appendix I), the FAA made editorial changes throughout the PEA, as well as additional minor text edits for accuracy or to add clarity. In addition, the FAA made the following more substantive edits to the PEA:

- Replaced Exhibit 1-2 with a new version showing a corrected launch site boundary.
- Added text to Section 2.1.1 of the PEA clarifying that the vehicles' thrust would be greater than its lift for the majority of the rocket-powered portion of its ascent.
- Added discussion of Reaction Engines to the list of FTG tenants in Section 1.1.2 and the cumulative impact analysis in Chapter 5.
- Added a copy of the June 4, 2018 USFWS Section 7 consultation letter to Appendix F, *Agency Consultation and Tribal Coordination*. Added reference to this letter in Section 4.2.2.
- Added a copy of the May 3, 2018 Colorado SHPO consultation letter to Appendix F, *Agency Consultation and Tribal Coordination*. Added reference to this letter in Section 4.5.2.

1.5 Other Environmental Requirements

In addition to NEPA, 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 FTG. If a prospective launch operator applies for a launch operator license from the FAA, the following

permits and reviews may need to be considered along with a tiered NEPA analysis as discussed in Section 1.0 above and Appendix A.

- **Air Quality Permit.** A future tiered proposed action may require Adams County to seek an air quality permit(s) issued by the Colorado Department of Public Health and Environment, Air Pollution Control Division for construction and operation of air emission sources including the propellant tanks.
- **Spill Prevention, Control, and Countermeasures Plan, Stormwater Management Plan, Stormwater Discharge Permits.** Adams County would need to update the Spill Prevention, Control, and Countermeasures Plan and the industrial Stormwater Management Plan for FTG to include the propellant storage areas. Construction that involves ground-disturbing activities would need to comply with the construction stormwater permitting requirements of the Colorado Water Quality Control Division. There are specific municipal stormwater discharge permits which authorize discharge of stormwater from regulated small municipal separate storm sewer systems (MS4s). FTG is outside the MS4 program area for Adams County (Adams County 2016a), but inside the Adams County Stormwater Utility service area. The Adams County Stormwater Utility assesses an annual user fee to all properties located within the service area.
- **Noise.** The State of Colorado also has enacted laws to address safety, noise, and compatible land uses around airports that may be applicable to this proposed operation (see Colorado Revised Statute 24-65.1-202, Criteria for Administration of Areas of State Interest, and 43-10-133, Safe Operating Areas Around Airports).

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2.0 PROPOSED ACTION AND ALTERNATIVES

This chapter describes the alternatives considered in the PEA: the Proposed Action and No Action Alternative.

Under the Proposed Action, the FAA would issue a launch site operator license to the Adams County BOCC that would allow the County to offer the commercial space launch site, Spaceport Colorado, to one or more commercial launch operators for the operation of horizontal take-off and horizontal landing RLVs. The FAA would also conditionally approve the modified ALP that shows the launch site boundary. Additional information is provided in Section 2.1, *Proposed Action*.

Section 2.2, *No Action Alternative*, describes the No Action Alternative. Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC, and the ALP would not be modified to reflect the launch site boundary.

Section 2.3, *Alternatives Considered but Not Carried Forward*, describes alternatives considered but not carried forward for detailed analysis.

As described in Chapter 1, *Introduction*, this PEA includes operational parameters that a future launch operator would need to accommodate to be able to operate at FTG. Once a future launch operator is identified, the FAA would analyze all relevant aspects of the proposal using the exact RLV operations and associated components.

2.1 Proposed Action

The Adams County BOCC proposes to operate a commercial space launch site at FTG in Adams County, Colorado, and offer the site to one or more commercial launch operators for the operation of a horizontal take-off and horizontal landing RLV. To operate a commercial space launch site, the Adams County BOCC must obtain a launch site operator license from the FAA. Under the Proposed Action addressed in this PEA, the FAA would: (1) issue a launch site operator license to the Adams County BOCC for the operation of a commercial space launch site at FTG, and (2) conditionally approve the modified ALP that shows the launch site boundary.

Under the Proposed Action, the Adams County BOCC would offer FTG to horizontal launch operators that would take off from the runway under jet power. Adams County has not identified a launch operator at this time. Sections 2.1.1, *Operation of Conceptual Horizontal Take-Off and Horizontal Landing RLV at FTG*, and 2.1.2, *Conceptual Launch Activities*, outline the operation of a conceptual horizontal take-off and horizontal landing RLV at the site and associated launch activities. Section 2.1.3, *Conceptual Facilities Needed to Support Launch Operations at FTG*, outlines the conceptual facilities that could be needed to support launch operations at FTG. If a launch operator is identified, a separate environmental document that is tiered off this PEA would be completed by the FAA to analyze the issuance of a license to a vehicle operator. The tiered EA would also analyze the impacts associated with the construction of facilities to support launch operations for the unconditional approval of the ALP. This subsequent EA would include specific details on the exact RLV and associated components required to support operations.

2.1.1 Operation of Conceptual Horizontal Take-Off and Horizontal Landing RLV at FTG

Adams County proposed a conceptual horizontal take-off and landing RLV to bound the analysis (Exhibit 2-1). The conceptual RLV is a piloted vehicle that could carry a pilot and additional flight participants and/or payloads on suborbital flights. The conceptual RLV would take off horizontally from the runway under jet power and fly to an operating area prior to igniting its rocket engine to perform a parabolic suborbital flight. Upon descent and return to subsonic speeds, the conceptual RLV would restart its jet engines and return for a horizontal landing on the runway under jet power.



Exhibit 2-1. Conceptual RLV

The conceptual RLV would be approximately 44 ft in length with a wing span of approximately 29 ft. The weight of the vehicle, when fully fueled and ready for take-off, would be approximately 22,750 lbs. Table 2-1 describes the characteristics of the conceptual RLV.

Table 2-1. Conceptual RLV Description

Attribute	Approximate Value
Length	44 ft
Wingspan	29 ft
Height	12 ft
Gross weight	22,750 lbs
Number of Jet Engines	2
Jet Engine Type	J-85 w/ afterburner
Jet Engine Thrust	5,000 lbf (each)
Number of Rocket Engines	1
Rocket Engine Type	Polaris AR-36
Rocket Engine Thrust	36,000 lbf
LOX Quantity	6,500 lbs
RP-1 Quantity	2,500 lbs
Jet-A Quantity	2,300 lbs

Notes: ft = feet; lbs = pounds; lbf = pounds force; LOX = liquid oxygen.

The RLV would have two jet engines using Jet A fuel and one rocket engine using a pressure-fed, bipropellant propulsion system with liquid oxygen (LOX) as the oxidizer and rocket propellant (RP)-1 (a

highly refined grade of kerosene) as the fuel to operate the engines. It would also use gaseous helium to pressurize the propellant tanks. The jet engines of the RLV provide the primary thrust for the launch vehicle to take off, reach the RLV Operating Area, and ascend to an altitude of approximately 45,000 ft where the rocket engines would be ignited. The rocket engine provides the thrust for the RLV to reach its max apogee⁵ of 350,000 ft. The vehicles’ thrust would be greater than its lift for the majority of the rocket-powered portion of its ascent. The propellants are each separately fed into the combustion chamber of the RLV engine and ignited by a spark similar to that of a spark plug in an automobile engine.

The conceptual RLV would be similar in size, and would take off and land under jet power in a similar manner to existing aircraft at FTG. The conceptual RLV would not require runway lengths or pavement strengths in excess of existing infrastructure at FTG.

For the purposes of this PEA, Adams County proposed a certain number of annual conceptual RLV launch operations during the 5-year license period based on industry trends for RLVs. While it is assumed the launch site operator license would be issued to FTG in 2018, it is important to note that actual launch operations would not begin until a launch license has been issued to a prospective launch operator. Table 2-2 lists the maximum number of proposed annual launch operations that the FAA analyzed in this PEA. The number of launch operations is expected to increase to a maximum of 1 launch per week so this PEA analyzes 26 launches in the first year and 52 launch operations for years 2-5 for a total number of 234 launch operations over the 5-year license.

Table 2-2. Proposed Launch Operations for the Conceptual RLV

Year	Frequency	Total Number of Launch Operations per Year*
Year 1	1 every other week	26
Year 2	1 per week	52
Year 3	1 per week	52
Year 4	1 per week	52
Year 5	1 per week	52
Total Maximum Number of Launch Operations for the Five-Year License		234

Note: *One launch operation includes a launch and descent.

2.1.2 Conceptual Launch Activities

As described in Chapter 1, *Introduction*, Adams County has proposed to operate the launch site in a manner that would ensure that none of the RLV pre-launch or launch operations would adversely impact the tenants or other users of FTG. Based on information provided by Adams County, the FAA assumes the entire mission would be expected to take less than 2 hours and FTG would not be closed during any portion of the operation. Some areas within the launch site boundary, such as the mission preparation areas, would be restricted temporarily (up to 1 hour) during certain operations and require operational separation in

⁵ Apogee refers to the highest altitude achieved by a launch vehicle before beginning descent.

accordance with the FTG Explosive Site Plan (14 CFR § 420.63). Access to one runway or the other may be temporarily restricted due to RLV operations; however, Adams County has proposed that one runway would remain available at all times. In addition, routine closures of one of the runways at FTG happen periodically to accommodate regular maintenance activities such as mowing and weeding. In instances where a launch operator's separation distances extend into public areas, the operator would be required to demonstrate compliance with the public requirements in 14 CFR Part 431. With the exception of the oxidizer loading procedure just prior to positioning for take-off, the conceptual RLV would operate in a manner similar to other conventional aircraft.

Adams County has proposed that all launch operations would be daytime operations for the purpose of this PEA (between the hours of 7:00 a.m. and 10:00 p.m.). The activities associated with the RLV operations include the following:

- Pre-flight activities (air traffic coordination, vehicle assembly, engine test checkout, vehicle loading, and static engine testing).
- Flight profile (take-offs, flights, and landings).
- Post-flight activities (closing feed valves and depressurizing propellant tanks, taxiing of the RLV from the runway, pilot disembarking, and post-flight checkouts and inspections).

Existing infrastructure, including hangars and Runway 8/26, would be used to support launch operations at FTG. Additional infrastructure that might be needed to support launch operations is discussed in Section 2.1.3.

Pre-Flight Activities

FTG Operations would require launch operators to provide them with notification before a planned launch. Notification details would be developed during the launch license application process. FTG and the launch operator would coordinate operations with the Denver Air Route Traffic Control Center, Denver Terminal Radar Approach Control Facilities, Denver Tower, Front Range Tower, the Flight Standards District Office and other parties as needed. FTG Operations would notify the launch operator of other activities in FTG, resolve potential conflicts for commercial launch use, and notify other appropriate airspace scheduling agencies. Missions, flight tracks, and other aspects of the launch would be coordinated with all flight and ground support crews prior to each launch. Safety of air traffic in the region would be ensured through close coordination of scheduling with the Denver Air Route Traffic Control Center and the development and implementation of temporary assigned airspace prior to and during each individual launch event. There would be no change in shape or altitude of the existing airspace.

Prior to launch, a brief hot-fire test of the rocket engine, also termed 'static run-up' test, would last approximately 2 seconds. For the purposes of this PEA, Adams County has proposed that up to two engine tests per week could occur. The static run-up test could occur in the Mission Preparation Area #2 of Runway 8/26 (Exhibit 2-2). This testing is a last checkout of the rocket propulsion system prior to launch. A top off of the propellants from mobile propellant transport vehicles may be conducted to ensure full flight capacities are achieved. The vehicle would transit to Runway 8/26 in preparation for take-off. All remaining

equipment and support personnel would clear the area. Final flight preparations are expected to take approximately 5 to 7 minutes.

Flight Profile

Adams County's proposed flight profile for the RLV includes take-off, flight, and landing. Total estimated flight time is expected to be less than 1 hour.

The RLV would take-off horizontally from Runway 8/26 and follow ATC direction along its assigned departure route to a point within the potential RLV operating area (Exhibit 1-7).⁶ As noted in Section 1.2.3, *Letter of Agreement*, future RLV operations could take place from multiple locations within this operating area; this would be determined during the evaluation of a launch license application when the specific vehicle parameters would be available. However, for the purposes of analysis in this PEA, Adams County proposed a 50-by-100-mile flight corridor within the larger operating area (referred to as the RLV Operating Area) depicted as the purple polygon in Exhibit 1-7. All rocket engine operations would take place within the RLV Operating Area. Once the RLV is within the RLV Operating Area, it would ascend to a launch altitude of approximately 45,000 feet above mean sea level and enter into a holding pattern while awaiting clearance for launch. When ATC has provided clearance and the RLV has reached its ignition point, the rocket engine would ignite and the RLV would transition to a steep climb angle of 75 degrees until the rocket engine shut off at approximately 150,000 ft mean sea level and a maximum speed of approximately Mach 3.5. The vehicle would coast upwards on a parabolic trajectory to final apogee at approximately 62 miles mean sea level. After reaching apogee, the vehicle would begin its unpowered descent in a ballistic (i.e., unpowered) profile. The jet engines would then be restarted after aerodynamic control can be established (approximately 2 to 3 minutes after apogee). Once the RLV is back in controlled airspace, ATC would guide the RLV along an arrival route to return and land at FTG under jet engine power.

⁶ Future RLV operations could depart from either Runway 8/26 or 17/35; however, for the purposes of analysis in this PEA, the FAA has assumed launches would take place from Runway 8/26. Any potential environmental impacts related to use of both runways would be analyzed in subsequent documents that tier off this PEA.

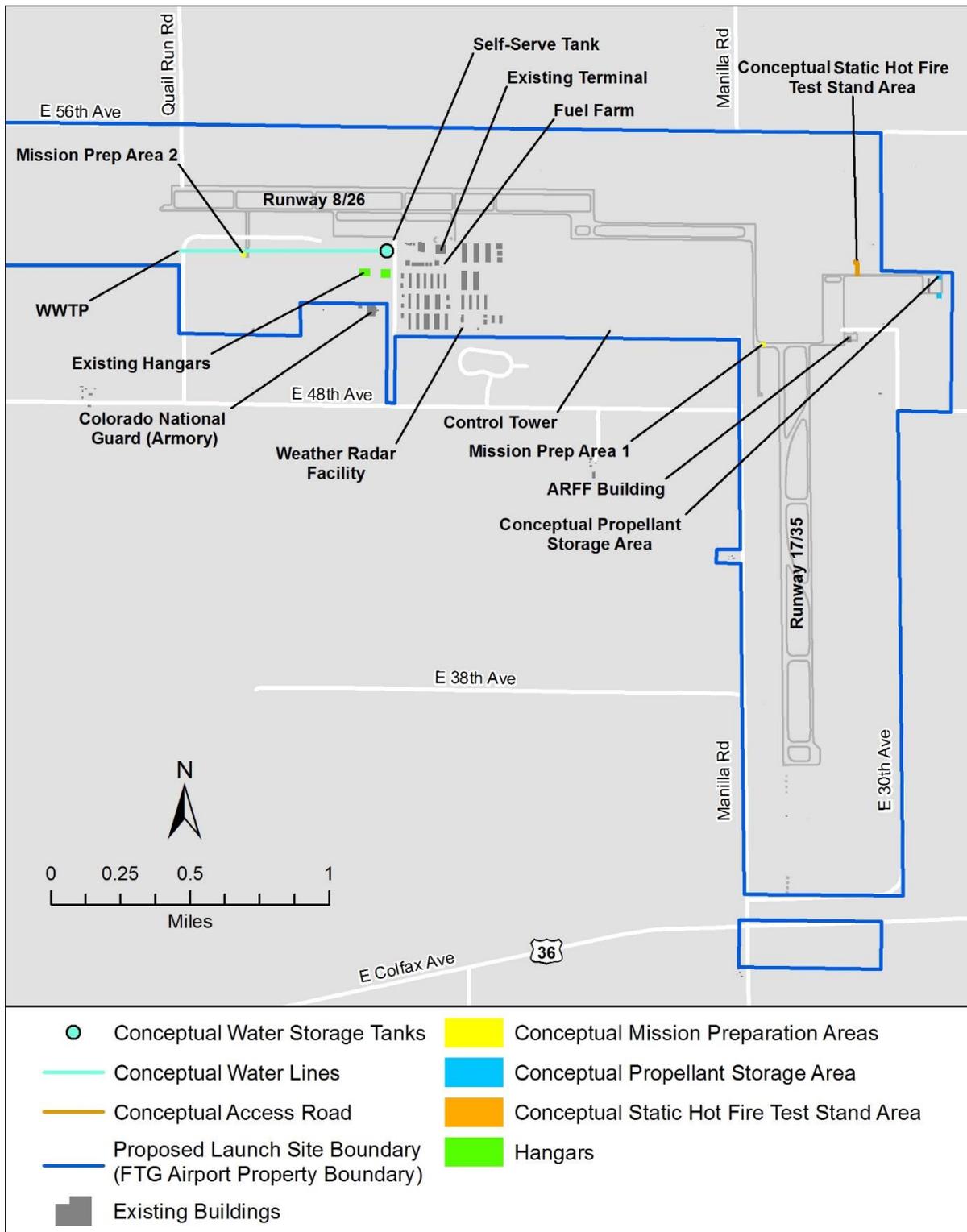


Exhibit 2-2. Existing and Conceptual Facilities at FTG

The RLV is launched with the planned rocket propellant quantities needed to complete its suborbital mission with the expectation that only residual propellants would remain on board during approach and landing. Once the commitment is made to land back at FTG, any excess oxidizer (LOX) is vented through the engine nozzle prior to landing at a minimum altitude of 3,500 ft. Any remaining residual jet fuel would be kept on board the RLV for future mission needs.

The use of the airfield and airspace would be coordinated with the FAA, Denver Air Route Traffic Control Center, Denver Terminal Radar Approach Control Facility, Denver Tower, Front Range Tower, FTG, and the launch operator. Additional details regarding the use of airspace are described in Appendix G. These would be scheduled flights and advance notice would be provided via a Notice to Airmen (NOTAM). Because the RLV operates in a manner equivalent to a conventional aircraft, neither the airport nor the surrounding airspace would be closed during these flights. The flights would operate in accordance with the LOA established with ATC during the launch licensing process.

Post-Flight Activities

The RLV would land under jet power and brake to a final stop. The RLV would taxi off the runway to Mission Preparation Area #2 to begin procedures to safely shut down the systems by closing various propellant feed valves and depressurizing the fuel and helium tanks. This process would take approximately 5 minutes. Once the vehicle systems shut down, the pilot would disembark. Additional post-flight activities would be conducted to secure payloads and conduct initial visual inspections of the launch vehicle prior to transporting the RLV back to the flight support hangar for post flight checkouts and inspections.

Launch Failures

For each future flight track and vehicle, FTG would work with the launch operator and the FAA to ensure public safety according to regulations in 14 CFR Part 431. FAA regulations, as defined in 14 CFR Parts 431, and 420, set minimum public safety risk thresholds for granting a license. The regulations require the risk to the public on the ground of becoming a casualty as a result of a launch, expressed as expected casualties, to be less than one hundred in a million. The FAA would not grant a license if this level of safety compliance to all applicable regulations cannot be adequately demonstrated. The launch operator would be responsible for developing an emergency response plan that addresses launch failures.

Adams County has proposed that all nominal trajectories (i.e., the trajectories that a vehicle would fly if all vehicle aerodynamic parameters are exactly as expected), will avoid densely populated areas. In the unlikely event of a launch failure, the debris impacts would be expected to be contained within the hazard area. The potential impacts from launch failures are discussed under the environmental impact categories that could be potentially affected by a launch failure: Section 4.2, *Biological Resources (including Fish, Wildlife, and Plants)*; Section 4.4, *Hazardous Materials, Solid Waste, and Pollution Prevention*; and Section 4.11, *Water Resources (including Wetlands, Floodplains, Surface Waters, and Groundwater)*.

Emergency Alternate Runway/Airports

Adams County has proposed that the conceptual RLV would return to Front Range under jet engine power. However, potential emergency landing locations (e.g., other airports) may be identified as part of the

launch license application process. An emergency landing location would only be necessary in the event that unforeseen circumstances during flight make a return to Front Range unavailable. The Adams County BOCC lists Buckley Air Force Base and Centennial Airport as potential emergency alternate runway/airports in their Emergency Procedures Manual submitted as part of the launch site operator license application. The location of potential emergency landing locations and any necessary training to be conducted at such sites would be identified and described a future the launch operator license application. Once a launch operator license application is received, the FAA would re-evaluate the potential impacts of any emergency landing locations included in the application in a future NEPA analysis tiering off this PEA.

2.1.3 Conceptual Facilities Needed to Support Launch Operations at FTG

The analyses in this PEA are based on assumptions regarding conceptual project components, including the location of propellant storage, mission preparation activities and related facilities, and the surface movement of RLVs associated with operation of a horizontal RLV at FTG. The purpose of describing these components is to conservatively assess the potential environmental impacts of launch vehicle operations at FTG. These conceptual components are not being approved as part of the Proposed Action in this PEA, and this information does not necessarily reflect the exact type of facilities that would be needed to support the launch vehicle. Instead, it defines the scope (or bounds) of the analysis. Therefore, the analysis is based on assumptions made with regard to the facilities as set forth below. If a prospective launch operator applies for a license to operate a launch vehicle at FTG, a separate environmental document that is tiered off this PEA would be completed and would include the details on the exact RLV and associated facilities required to support operations. Any facility changes that alter the ALP would require FAA review of the updated ALP, and approval of the proposed development.

Installation of Aboveground Propellant and Fuel Storage Tanks

Based on information provided by Adams County, the FAA assumes that the proposed action would necessitate installation of a proposed propellant storage area that would consist of an oxidizer storage area and a fuel storage area (Exhibit 2-2). The entire propellant storage area would be surrounded by a security fence. The oxidizer storage area would include a 15,000-gallon tank of LOX on a concrete pad (approximately 100 ft by 100 ft).

A separate fuel storage area would be located at least 100 ft away from the oxidizer storage area. A 10,000-gallon kerosene (RP1) storage tank would be installed on the existing asphalt surface. Additional space would be allocated in the fuel storage area for forty 55-gallon drums for Jet A storage.

All fuels and oxidizers would be stored in accordance with applicable fire codes and fuel-specific storage and containment requirements. The fuel storage tanks would be installed on existing asphalt and would be placed in secondary concrete containment which would contain leaked fuel and prevent the migration of accumulated liquid to soil, groundwater, or nearby surface waters. In addition to the propellant storage tanks, the storage areas would also include a gravel truck access aisle and gravel pad surrounding the pads. The helium would be stored inside the flight support hangar in three small helium bottles (K bottles).

Construction of Concrete Pads for Mission Preparation

Based on information provided by Adams County, the FAA assumes that the construction of concrete pads would occur in the proposed Mission Preparation Areas #1 and #2 (Exhibit 2-2). The pads would be used to support launch operations at FTG. At Mission Preparation Area #1, the existing asphalt would be removed and replaced with a concrete pad of approximately 100 ft by 100 ft. Mission Preparation Area #2 would be adjacent to the asphalt runway. At Mission Preparation Area #2, the existing asphalt would be removed and replaced with a concrete pad approximately 100 ft by 100 ft. The concrete pads would have the same or greater weight rating as the existing asphalt surfaces.

Construction of Concrete Pad for Static Hot-Fire Engine Testing

In addition to launch and descent activities, and based on information provided by Adams County, the FAA assumes that operations at FTG would include the testing of rocket engines. The FAA does not license the rocket engine equipment itself or the ground tests of rocket engines, only the operation of the launch vehicle and the launch site. However, the potential environmental impacts of the engine tests are included in this document because they are a related activity.

The test pad, approximately 20 ft by 20 ft, would be constructed of reinforced concrete in an open area more than 1,250 feet north of the ARFF and other buildings (Exhibit 2-2). This location satisfies the explosive siting requirements in accordance with 14 CFR Part 420.

Engines to be tested would be mounted on a mobile test stand which would be towed to and positioned on the test pad for the engine test. The mobile test stand would be fully autonomous with battery power for instrumentation and control. The mobile test stand would be configured in one of the existing hangars (specific hangar selection would depend on the needs of the operator and availability at the time) and fueled at the test pad (Exhibit 2-2). Currently available hangars are shown on Exhibit 2-2.

Engines to be tested are expected to be comparable in size with the engine on the RLV (approximately 36,000 pounds force of thrust). For the purposes of evaluating environmental impacts in this PEA, the FAA in coordination with FTG, has assumed a maximum of up to 100 static hot-fire tests per year, at a duration of 8 seconds per engine.

Installation of Aboveground Water Storage Tank and Non-Potable Water Line

To accommodate launch operations, an aboveground steel non-potable water storage tank, capable of storing up to 1.5 million gallons of water, would be installed next to one of the existing hangars proposed to be used for flight support (Exhibit 2-2). The 1.5 million gallon tank would be approximately 86 feet in diameter and 40 feet high. A non-potable water line, approximately 2,000 ft in length, would be connected to an existing line that feeds to the existing WWTP (Exhibit 2-2). The non-potable water from the storage tank would support daily operations, consisting of mission preparation, recovery, upkeep, administration, and storage at the flight support hangar and a sprinkler system. Potable water lines currently exist at the existing hangars and would support the needs of personnel. The existing potable water system and WWTP were designed to support the full build out of Hangar Development Modules 1 through 7 covering the

entire western portion of the airport. Two modules are nearing full design development so the potable water system is fully capable of supporting these added requirements.

Installation of High-Speed Fiber Optic Communication Lines, Security Fencing, and Access Roads

Based on information provided by Adams County, the FAA assumes that proposed launch site operations and commercial launch providers would require the installation of high-speed fiber optic communication lines throughout FTG to ensure adequate communications during launch operations. Installation of the lines would require placement of approximately 20,000 linear ft of underground conduits containing the cable (Exhibit 2-2).

The FAA assumes that the propellant storage area and static hot-fire test stand area would be surrounded by a 6-ft tall perimeter chain-link fence to maintain personnel and visitor safety and facility security. The perimeter fence would include access control and a video surveillance system to detect unauthorized access. The security system would be monitored 24 hours a day, either by FTG staff or a contract security service.

The FAA assumes that proposed interior site access roads, as shown in Exhibit 2-2, would be constructed of asphalt and built to accommodate periodic heavy trucks that would be delivering propellants to the storage area and other materials to the static hot-fire test stand area. Approximately 1,000 feet of new access roads would be constructed to a width of 25 ft, and approximately 500 ft of existing access roadway would be rehabilitated.

New Personnel

Based on information provided by Adams County, the FAA assumes that between 2018 and 2022, approximately 20 new permanent full-time FTG employees would be on-site to support proposed operations. The new full-time permanent employees would work in the flight support hangar and/or the terminal building. Existing facilities are underutilized and have capacity for the expected increases. No new facilities or parking would be needed to accommodate the additional personnel.

2.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to FTG and thus FTG would not be available to potential RLV launch operators. In addition, there would be no need to update the FTG ALP. Existing GA operations, as described in Section 1.1, *Background*, would continue at FTG. However, the No Action Alternative would not satisfy the project's purpose and need because it would not allow for operation of a commercial space launch site. Adams County has stated that failure to receive the launch site operator license will significantly impact their ability to attract aerospace and commercial space oriented businesses and eliminate FTG's opportunity to become a hub for commercial space transportation.

The CEQ regulations implementing NEPA require 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 and is being carried forward for these reasons.

2.3 Alternatives Considered but Not Carried Forward

There are no other reasonable alternatives that would meet the purpose and need for the Proposed Action, because there are no other sites owned or managed by the Adams County BOCC that would meet the technical and operational requirements to accommodate an RLV. This does not mean the FAA has reviewed, evaluated, or rejected any other potential commercial space launch site locations in the State of Colorado; rather, it simply means the FAA's purpose and need in this case is driven by the fact that Adams County is the proponent of this particular proposal and has selected FTG as the proposed location.

At this time, Adams County does not have a commitment from any commercial launch operators to use FTG. However, the conceptual RLV is representative of the type of vehicle that Adams County expects to launch from FTG. The existing runway length is sufficient for other types of horizontally launched vehicles; Adams County originally considered a horizontal vehicle taking off under rocket power as part of this proposal. However, in coordinating with the FAA Air Traffic Organization, Adams County recognized that a horizontally launched vehicle that takes off and lands under jet power could more readily operate from the site. Therefore, this vehicle type is the only vehicle type included for consideration in this PEA. Should a prospective launch operator apply for a launch license to operate a specific vehicle at FTG, the FAA will analyze the potential environmental impacts of the operations of that vehicle relative to the assumptions. The vehicle would be required to meet the assumptions as outlined in this PEA. In addition, a separate environmental document, tiering off this PEA, would be required to support the issuance of a launch license to prospective launch operators.

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3.0 AFFECTED ENVIRONMENT

This chapter provides a description of the environmental resources that would be affected by the Proposed Action, as required by the CEQ regulations, FAA Order 1050.1F, and FAA Order 5050.4B. The level of detail provided in this chapter is commensurate with the importance of the impact on these resources (40 CFR § 1502.15). The Region of Influence (ROI) for each resource is described in each of the resource sections. As required by FAA Order 1050.1F, this PEA presents an evaluation of impacts for the environmental impact categories listed below.

- Air Quality
- Biological Resources (including Fish, Wildlife, and Plants)
- Climate
- Coastal Resources
- Department of Transportation Act, Section 4(f)
- Farmlands
- Hazardous Materials, Solid Waste, and Pollution Prevention
- Historical, Architectural, Archaeological, and Cultural Resources
- Land Use
- Natural Resources and Energy Supply
- Noise and Compatible Land Use
- Socioeconomics, Environmental Justice, and Children’s Environmental Health and Safety Risks
- Visual Effects (including Light Emissions)
- Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers)

For each of the resources covered in this chapter, the following information is provided:

- Background
- Regulatory Setting
- Existing Conditions

The analyses in this PEA are based on assumptions regarding conceptual project components, including the location of propellant storage, mission preparation activities and related facilities, and the surface movement of RLVs associated with operation of a horizontal RLV at FTG. The purpose of describing these components is to conservatively assess the potential environmental impacts of launch vehicle operations at FTG. These conceptual components are not being approved as part of the Proposed Action in this PEA, and this information does not necessarily reflect the exact type of facilities that would be needed to support the launch vehicle. Instead, it defines the scope (or bounds) of the analysis. When a prospective launch operator applies for a license to operate a launch vehicle at FTG, a separate environmental document, tiering off this PEA, would be required.

The analysis of these environmental impact categories is presented in Chapters 3, *Affected Environment*, and 4, *Environmental Consequences*, of this PEA; those environmental impact categories not analyzed in detail are discussed below.

Resources Not Analyzed in Detail

This PEA does not analyze potential impacts on the following environmental impact categories in detail, for the reasons explained below:

- **Coastal Resources** – There are no coastal resources within the inland areas of Colorado where proposed construction and operational activities would occur.
- **Department of Transportation Act, Section 4(f)** – The FAA must consider a proposed project’s potential impact to properties protected under Section 4(f) of the Department of Transportation Act (49 U.S.C. § 303(c)). Section 4(f) properties include publicly owned parks, recreation areas, and wildlife or waterfowl refuges, or any publicly or privately owned historic site listed or eligible for listing on the National Register of Historic Places (NRHP). Impacts to Section 4(f) properties can include physical use (e.g., an actual physical taking of Section 4(f) property through purchase of land or a permanent easement, physical occupation of a portion or all of the property, or alteration of structures or facilities on the property) or constructive use. Constructive use occurs when the impacts of a project on a Section 4(f) property (e.g., noise) are so severe that the activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired (see FAA Order 1050.1F, Appendix B-2). As the sonic booms produced by the proposed action would be no more than 0.7 psf and occur only once a week, they would not result in a constructive use. As a result, the ROI for Section 4(f) properties is the airport boundary. There are no Section 4(f) properties within this ROI.
- **Farmlands** – Per soils mapping conducted for this analysis, there is no designated farmland of statewide importance within the FTG boundary. Land within the airport boundary has been designated by Natural Resources Conservation Service as either not prime farmland or prime farmland if irrigated. Currently, there is no plan to irrigate the land on FTG property. Approximately 1.5 acres of farmland could be converted to non-agricultural use if the static hot-fire test stand area based on current assumptions for the analysis. FTG has 1,708.6 acres designated for farming and FTG is surrounded by approximately 54,000 acres of active farmland within a 5-mile radius. Since FTG is surrounded by such a large amount of agricultural land, with a large acreage located on FTG property, the construction of the static hot-fire test stand would not result in a significant loss of agricultural land within the region.
- **Children’s Environmental Health and Safety Risks** – EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, was passed in 1997 to ensure that children do not suffer disproportionately from environmental or safety risks. The ROI for evaluation of health and safety risks to children is the airport boundary, as this area encompasses all of the DNL 65 dB noise contour. There are no schools, day care centers, parks, or playgrounds within the ROI. Therefore, the Proposed Action is not expected to result in any disproportionate health or safety impacts on children during either construction or operation.

- **Wild and Scenic Rivers** – The ROI for wild and scenic rivers includes Adams, Arapahoe, Kit Carson, Lincoln, Morgan, Washington, and Yuma counties which includes the FTG boundary, the operational flight track, and the sonic boom footprint. There are no wild and scenic rivers as designated by the Wild and Scenic Rivers Act located within the ROI. The nearest wild and scenic river segment is the Cache La Poudre River in Larimer County, Colorado, which is located approximately 70 miles northwest of the ROI (National Wild and Scenic Rivers System 2014).

3.1 Air Quality

3.1.1 Background

Air pollution is a concern because of its demonstrated effects on human health. The Clean Air Act (42 U.S.C. §§ 7401-761q) is the primary statute that regulates air quality in the United States. Ambient air quality refers to the atmospheric concentration of a specific compound (amount of pollutants in a specified volume of air) that occurs at a particular geographic location. The ambient air quality levels measured at a particular location are determined by the interactions of emissions, meteorology, and chemistry. Emission considerations include the types, amounts, and locations of pollutants emitted into the atmosphere. Meteorological considerations include wind and precipitation patterns that affect the distribution, dilution, and removal of pollutant emissions. Chemical reactions can transform pollutant emissions into other chemical substances. Ambient air quality data are generally reported as a mass per unit volume (e.g., micrograms per cubic meter of air) or as a volume fraction (e.g., parts per million by volume).

The Earth's atmosphere consists of four main layers: the troposphere, stratosphere, mesosphere, and ionosphere. For the purposes of this PEA, the discussion of air quality within the lower troposphere is defined as at or below 3,000 ft above ground level, which the EPA accepts as the nominal height of the atmospheric mixing layer (U.S. Environmental Protection Agency 1992). The mixing layer (sometimes referred to as the boundary layer) is the layer of air directly above the Earth that is relatively well mixed. This layer extends to a height referred to as the mixing height, above which the free troposphere extends up to the tropopause. Typically, temperature and density decrease with altitude in the atmosphere up to the mixing height. However, at the mixing height, the temperature begins to increase with altitude and creates an inversion which prevents a parcel of air from spontaneously rising past the mixing height (Visconti 2001). Pollutants released above the mixing height generally do not mix with ground level emissions and do not have an effect on ground level pollutant concentrations.

The ROI for air quality is Adams County because the bulk of the construction and operational air emissions would occur within this localized area. Adams County is part of the Metropolitan Denver Intrastate Air Quality Control Region (40 CFR § 81.16), which includes the following counties: Adams, Arapahoe, Boulder, Clear Creek, Denver, Douglas, Gilpin, and Jefferson.

3.1.2 Regulatory Setting

National Ambient Air Quality Standards

Under the Clean Air Act, the EPA has established National Ambient Air Quality Standards (NAAQS) for pollutants of concern known as “criteria pollutants” (40 CFR Part 50). The criteria pollutants are carbon

monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), ozone (O₃), particulate matter less than or equal to 10 microns aerodynamic diameter (PM₁₀), fine particulate matter less than or equal to 2.5 microns aerodynamic diameter (PM_{2.5}), and sulfur dioxide (SO₂). The NAAQS represent the maximum levels of air pollution that are considered acceptable, with an adequate margin of safety, to protect public health (Primary Standards) and welfare (Secondary Standards). Short-term standards (1-, 3-, 8-, and 24-hour averaging periods) are established for pollutants contributing to acute health effects, while long-term standards (quarterly and annual averages) are established for pollutants contributing to chronic health effects.

The Colorado Department of Public Health and Environment, Air Pollution Control Division, has adopted the NAAQS and also maintains two state air quality standards. The NAAQS and state standards are presented in Table 3-1.

Table 3-1. National and Colorado Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standards	Secondary Standards
Carbon monoxide	8-hour	9 ppm	None
	1-hour	35 ppm	
Lead	Rolling 3-month average	0.15 µg/m ³	Same as Primary
Nitrogen dioxide	Annual (arithmetic average)	53 ppb	Same as Primary
	1-hour	100 ppb	None
Particulate matter 10 microns	24-hour	150 µg/m ³	Same as Primary
Particulate matter 2.5 microns	Annual (arithmetic average)	12.0 µg/m ³	15.0 µg/m ³
	24-hour	35 µg/m ³	Same as Primary
Ozone	8-hour	0.070 ppm	Same as Primary
Sulfur dioxide	3-hour	None	0.5 ppm
	1-hour	75 ppb	None
Sulfur dioxide (Colorado)	3-hour	700 µg/m ³ (0.267 ppm)	None
Visibility (Colorado) ¹	4-hour (standard applies 8:00 a.m. – 4:00 p.m. only)	0.076/kilometer (single standard, not designated primary or secondary)	

Sources: 40 CFR §50, 5 Code of Colorado Regulations 1001-14

¹ Visibility (Colorado) - The standard for visual air quality is 0.076 per kilometer of atmospheric extinction, which means that 7.6 percent of a light source's intensity is extinguished over a 1-kilometer path.

µg/m³ = micrograms per cubic meter; ppb = parts per billion; ppm = parts per million; PM₁₀ = particulate matter less than or equal to 10 microns in diameter; PM_{2.5} = fine particulate matter less than or equal to 2.5 microns in diameter.

Areas that are and have historically been in compliance with the NAAQS are designated by EPA as attainment areas. Areas that violate a NAAQS are designated as non-attainment areas. Areas that have transitioned from non-attainment to attainment are designated as maintenance areas and are required to adhere to maintenance plans to ensure continued attainment. The Metropolitan Denver Intrastate Air Quality Control Region, which includes Adams County and FTG, is designated as moderate non-attainment for ozone (40 CFR § 81.306). It is also designated as a maintenance area for CO and PM₁₀.

Hazardous Air Pollutants

In addition to the ambient air quality standards for criteria pollutants, regulations exist for hazardous air pollutants (HAPs) emitted from stationary sources. The National Emission Standards for Hazardous Air

Pollutants, established by EPA under the Clean Air Act, regulate 188 HAPs for stationary sources based on available control technologies (40 CFR Parts 61 and 63). The majority of HAPs are volatile organic compounds (VOCs).

HAPs emitted from mobile sources are called Mobile Source Air Toxics (MSATs). MSATs are compounds emitted from highway vehicles and non-road equipment which are known or suspected to cause cancer or other serious health and environmental effects. In 2001, the EPA issued its first MSAT Rule, which identified 21 compounds as being HAPs that required regulation (U.S. Environmental Protection Agency 2001a). A subset of six of these MSAT compounds were identified as having the greatest influence on health and included benzene, 1,3-butadiene, formaldehyde, acrolein, acetaldehyde, and diesel particulate matter. The EPA issued a second MSAT Rule in February 2007, which generally supported the findings in the first rule and provided additional recommendations of compounds having the greatest impact on health. The rule also identified several engine emission certification standards that must be implemented (U.S. Environmental Protection Agency 2007).

MSATs would be the primary HAPs emitted by mobile sources during construction and operations under the Proposed Action. The equipment used during construction would likely vary in age and emission rates. Construction equipment would be operated intermittently over a large area and would produce negligible ambient HAP concentrations in a localized area. Operational equipment, including vehicles driven by commuters, produces negligible ambient HAP concentrations. Therefore, HAP emissions are not considered further in this analysis.

General Conformity

The EPA General Conformity Rule (40 CFR 93 Subpart B) ensures that the actions taken by federal agencies in non-attainment and maintenance areas conform to a state's plan to meet the NAAQS. The General Conformity Rule applies to federal actions occurring in non-attainment or maintenance areas. It provides that a federal agency cannot issue a permit for or support an activity unless the agency determines that the action will conform to the most recent EPA-approved State Implementation Plan. This means that projects using federal funds or requiring federal approval must not:

1. cause or contribute to any new violation of a NAAQS,
2. increase the frequency or severity of any existing violation, or
3. delay the timely attainment of any standard, interim emission reduction, or other milestone.

A conformity applicability analysis is the first step of a conformity evaluation and assesses if a federal action must be supported by a conformity determination. This is typically done by quantifying applicable direct and indirect emissions that are proposed to result from a federal action. Direct emissions are those that are caused by or initiated by the federal action and occur at the same time and place as the action. Indirect emissions are those caused by the federal action, but occur later in time and/or removed in distance from the action. The emissions change due to the project (the net emissions) is compared to the *de minimis* threshold specified in the General Conformity Rule for each pollutant. If the results of the applicability analysis indicate that the net emissions would not exceed the *de minimis* emission thresholds applicable to the Proposed Action, then the conformity evaluation process is completed. If emissions of one or more

applicable pollutants exceed a *de minimis* threshold, then the project must demonstrate conformity under one of the methods prescribed by the General Conformity Rule.

Because Adams County is designated non-attainment for ozone and maintenance for CO and PM₁₀, the General Conformity Rule applies to the project and a general conformity applicability analysis has been performed as part of this PEA. In accordance with the air conformity requirements of 40 CFR § 3.153(b)(1), the applicable *de minimis* levels are presented in Table 3-2.

Table 3-2. Applicable General Conformity *de Minimis* Thresholds (tons per year)

CO	NO _x ¹	PM ₁₀	VOCs ¹
100	100	100	100

Source: 40 CFR §93.153.

¹Volatile organic compounds (VOCs) and nitrogen oxides (NO_x) are ozone precursors.

Air Quality Permitting

The Colorado Department of Public Health and Environment, Air Pollution Control Division regulates stationary sources of air pollution in the state and requires that Air Pollution Emission Notices (APENs) and permit applications be filed for stationary sources that exceed specific emission thresholds. In addition, land development projects that disturb 25 or more contiguous acres and/or will last more than 6 months in duration are required to submit land development APENs and are subject to mandatory fugitive dust control requirements.

3.1.3 Existing Conditions

As described above, the Metropolitan Denver Intrastate Air Quality Control Region is designated as a moderate non-attainment area for ozone and is designated as a maintenance area for CO and PM₁₀. The region is designated attainment/unclassifiable for the remaining criteria pollutants (SO₂, PM_{2.5}, Pb, NO₂).

Currently, the Colorado State Implementation Plan includes the 2008 Ozone Action Plan (Colorado Department of Public Health and Environment 2008), although this plan has not yet been approved by the EPA. The Carbon Monoxide Redesignation Request and Maintenance Plan for the Denver Metropolitan Area was approved by EPA in 2004 (U.S. Environmental Protection Agency 2004). The PM₁₀ Redesignation Request and Maintenance Plan for the Denver Metropolitan Area was approved by EPA in 2002 (U.S. Environmental Protection Agency 2002). The 2008 Ozone Action Plan and the maintenance plans for CO and PM₁₀ all contain emission budgets for the region to ensure that the area is achieving and/or maintaining attainment status.

The Colorado Department of Public Health and Environment operates air quality monitors that measure ambient pollutant concentrations at a number of locations in the state. The monitors nearest to FTG are located in Aurora (about 10 miles from FTG), Welby (about 22 miles from FTG), and Denver (about 24 miles from FTG). During 2014-2016 exceedances of the ozone NAAQS were recorded at all three monitoring sites, and exceedances of the PM_{2.5} NAAQS were recorded at the Denver site. (An exceedance is not necessarily a violation, because violations are determined according to specific statistical and regulatory criteria.)

Existing stationary sources of emissions at FTG include emergency generators and aboveground and underground fuel storage tanks. FTG has an active APEN for the emergency generators; however, emissions from the fuel storage tanks are below APEN reporting thresholds. Existing mobile sources at FTG include aircraft, motor vehicles, and aircraft ground support equipment.

3.2 Biological Resources (including Fish, Wildlife, and Plants)

3.2.1 Background

Biological resources include terrestrial and aquatic plant and animal species and their habitats, including special status species (federally listed or state-listed threatened or endangered species, species proposed for listing, species that are candidates for federal listing, marine mammals, and migratory birds) and environmentally sensitive or critical habitat. Biological resources provide aesthetic, recreational, and socioeconomic benefits to society.

The ROI for vegetation is defined as the property boundary of FTG, as this is the limit of construction activities where physical impacts on vegetation would occur. The ROI for wildlife includes Adams, Arapahoe, Kit Carson, Lincoln, Morgan, Washington, and Yuma counties, which includes the FTG boundary, the 65 DNL noise contour, the operational flight track, and the sonic boom footprint.

3.2.2 Regulatory Setting

Biological resources are protected by both federal and state laws, as described below.

Endangered Species Act. The Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. § 1531 et seq.), is the primary federal legislation that provides protection to imperiled species and the ecosystems upon which they depend. Section 7 of the ESA requires federal agencies to ensure their actions are not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of critical habitat as defined in 16 U.S.C. § 1532(5)(a). An endangered species is defined as any species which is in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as any species which is likely to become endangered within the foreseeable future.

The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service⁷ administer the ESA which prohibits “take⁸” of listed species. The USFWS also maintains a list of candidate species for possible listing under the ESA. Although candidate species receive no statutory protection under the ESA, the USFWS

⁷ The USFWS has jurisdiction over terrestrial and freshwater species. The National Marine Fisheries Service has jurisdiction over marine and anadromous species.

⁸ Per 16 U.S.C. § 1532(19) the term “take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct.

encourages cooperative conservation efforts for these species because they are species that may warrant future protection under the ESA.

Bald and Golden Eagle Protection Act. Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668–668c) and the Migratory Bird Treaty Act. The Bald and Golden Eagle Protection Act prohibits anyone from “taking” a bald or golden eagle, including their parts, nests, or eggs, without a permit issued by the USFWS. Implementing regulations (50 CFR§22), and USFWS guidelines as published in the National Bald Eagle Management Guidelines, provide for additional protections against “disturbances.” Similar to a take, “Disturb” means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, injury to an eagle or causes either a decrease in its productivity or nest abandonment due to a substantial interference with breeding, feeding, or sheltering. A permitting process provides limited exceptions to the Bald and Golden Eagle Protection Act’s prohibitions. The USFWS has issued regulations for the permitting process in 50 CFR Part 22.

The Migratory Bird Treaty Act. The Migratory Bird Treaty Act (16 U.S.C. §§ 703-712) protects migratory birds, including their active nests, eggs, and parts, from possession, sale, purchase, barter, transport, import, export, and take. The USFWS is the federal agency responsible for the management of migratory birds as they spend time in habitats of the U.S. For purposes of the Migratory Bird Treaty Act, “take” is defined as “to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect” (50 CFR § 10.12). The Migratory Bird Treaty Act applies to migratory birds that are identified in 50 CFR § 10.13 (defined hereafter as “migratory birds”).

The Colorado Nongame, Endangered, and Threatened Species Conservation Act. This law provides protection within the state for state-listed species and establishes the State’s intent to protect endangered, threatened, or rare species. Colorado Parks and Wildlife maintains a list of state-listed endangered, threatened, and state special concern species that receive protection under the law. Under the law, it is unlawful for any person to take, possess, transport, export, process, sell or offer for sale, or ship any state threatened or endangered wildlife species (Colorado Revised Statutes § 33-2-105).

Noxious Weeds. State and federal regulations are in place to protect habitat from plant species determined to be “noxious.” The Colorado Department of Agriculture Noxious Weed Act of 2003 (Colorado Revised Statutes 35-5-101; Colorado Revised Statutes 35-5.5-101; EO D-006-99) defines and prioritizes management objectives for state-designated noxious weeds. Adams County manages noxious weeds pursuant to the Colorado Noxious Weed Act, and has developed a Weed Management Plan to prevent the spread of noxious weeds.

3.2.3 Existing Conditions

A site visit to FTG was conducted by the EA contractor on June 6, 2013, to observe existing conditions and identify potential habitat in the vicinity of FTG and in the areas of proposed construction. This section describes the existing biological environment of FTG property and the general environment of Colorado’s northeastern plains. The focus is on vegetation and wildlife, including protected and sensitive species, which are known or likely to occur within the ROIs. Box Elder Creek is the closest fish-bearing water to the

construction area. This creek is more than 2 miles away from FTG. Because Adams County has proposed to implement Best Management Practices (BMPs) to address runoff, potential impacts on fish are not considered further in this analysis. A separate environmental document, tiering off this PEA, would be required prior to any development required for a launch operator to operate out of FTG.

Vegetation

FTG is located in the plains grassland ecosystem (Chapman et al. 2006). However, because of the high level of modification on FTG property, none of this native ecosystem remains within the ROI. Habitat types within the unpaved areas that could be affected by construction include upland mowed grass and cultivated cropland. During the site visit, several herbaceous species were observed in the mowed grassy area, including field bindweed (*Convolvulus arvensis*) and Mallow species (*Sphaeralcea* spp.). There are no trees present in the construction areas. The nearest trees are located along Front Range Parkway leading up to the main terminal building. Noxious weeds observed include diffuse knapweed (*Centaurea diffusa*) and field bindweed. These weeds are typical of Colorado Front Range roadsides and developed areas.

Wildlife

Wildlife in the ROI, including the portion of the ROI associated with the sonic boom footprint, include a variety of birds, mammals, reptiles, and amphibians. Migratory birds are discussed below under special status species. Mammals that may use the disturbed grassy areas and cultivated fields on FTG property include pronghorn antelope (*Antilocarpra americana*), coyote (*Canis latrans*), black-tailed prairie dog (*Cynomys ludovicianus*), desert cottontail (*Sylvilagus audubonii*), mule deer (*Odocoileus hemionus*), American badger (*Taxidea taxus*), and thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*). In addition, unpaved areas on FTG property also likely provide habitat for rodents such as deer mice (*Peromyscus maniculatus*), house mice (*Mus musculus*), and meadow voles (*Microtus pennsylvanicus*).

Special Status Species

Federally Listed Species. Based on a report generated from the USFWS's Information for Planning and Consultation system (Appendix B), there are nine terrestrial federally listed threatened or endangered species with the potential to occur in the ROI (including the portion of the ROI associated with the sonic boom footprint) and/or that could be affected by project activities. Effects to four of these species—least tern, piping plover, whooping crane, and Western prairie fringed orchid—only need to be considered if the project involves water-related activities or water use in the North Platte, South Platte, and Laramie River Basins.

The FAA anticipates some water use could occur during construction, either for the generation of the concrete for the mission preparation areas or for dewatering. Adams County has stated the concrete would be provided by an existing concrete batch plant located within a county or municipality that is a member of the South Platte Water Related Activities Program, Inc. Adams County has stated the total water use for mixing the concrete needed for the pads would be a one-time use of less than 1 acre-foot. This use would be considered “minor” under the Platte River Recovery Implementation Program (U.S. Fish and Wildlife Service 2007). This minor one-time use would not affect the flow of water to the South Platte River.

Therefore, construction would have no effect on the least tern, piping plover, whooping crane, and Western prairie fringed orchid, and these four species are not considered further in the analysis.

The remaining five species are shown in Table 3-3. None of these species are known to occur at FTG. There is no critical habitat in the ROI.

Table 3-3. Federally Listed Species in the Region of Influence

Species	Status	Habitat Description	County Occurrence ^a
Plants			
Ute ladies' tresses (<i>Spiranthes diluvialis</i>)	T	Floodplains and sub irrigated wetlands	Adams, Arapahoe, Morgan
Colorado butterfly plant (<i>Gaura neomexicana</i> var. <i>coloradensis</i>)	T	Wetlands and floodplains	Adams
Birds			
Mexican spotted owl (<i>Strix occidentalis lucida</i>)	T	Old growth forest with cliffs	Adams, Arapahoe
Mammals			
Preble's meadow jumping mouse (<i>Zapus hudsonius preblei</i>)	T	Wetland and riparian areas with shrubs	Adams, Arapahoe, Morgan
Black-footed ferret (<i>Mustella nigripes</i>)	E	Depend on prairie dogs for survival—food and shelter; reintroduced at sites throughout Colorado	Adams

^a County occurrence based on species listings by county.

Source: U.S. Fish and Wildlife Service 2018

Status Codes: E = Endangered; T = Threatened

Migratory Birds. Migratory bird species found near FTG consist largely of species associated with the shortgrass prairie. Avian species documented during the site visit included: western meadowlark (*Sturnella neglecta*), horned lark (*Eremophila alpestris*), American kestrel (*Falco sparverius*), house sparrow (*Passer domesticus*), mourning dove (*Zenaidura macroura*), Say's phoebe (*Sayornis saya*), European starling (*Sturnus vulgaris*), western kingbird (*Tyrannus verticalis*), lark bunting (*Calamospiza melanocorys*), rock dove (*Columba livia*), Swainson's hawk (*Buteo swainsoni*), and red-tailed hawk (*Buteo jamaicensis*). No nests were observed during the site visit; however, grassy upland areas could be used by ground nesting species. As an existing GA airport, FTG implements procedures to minimize the presence of hazardous wildlife attractants (e.g., water features) in order to minimize conflict between wildlife and aircraft. Appendix B contains a report generated from the USFWS's Information, Planning, and Conservation system for all of the counties in the wildlife ROI. This report contains a list of migratory birds of conservation concern that could be present in the ROI.

Bald and Golden Eagles. There is no nesting habitat for bald or golden eagles near FTG property; however, they may be transient in and around FTG. The bald eagle may occasionally forage near FTG property in active prairie dog colonies, although no perennial streams or large bodies of water, or winter roost sites occur near FTG. Bald and golden eagle nesting habitat may occur in the off-site locations of the ROI (i.e., the areas within the sonic boom footprint).

State-Listed Species. Colorado Parks and Wildlife lists 74 species of amphibians, birds, fish, mammals, reptiles, and mollusks as endangered, threatened, or of special concern within the State of Colorado (Colorado Parks and Wildlife 2013). The majority of these species do not occur on FTG property because FTG is located outside their range and/or suitable habitat is not present at FTG. Of the 74 species listed by Colorado Parks and Wildlife, three species that are not also federally protected were identified as having the potential to occur near FTG—black-tailed prairie dog, burrowing owl, and ferruginous hawk (Table 3-4). None of these species are known to occur at FTG. State-listed species potentially present in the counties associated with the sonic boom footprint are not anticipated to be adversely effected by the Proposed Action due to the low frequency and low overpressure s of the sonic boom (see Section 4.8.2).

Table 3-4. State-Protected and Sensitive Species at or Near FTG

Common Name	Status	Habitat Description	Potential for Occurrence in On-Site ROI ^a
Black-tailed prairie dog (<i>Cynomys ludovicianus</i>)	SSC	Grassy plains or prairies	Suitable habitat is present on-site; however, active prairie dog towns are not present on FTG property, as current airport operations and control policies preclude this species from inhabiting the site.
Burrowing owl (<i>Athene cunicularia</i>)	ST	Grasslands and mountain parks, near existing prairie dog towns. Well-drained, steppes, deserts, prairies, and agricultural lands.	Suitable habitat is present; however, active prairie dog towns are not present on FTG property and individual burrowing owls were not observed during the site visit. Burrowing owls may occur in prairie dog towns in nearby surrounding areas.
Ferruginous hawk (<i>Buteo regalis</i>)	SSC	Open grasslands and shrub steppe communities	Range extends over the eastern plains; however, suitable foraging habitat exists mainly where prairie dog towns are located.

^a On-site ROI is defined as FTG.

Sources: U.S. Fish and Wildlife Service 2014; Colorado Parks and Wildlife 2013.

Status Codes: ST = State Threatened; SSC = State Special Concern

3.3 Climate

3.3.1 Background

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. The primary GHGs of concern are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF₆). These emissions occur from natural processes and human activities.

Each GHG is assigned a global warming potential. The global warming potential is the ability of a gas or aerosol to trap heat in the atmosphere. The global warming potential rating system is standardized to CO₂, which has a value of one. For example, CH₄ (methane) has a global warming potential of 21, which means that it has a global warming effect 21 times greater than CO₂, on an equal-mass basis. The equivalent CO₂ rate is calculated by multiplying the emission of each GHG by its global warming potential and adding the results together to produce a single, combined emission rate representing all GHGs, and this value is represented by CO₂e, which is defined as the carbon dioxide equivalent.

3.3.2 Regulatory Setting

FAA Order 1050.1F requires consideration of potential climate impacts.

There are currently no requirements for sources to submit APENs, obtain construction permits, or pay annual fees due solely to their GHG emissions.

3.3.3 Existing Conditions

Research has shown there is a direct correlation between fuel combustion and GHG emissions. In terms of U.S. contributions, the Government Accountability Office reports that "domestic aviation contributes about 3 percent of total CO₂ emissions, according to EPA data," compared with other industrial sources including the remainder of the transportation sector (20 percent) and power generation (41 percent) (Government Accountability Office 2009). The International Civil Aviation Organization estimates that GHG emissions from aircraft account for roughly 3 percent of all anthropogenic GHG emissions globally (Melrose 2010). Climate change due to GHG emissions is a cumulative global phenomenon, so the affected environment is the global climate (U.S. Environmental Protection Agency 2009a).

3.4 Hazardous Materials, Solid Waste, and Pollution Prevention

3.4.1 Background

Analysis of the presence, handling, storage, and disposal of hazardous materials, hazardous waste, and solid waste includes an evaluation of the following:

- Potential to encounter existing hazardous materials during the construction and operation of the Proposed Action.
- Potential hazardous materials that could be transported and used during construction and operation of the Proposed Action, and applicable pollution prevention strategies and procedures.
- Potential to interfere with any ongoing remediation of existing contaminated sites in the immediate vicinity of the Proposed Action.
- Waste streams that would be generated by the Proposed Action, potential for the wastes to impact environmental resources, and the impacts on waste handling and disposal facilities that would likely receive the wastes.

The ROI for hazardous materials, pollution prevention, and solid waste is limited to FTG property and the immediate vicinity that could be affected by the materials transported, stored, and used; waste generated; or launch pad spills/releases that could occur as a result of implementing the Proposed Action. Launch failures are discussed in Sections 2.1.2, *Conceptual Launch Activities*, and Section 4.4.1, *Proposed Action*, of this PEA.

3.4.2 Regulatory Setting

The handling and disposal of hazardous materials, chemicals, substances, and wastes are governed at various levels ranging from the federal level to the local level. Applicable federal statutes include the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act of 1986, the

Emergency Planning and Community Right-To-Know Act of 1986, and the Community Environmental Response Facilitation Act of 1992. The Resource Conservation and Recovery Act (RCRA) governs the generation, treatment, storage, and disposal of hazardous wastes. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides for consultation with natural resources trustees and cleanup of any release of a hazardous substance (excluding petroleum) into the environment. The federal Hazardous Materials Regulations are contained in 49 CFR Parts 171 through 180. The federal Oil Spill Prevention, Control, and Countermeasure Regulations are contained in 40 CFR Part 112.

The management of biosolids generated from wastewater treatment is governed under the Colorado Department of Public Health and Environment, Water Quality Control Commission, 5 Code of Colorado Regulations 1002-64, Biosolids Regulation, Regulation No. 64.

The Colorado Department of Labor and Employment, Division of Oil and Public Safety enforces regulations related to aboveground and underground storage tank operations, including installation, registration, testing, and maintenance. The Colorado Department of Public Health and Environment enforces federal and state laws and regulations pertaining to hazardous waste. The Colorado Hazardous Waste Regulations are contained in 6 Code of Colorado Regulations 1007-3 (Parts 260 through 269).

Adams County maintains transfer stations for the consolidation of solid waste and recyclables and landfills for the disposal of solid waste generated within the County. The Adams County Public Works Department is responsible for enforcing State regulations for general sanitation. The Adams County Development Standards and Regulations include requirements for garbage area screening and placement of trash and recycling receptacles (Adams County 2016b).

3.4.3 Existing Conditions

Based on information provided by Adams County officials, no areas of known contamination exist at FTG (Adams County 2014b). According to information provided by the Tri-County Health Department (Tri-County Health Department 2014), no known landfills exist within a 2-mile radius of FTG. A database search conducted by Environmental Data Resources, Inc. within a 1-mile radius around FTG property indicates that two properties of potential relevance were located within the search radius: Gold Metal Paint and Kumar & Associates – Front Range. The findings regarding these two properties are presented below and the full Environmental Data Resources report is included in Appendix H, *Environmental Data Resources Report for Front Range Airport*.

Gold Medal Paint Works, EPA Identification Number EPA ID # COR000214783, 5120 Violet Hill St, Watkins, Colorado, 80173, is listed in the RCRAInfo database as an historical small quantity generator of hazardous waste (EPA Waste Codes: D007 chromium and F002 spent halogenated solvents). Additionally, Gold Medal Paint Works/Norm Teltow, EPA ID # COR000223149, 5190 Violet Hill Street, Ste F, Front Range Airport, Watkins, Colorado, 80173, is listed as a conditionally exempt small quantity generator of hazardous waste (EPA Waste Codes: D007 chromium, F002 spent halogenated solvents, D001 ignitable waste, D035 methyl ethyl ketone, and F003 and F005 spent non-halogenated solvents) and a handler of universal waste

batteries, lamps, pesticides, and thermostats. The database includes a Focused Compliance Inspection (2010) and two Facility Self Disclosures (2008, 2009) recorded for Gold Medal Paint.

In addition, Gold Medal Paint (EPA ID # COR000223149) is included in the federal Resource Conservation and Liability Act CORRACTS facilities list of hazardous waste handlers with Resource Conservation and Liability Act corrective action activity for various Compliance Advisory and Compliance Order enforcement actions from 2010-2012. The Gold Medal Paint facility was included on the EPA Watch List for Resource Conservation and Liability Act Facilities in July 2012 and August 2012.

On October 22, 2012, the Colorado Department of Public Health and Environment issued a letter to Mr. Normal Teltow III referencing a Preliminary Site Characterization Report dated September 21, 2012. The letter stated that the Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division "...has determined that a release has not occurred into the environment, and thus there is no need to further test, characterize, and/or perform remediation at the referenced facility." Gold Medal Paint, formerly a tenant of the Front Range Airport Authority, is no longer operating at FTG.

A site identified in the Environmental Data Resources report as "Kumar & Associates – Front Range, 5100 Quail Run Rd Field Lab" is located just south of 48th Avenue off airport property. The facility (EPA ID # COD983784984) is included in the RCRAInfo database as an historic generator of hazardous waste (EPA Waste Code: F001 spent halogenated solvents).

The majority of the hazardous materials stored and handled at FTG are products used in aircraft service and repair operations, ground vehicle maintenance, and facilities and grounds maintenance (e.g., paints, solvents, lubricants, adhesives, sealants).

FTG currently conducts aircraft and airport maintenance that requires the use of small quantities of hazardous materials such as paints, lubricants, solvents, and adhesives. Airport customers can purchase fuel from the airport, which maintains a supply of aviation fuel in bulk storage tanks. FTG Fixed-Based Operator provides onsite aircraft deicing services. Information contained in the Stormwater Management Plan indicates that deicing of aircraft occurs infrequently during the winter months. Deicing is conducted on the ramp area located north of the terminal building using a glycol-based deicing fluid, and the storm sewer outfall from this area is used to monitor the discharge (Front Range Airport 2012a). FTG maintains an Emergency Procedures Manual that describes steps to be followed in the event of a spill of any type of combustible fuel, hydraulic fluid, motor oil, turbine oil, alcohol, caustics, pesticides, herbicides, paints, thinners, solvents, and other hazardous materials, including chemical, biological, radiological or explosive or unknown substances (Front Range Airport 2012b).

Aircraft maintenance takes place primarily indoors at the tenant maintenance shops. FTG provides for use by airport tenants of a 500-gallon above ground tank for collection of used oil for recycling. This tank is located near the aircraft fuel storage area. Two 55-gallon barrels are used to collect spent aviation fuel. The 500-gallon tank and 55-gallon barrels are emptied regularly by a local oil recycling company (Front Range Airport 2012b).

Aviation and automotive vehicle fuels are presently stored in bulk quantities in several locations on FTG. Fuel is delivered to the FTG fuel farm by over-the-road tankers. The fuel is then pumped into FTG fuel trucks via pumps and above ground piping. The Fuel Farm area contains three underground storage tanks, consisting of two 15,000-gallon tanks containing Jet A fuel and one 20,000-gallon tank containing 100 LL fuel (Exhibit 2-2), and each tank is equipped with a leak detection system. In addition, FTG maintains a two-compartment double-walled aboveground tank with the capacity to store 1,000 gallons of unleaded automotive gasoline and 1,000 gallons of equipment diesel fuel. A 10,000-gallon Self-Serve tank containing 100 LL fuel, is located near the existing terminal (Exhibit 2-2). FTG also maintains fuel trucks, including the following: a 5,000-gallon Jet A refueler, a 2,000-gallon back-up Jet A refueler, a 1,500-gallon 100 LL refueler, a 750-gallon trailer-mounted back-up 100 LL refueler, and a 2,000-gallon automotive diesel refueler.

The routine hazardous waste generation associated with the aircraft maintenance and fueling operations and the maintenance of FTG facilities and grounds is currently at a level that classifies FTG as a conditionally exempt small quantity generator of hazardous waste. Fleet maintenance operations generate hazardous materials such as parts, cleaning solvents, and glycol-based antifreeze, which are collected and transported off site under manifest for recycling or disposal. Jet A and 100 LL fuel removed from tanks during daily tank checks is processed through a recycling unit and returned to the tanks so that no waste is generated (Front Range Airport 2013). Used vehicle batteries are returned to the battery supplier in exchange for new batteries purchased. Waste oil generated through maintenance of the FTG fleet and collected from FTG tenants is accumulated in an aboveground tank equipped with secondary containment and housed in a locking steel shipping container. FTG maintains a contract with a licensed waste oil hauler to transport the waste oil off site under manifest (Front Range Airport 2013).

The FTG Minimum Standards, Rules and Regulations for Airport Users, Section 300 Aircraft Rules, includes the following:

300.22 All washing of aircraft shall be from a metered water source. Washing of the exterior of the aircraft is permitted as allowed by the Airport's Storm Water Management Plan. Only biodegradable, phosphate-free detergents are allowed. Solvents and thinners shall not be allowed for degreasing of engines and components in outdoor washing sites. Degreasing of engines and components shall be allowed in buildings protected by a water/oil separator. Environmentally friendly degreasers are required.

As an alternative, the run-off debris from degreasing of engines and components can be collected using environmental absorption products. However, no run-off can be allowed to contaminate the ground area. The absorption products used for this purpose cannot be disposed of in the general trash. These items must be placed in containers and transported to a hazardous waste collection site. Environmentally friendly degreasers are required.

The FTG Minimum Standards for Commercial Aeronautical Activities (Revised October 15, 2003) describes requirements for Fixed-Based Operator and tenant (e.g., Scheduled Air Carrier, Aircraft Rental) activities. Included in the Minimum Standards for some activities is the requirement for the Operator "to bear the cost for ...

- vii. Any environmental studies.
- vii. Deicing equipment and the collection, detention, and disposal of deicing chemicals. Including an engineered detention pond, which meets EPA standards.
- viii. Any other costs associated with federal, state, or local requirements, laws, rules, or regulations...”

In reference to solid waste generated at FTG, four dumpsters are provided for the collection of general refuse, and FTG uses a contracted hauler for the collection and transportation of the solid waste generated to various off-site disposal facilities. Some wastes generated at FTG are hauled to the Adams County Landfill and the solid waste generated at the wastewater treatment plant is hauled by a licensed waste hauler to an off-site facility under manifest (Front Range Airport 2013). FTG is in the process of developing a recycling program for office waste and is evaluating the feasibility of including other waste types in the program.

3.5 Historical, Architectural, Archaeological, and Cultural Resources

3.5.1 Background

Historical, architectural, archaeological, and cultural resources encompass a range of sites, properties, and physical resources relating to human activities, society, and cultural institutions. Such resources include past and present expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, structures, objects, and districts, which are considered important to a culture or community. Historical, architectural, archaeological, and cultural resources also include aspects of the physical environment, namely natural features and biota, which are a part of traditional ways of life and practices and are associated with community values and institutions.

Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) is called a *historic property*. A unique type of cultural resource that can be eligible for listing in the NRHP is called a *traditional cultural property*. A traditional cultural property is generally defined as a property that is eligible for the NRHP because of its association with cultural practices or beliefs of a living community that are rooted in that community’s history and are important in maintaining the continuing cultural identity of the community. Traditional cultural properties are typically identified through consultation with Indian tribes or other consulting parties that have cultural affiliation with the Area of Potential Effects (APE). The APE is the “geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties” (36 CFR § 800.16(d)).

3.5.2 Regulatory Setting

Section 106 of the National Historic Preservation Act requires a federal agency to consider the effects of its undertaking on historic properties in accordance with 36 CFR Part 800 (Advisory Council on Historic Preservation 2013). Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO) and other parties, including Indian tribes. The Section 106 process is outlined in 36 CFR Part 800. Major steps in the process include identifying the APE in consultation with the SHPO, identifying and

evaluating any historic properties within the APE, and assessing the effect of the undertaking on any historic properties. If a historic property would be adversely affected, the consultation process includes resolution of adverse effects.

In accordance with 36 CFR § 800.4(a)(1), the FAA, in consultation with the Colorado SHPO, has determined an APE in consideration of both potential direct construction effects, indirect effects, and noise effects to architectural and archaeological resources (see Appendix F, *Agency Consultation and Tribal Coordination* for correspondence with the SHPO). The APE, also considered the ROI for this resource area, was defined as the area encompassed by the DNL 65 A-weighted decibel (dBA) noise contour determined during noise modeling (Exhibit 4-3). The DNL 65 dBA noise contour is located entirely within the FTG property boundary and includes the construction areas. Although sonic booms would be produced during descent, the overpressures (Exhibit 4-4) would not be high enough to cause structural damage to architectural resources (see Section 4.8.2). Therefore, the sonic boom footprint is not included in the APE.

3.5.3 Existing Conditions

The area surrounding FTG is primarily agricultural. It is an upland prairie setting with open rolling grasslands in what is known as the Platte River Basin, an area within the Colorado Piedmont section of the Great Plains Physiographic Province. Built resources are primarily remnants of small farmsteads and transportation facilities. Much of the area that would be affected by the installation of infrastructure has been previously disturbed by airport development activities. Existing infrastructure within the APE includes the ARFF and maintenance building; six small aircraft hangers; paved areas for runways, taxiways, roads, and aprons; stormwater conveyance systems; and underground utilities, including water, electric, communications, and septic systems. As discussed below, no historic properties were identified in the APE.

In 2013, as part of the intensive cultural resources survey described below, a Class I records review on Compass, the SHPO's Colorado Cultural Resources On-Line Database, was conducted for the entire APE, plus a 1-mile buffer around the APE. Compass contains all reports, forms, and other information about previous cultural resources surveys and previously recorded cultural resources that have been filed with the Colorado Office of Archaeology and Historic Preservation. The records review revealed sixteen cultural resources studies had previously been performed within 1 mile of the APE, but none had occurred within the APE. Seventeen previous cultural resources surveys were conducted within the search area. The studies identified 38 isolated archaeological finds and one prehistoric archaeological site—an open camp. The isolated finds were small ephemeral artifact scatters. None of the isolated finds or archaeological sites were determined eligible for the NRHP, and none were located within the APE. The review also identified records of eight previously documented historic-era sites, some with standing structures or buildings. These include a segment of a historic road, a segment of the Union Pacific Railroad Salina Branch (1870), a windmill, and the remains of several small farmsteads. None were determined eligible for the NRHP, and none were located within the APE.

On June 14 and 18, 2013, and August 9, 2013, Class III (i.e., 100 percent coverage) pedestrian cultural resources surveys were conducted by qualified archaeologists and architectural historians within the portions of the APE where direct ground disturbance was anticipated (Nowick et al. 2015). Archaeologists

surveyed the areas that were either unpaved or not clearly subject to previous ground disturbance at 30-meter intervals, and architectural historians surveyed buildings and structures in the APE. The survey was conducted following 36 CFR Part 800, the Secretary of the Interior's Standards for the Identification and Evaluation of Historic Properties, and the guidelines outlined in the *Colorado Cultural Resources Survey Manual, Guidelines for Identification: History and Archaeology* (Colorado State Historic Preservation Officer 2007). During the surveys, one farmstead was identified, and no archaeological sites were found (Nowick et al. 2015). The farmstead is described below.

The Wagner/Tupps Farmstead (5AM3123) is a twentieth century dryland wheat farm at East 48th Avenue and Front Range Airport Perimeter Road, east of runway 17/35. It is on land owned by FTG and is currently used for storage. The farmstead remains consist of a concrete block and frame garage (FTG-1) and outhouse (FTG-2), both constructed between 1917 and 1950; the foundation of a barn (FTG-3); the foundation of a residence constructed in 1968 (FTG-4); and a well, likely added after circa 1955 (FTG-5). William and Augusta Wagner patented 320 acres in the south half of Section 14 in 1916. The Wagner's lived on the property only briefly and moved to Denver by 1920, where Mr. Wagner was a fuel salesman. The property was rented to Harold and Grace Tupps in 1940. The Tupps family appears to have continued living on the property until they purchased it from Augusta Wagner in 1955. The well appears to be a later addition by the Tupps family, likely sometime after they took ownership of the property in 1955, based on the construction materials. A small residence, now demolished with only its foundation extant, was added in 1968 by the later owners of the property—the Lisco family—who purchased the property in 1966 from the Tupps. The farmstead remains are in poor condition, lacking major structural components and substantially deteriorated. The various remains date from different periods, and different owners and occupants. The FAA has determined the farmstead is not eligible for the NRHP under Criteria A-D (36 CFR § 60.4) due to its lack of historical, architectural, or archaeological significance, and because it lacks historic integrity. Since is it not eligible for the NRHP, the Wagner/Tupps Farmstead is not a historic property. The Colorado SHPO concurred with this determination (Appendix F).

In addition to the cultural survey, in December 2015 and June 2017, the FAA provided 43 Indian tribes, Tribal Historic Preservation Officers, and Native American individuals with a description of the Proposed Action and given an opportunity to provide comments. The FAA received responses from the Cheyenne & Arapaho and Northern Arapaho tribes, and the Pawnee Nation of Oklahoma (Appendix F). None of the tribes identified historic properties or traditional cultural properties in the APE.

3.6 Land Use

3.6.1 Background

The ROI for land use is the Airport Influence Zone (AIZ) around FTG that has been adopted by Adams County for land use planning purposes. The AIZ was selected as the ROI as it is the area impacted by the DNL 65 dB noise contour (see Section 4.8.2). The sonic boom footprint was not included in the ROI because impacts resulting from sonic booms of 0.7 psf and occurring only once a week would not impact land use. Additionally, the majority of the area within the sonic boom footprint consists of agricultural fields and is sparsely populated. There are no major towns or cities within the footprint. The AIZ is a 9-by-9-mile area

surrounding FTG which includes land impacted by the location of the airport and the noise created by low-flying aircraft. Potential impacts on land use will be analyzed using existing land uses and planned and future land uses, including master plans, area plans, or other specific plans within the study area. The Proposed Action is compared to these state, local, or regional planning documents to see if it aligns with existing and future land uses.

3.6.2 Regulatory Setting

An airport that has, or intends to receive federal funds under the Airport and Airway Improvement Act of 1982 is obligated to ensure “Appropriate action, including the adoption of zoning laws, has been or will be taken to the extent reasonable to restrict the use of land next to or near the airport to uses that are compatible with normal airport operations” (49 U.S.C. § 47107(a)(10)).

3.6.3 Existing Conditions

The land within the FTG boundary is used primarily for aviation (e.g., existing runways, buildings, and hangars). The land surrounding FTG is predominantly rolling grassland used for agricultural purposes (Exhibit 1-3). There are four residences within approximately 0.5 mile of the FTG property boundary and two nearby residential areas including Manila Village, with 13 residences, and Galamb’s Mobile Home Village, with 77 residences. The town of Watkins is located approximately 4 miles southwest of FTG property and the town of Bennett is located approximately 4 miles east of FTG property.

The land surrounding FTG is zoned by both Adams County and the City of Aurora. The City of Aurora has annexed large tracts of land around FTG and in the Comprehensive Plan has designated this area as the Front Range Airport Subarea (Exhibit 3-1). Zoning within this area is Northeast Plains, Front Range Airport Subarea and the stated purpose of this zoning area is to “take advantage of the Front Range Airport and supporting transportation network (air, rail, and highway) to support economic development that is oriented toward multi-modal transportation.” Residential uses are not permitted in this sub area and the area is designated as a major transportation center (Aurora, Colorado, Zoning Code, Sec 146-1000).

Other areas surrounding FTG that have not been annexed by Aurora remain within the jurisdiction of Adams County and the County has zoned the land immediately surrounding FTG as A-1, A-3, and PUD (planned use development). FTG itself is zoned AV (Aviation) (Adams County 2017). The following are descriptions of the allowable land uses within each Adams County Zoning designation:

- **AV—Aviation.** Land intended to provide for non-residential land uses associated with aviation operations, while minimizing risks to public safety and hazards to aviation users, including those employed at public aviation facilities.
- **A-1—Agricultural District.** The purpose of the Agricultural-1 District is to provide a rural, single-family dwelling district where the minimum lot area for a home site is intended to provide for a rural living experience. Limited farming uses are permitted, including the keeping of a limited number of animals for individual homeowner’s use. This district is primarily designed for the utilization and enjoyment of the County’s rural environment. Residential use in A-1 zoning within the AIZ overlay district surrounding FTG is restricted.

- **A-3—Agricultural District.** The purpose of the Agricultural-3 District is to provide land primarily in holdings of at least 35 acres for dry land or irrigated farming, pasturage, or other related food production uses.
- **PUD—Planned Unit Development.** In accordance with the Planned Unit Development Act of 1972, the objective of a Planned Unit Development is to establish an area of land, controlled by one or more landowners, to be developed under unified control or unified plan of development for a number of dwelling units, commercial, educational, recreational, or industrial uses, or any combination of the foregoing, the plan for which does not correspond in lot size, bulk, type of use, density, lot coverage, open space, or other restrictions to the existing land use regulations. Planned Unit Development zoned land near FTG is programmed for mixed use (non-residential) employment centers.

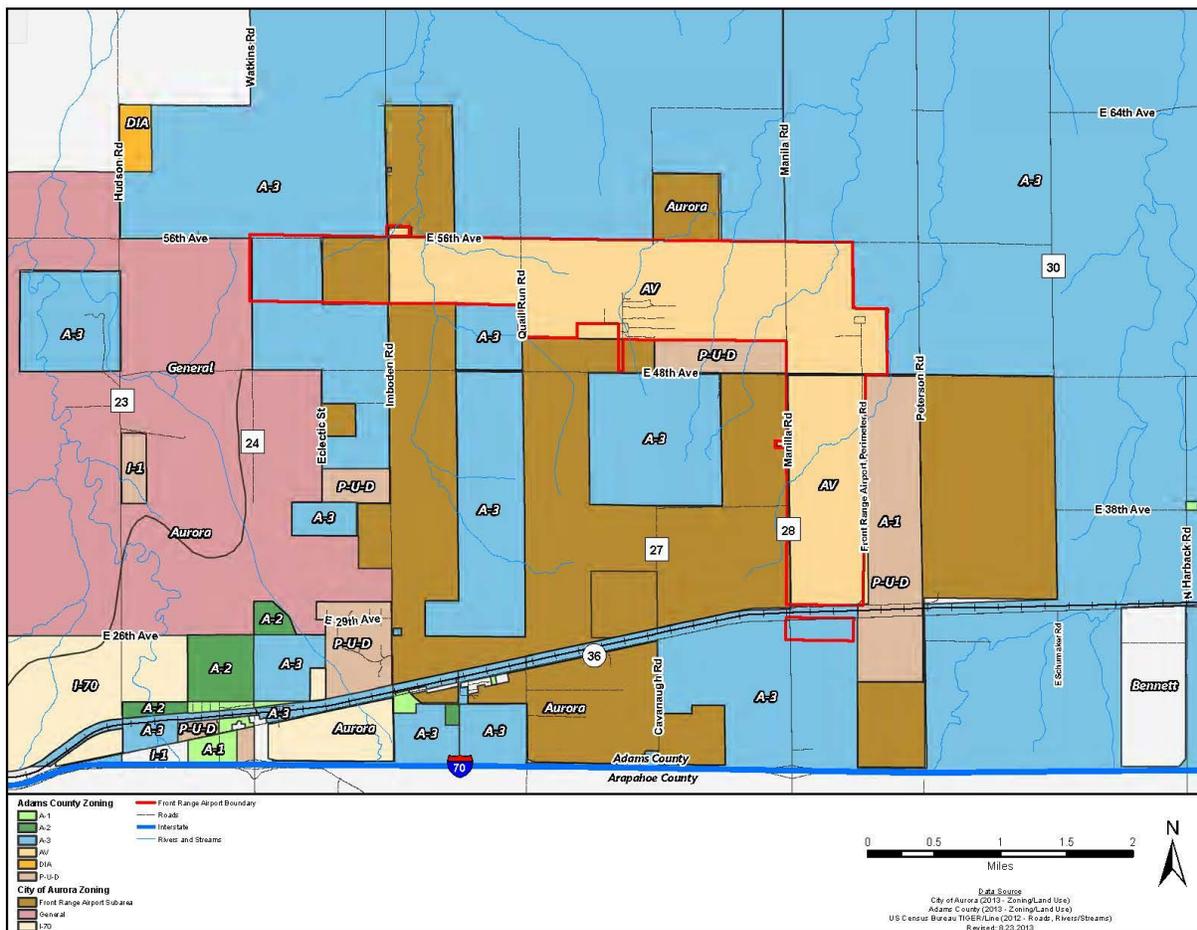


Exhibit 3-1. Front Range Airport Subarea Zoning

3.7 Natural Resources and Energy Supply

3.7.1 Background

As an impact category, natural resources and energy supply provides an evaluation of a project's consumption of natural resources and use of energy supplies. Whereas FAA Order 1050.1F acknowledges that there are no specific federal requirements in place to regulate the consumption and use of natural resources and energy supply, it also emphasizes that it is the policy of the FAA to encourage the development of facilities that exemplify the highest standards of design, including principles of sustainability. All elements of the transportation system should be designed with a view to their aesthetic impact, conservation of resources such as energy, pollution prevention, harmonization with the community and environment, and sensitivity to the concerns of the traveling public.

3.7.2 Regulatory Setting

EO 13693 of March 19, 2015, *Planning for Federal Sustainability in the Next Decade* establishes a policy for “... more efficient Federal operations ... to reduce agency direct greenhouse gas emissions by at least 40 percent over the next decade while at the same time fostering innovation, reducing spending, and strengthening the communities in which our Federal facilities operate.”

To satisfy the requirements of NEPA, the FAA must evaluate projects for impacts on energy supply and natural resources. Projects that have the potential to cause impacts on natural resources and energy supply include major facility expansion projects, significant changes in air traffic and/or airfield operations, and large-scale construction activities.

3.7.3 Existing Conditions

FTG currently purchases natural gas and electricity used in airport facilities from Xcel Energy. Xcel Energy completed construction of a new electric substation at 48th Avenue and Imboden Road in 2008 and this 50 megawatt substation (expandable to 150 megawatts) has the capacity to serve current and anticipated future electric demand at FTG and the surrounding area for the foreseeable future.

Potable water is purchased from the City of Aurora. The water supply originates through a series of deepwells which then is treated, pressurized and pumped to FTG. Water is distributed by FTG through a master meter. In addition, FTG owns and operates a state-of-the-art modular wastewater treatment facility. Facilities on the east side of FTG were not connected to the WWTP due to the expense of running sewer lines and are presently served by a septic system. The septic tanks are located just northeast of the east parking apron area. FTG intends to connect these facilities to the WWTP in the future when needed to support development.

FTG purchases both Jet A and 100LL (Avgas) fuel types from the global fuel distributor Avfuel for retail resale. Fuel sales have averaged approximately 300,000 gallons per year since 2008.

Clean Energy Collective (CEC), in partnership with Xcel Energy, built a 2000 kilowatt DC community solar facility on 14 acres of FTG property in 2017.

3.8 Noise and Noise-Compatible Land Use

3.8.1 Background

Noise is defined as unwanted sound that interferes with human activities or wildlife behavior. Noise sources can be steady-state (constant) or transient. An example of a constant noise is the noise of a fan. A sonic boom is an example of a very short transient noise event. Human perception of noise depends on a number of factors, including overall noise level, number of noise events, the extent of audibility above the background ambient noise level, and frequency content (pitch). Rocket noise generally has low frequency content which can be described as a low pitch rumble.

The ROI for noise includes Adams, Arapahoe, Kit Carson, Lincoln, Morgan, Washington, and Yuma counties, which includes the FTG boundary, the 2015 (baseline) 65 DNL noise contour (Adams), the operational flight track, and the sonic boom footprint.

3.8.2 Noise Metrics

Sound is measured in terms of the dB, which is the ratio between the sound pressure of the sound source and 20 micropascals, which is nominally the threshold of human hearing. Various weighting schemes have been developed to collapse a frequency spectrum into a single dB value. The dBA corresponds to human hearing accounting for the higher sensitivity in the mid-range frequencies. Another sound level weighting is the C-weighted scale, which emphasizes low frequency sounds, such as sonic booms.

Launch noise is a transient noise event initially at a high sound pressure level which then recedes into the background noise level as the rocket climbs in altitude. The Sound Exposure Level is a noise metric applicable to launch noise. The Sound Exposure Level normalizes the acoustic energy of a launch event as if it occurred in 1 second. The Sound Exposure Level allows an “apples to apples” comparison between two different noise events which may have different durations and magnitudes.

Other noise metrics used in launch noise analysis include Overall Sound Pressure Level, which can also be used to express an un-weighted linear value (dB). Maximum sound level refers to the maximum level that occurs during a noise time history sequence.

Sonic booms are typically measured in pounds per square foot (psf) for comparison with building structural damage criteria.

3.8.3 Regulatory Setting

Federal

Under the Noise Control Act of 1972, Occupational Safety and Health Administration established workplace standards for noise. The minimum requirement states that constant noise exposure must not exceed 90 dBA over an 8-hour period. The highest allowable sound level to which workers can be continuously exposed is 115 dBA and exposure to this level must not exceed 15 minutes within an 8 hour period. If noise levels exceed these standards, employers are required to provide hearing protection equipment that will reduce sound levels to acceptable limits.

The Control and Abatement of Aircraft Noise and Sonic Boom Act of 1968 establishes restrictions related to sonic booms; however, these apply only to aircraft and are not applicable to launch vehicles.

Several federal laws, including the Aviation Safety and Noise Abatement Act of 1979, as amended (49 U.S.C. §§ 47501–47507), and various commercial standards regulate commercial aircraft noise from airports. Through 14 CFR Part 36, the FAA regulates noise from commercial aircraft. FAA requirements for assessing impacts related to noise and noise-compatible land use are provided in FAA Order 1050.1F, Appendix B. The FAA has also established a voluntary process under 14 CFR Part 150 to provide airports with a structured process for collaboration regarding airport land use compatibility planning. This process encourages collaboration between airports, airlines and other user groups, neighboring communities, and the FAA, particularly air traffic controllers.

Table 3-5 illustrates federal compatible land use guidelines as a function of noise levels.

Table 3-5. Land Use Compatibility with Annual Day-Night Average Sound

Land Use	Annual Day-Night Average Sound Level (DNL) in Decibels					
	< 65	65-70	70-75	75-80	80-85	> 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N (1)	N (1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N (1)	N (1)	N (1)	N	N
Public Use						
Schools	Y	N (1)	N (1)	N	N	N
Hospitals, nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y (2)	Y (3)	Y (4)	Y (4)
Parking	Y	Y	Y (2)	Y (3)	Y (4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail- building materials, hardware and farm equipment	Y	Y	Y (2)	Y (3)	Y (4)	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y (2)	Y (3)	Y (4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y (2)	Y (3)	Y (4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y (6)	Y (7)	Y (8)	Y (8)	Y (8)
Livestock farming and breeding	Y	Y (6)	Y (7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y (5)	Y (5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Land Use	Annual Day-Night Average Sound Level (DNL) in Decibels					
	< 65	65-70	70-75	75-80	80-85	> 85

Source: Table 1 in Appendix A of 14 CFR Part 150, *Land Use Compatibility with Yearly Day-Night Average Sound Levels*. The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable or unacceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

NOTES:

Y (YES)—Land Use and related structures compatible without restrictions.

N (NO)—Land Use and related structures are not compatible and should be prohibited.

NLR—Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35—Land use and related structures generally compatible; measures to achieve NLR of 25, 30 or 35 dB must be incorporated into design and construction of structure.

- (1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.
- (2) Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
- (3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
- (4) Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
- (5) Land use compatible provided special sound reinforcement systems are installed.
- (6) Residential buildings require an NLR of 25.
- (7) Residential buildings require an NLR of 30.
- (8) Residential buildings not permitted.

State and Local

The State of Colorado allows counties to enact ordinances that regulate noise on public and private property (Colorado Revised Statutes 30-15-401). In addition to local sound ordinances, Colorado has enacted maximum permissible noise levels emanating from various zones (Colorado Revised Statutes 25-12-103). These maximum permissible noise levels are shown in Table 3-6. These maximum permissible noise levels are not applicable to operation of aircraft or RLVs, or to other activities which are subject to federal law with respect to noise control; however, these noise levels may be applicable to other proposed activities at FTG, including static hot-fire tests.

Table 3-6. Colorado Maximum Permissible Noise Levels for Zones and Time Periods

Zone	Maximum Sound Level (dBA)	
	7 a.m. to 7 p.m.	7 p.m. to 7 a.m.
Residential	55	50
Commercial	60	55
Light Industrial	70	65
Industrial	80	75

Source: Colorado Revised Statutes 25-12-103—Maximum permissible noise levels

3.8.4 Existing Conditions

The ambient noise environment around FTG is affected mainly by GA aircraft operations, periodic overflights of commercial aircraft from DEN, automobile traffic (Interstate 70 [I-70]), and the Union Pacific Railroad. Certain types of aircraft maintenance activities can also impact the ambient noise environment. Current noise levels near FTG are characteristic of rural residential areas periodically punctuated by brief aircraft overflights and other transient noises.

Between 1993 and 2017, the average number of aircraft operations at FTG was approximately 81,000 per year. Operations are conducted mostly with GA aircraft, followed by air taxi, and military. On an average day, the aircraft accessing FTG include single engine piston aircraft, such as Beechcraft 33/35/36; multi-engine aircraft, such as Piper Navajo; turboprops, such as Beech King Air 90; business jets, such as Cessna Citation; and helicopters (Federal Aviation Administration 2011). As shown in Exhibit 3-2 below, aircraft operations at FTG declined steadily between 2007 and 2013, and began increasing again in 2014.

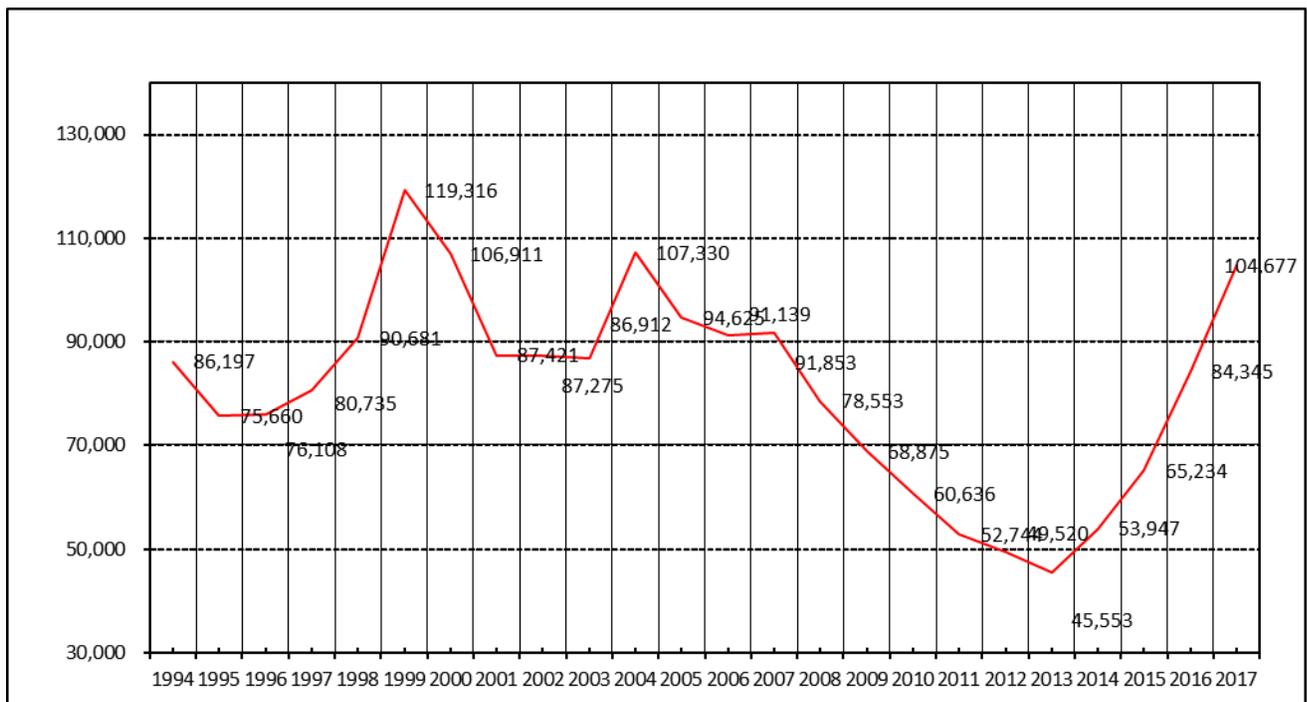


Exhibit 3-2. Operations at Front Range Airport 1993 Through 2017

Exhibit 3-3 shows the 2015 65 DNL noise contours at FTG, which serve as the baseline noise environment for this PEA. These noise contours were generated using INM (Integrated Noise Model)-modeled commercial aviation operations, departure and arrival profiles, and fleet mix. Section 5.18 of the August 2011 *Front Range Airport Increased Published Pavement Strength for Runway 17/35 Environmental Assessment* (Federal Aviation Administration 2011) discusses the INM modeling input parameters and is included in Appendix D, *Front Range Noise Analysis*. On February 26, 2018, the FAA Office of Environment

and Energy determined this methodology was appropriate for this analysis and provided its approval of the methodology, as required by FAA Order 1050.1F (see Appendix D of this PEA).

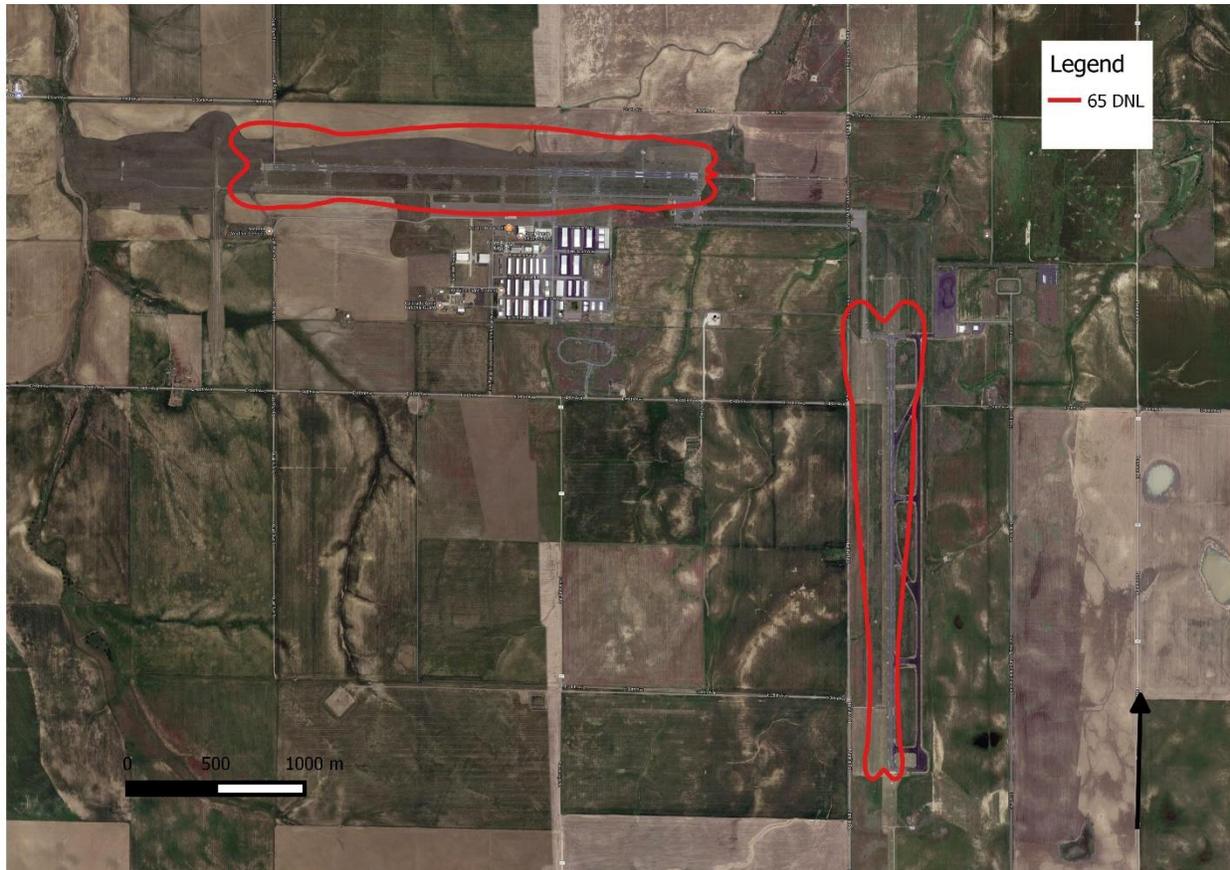


Exhibit 3-3. 2015 (Baseline) 65 DNL Noise Contours for FTG

In addition to aircraft operations at FTG, DEN and Buckley Air Force Base are located in proximity to FTG. DEN is located approximately 7 miles northwest of FTG, and Buckley Air Force Base is located approximately 13 miles southwest of FTG.

3.8.5 Noise Criteria

Human Annoyance

Past and present research by the Federal Interagency Committee on Noise (FICON) verified the DNL metric provides an excellent correlation between the noise level an aircraft generates and community annoyance to that noise level. The DNL is a 24-hour average of noise levels, with a 10 dB penalty for noise occurring at night. This adjustment is made to account for people's greater sensitivity to noise during nighttime hours (between 10 p.m. and 7 a.m.). DNL can be calculated on the basis of Sound Exposure Level and the number of daytime and nighttime noise events.

Hearing Conservation

In terms of hearing conservation, the Occupational Safety and Health Administration set a limit of 115 dBA for short exposure periods (less than 15 minutes) (Occupational Safety and Health Administration 1996). This is discussed in Section 3.8.4, *Noise-Compatible Land Use*.

Structural Damage

Rocket Noise

Structural damage due to rocket engine noise is rare, because airborne sound pressure levels must be extremely high to induce vibration levels high enough to cause damage. Glass windows and particularly fragile windows would be the most likely candidate for structural damage if it did occur. Window damage may occur at sound pressure levels of 150 dB (linear) or higher (Appendix D). Such high sound pressure levels would only be possible for residential locations in very close proximity to large rockets.

Sonic Booms

A sonic boom can cause building damage, in terms of glass breakage and other effects, if the magnitude is great enough. However, in most cases, the potential for sonic booms to damage structures is very small. At 1 psf, the probability of a window breaking ranges from one in a billion (Sutherland 1990) to one in a million (Hershey and Higgins 1976). At 10 psf, the probability of breakage is between one in a thousand and one in a hundred (Haber and Nakaki 1989). In general, the threshold for building damage due to sonic booms is 2 psf (Haber and Nakaki 1989), below which damage is unlikely. The possible types of building damage at increasing sonic boom overpressure values are shown in Appendix D, *Front Range Noise Analysis*.

3.8.6 Noise-Compatible Land Use

Compatible land use occurs when the use of an adjacent or nearby property is not adversely affected by flight operations at an airport, and flight operations at an airport are not adversely affected by the land use of the adjacent properties. Airports can affect nearby properties by exposing those properties to noise and potentially other hazards associated with aircraft operation. In order to ensure compatible land uses exist around airports, local jurisdictions typically adopt land use and/or zoning regulations that govern the types and locations of permissible land uses in areas affected by aircraft operations. As discussed above, both the City of Aurora and Adams County have adopted various land use regulations to ensure compatible land uses in the areas surrounding FTG. Land use and local zoning regulations are discussed in Section 3.6.3, *Existing Conditions*. Zoning around FTG is shown in Exhibit 3-1.

3.9 Socioeconomics and Environmental Justice

3.9.1 Background

Socioeconomics is an umbrella term used to describe aspects of a project that are either social or economic in nature. A socioeconomic analysis evaluates how elements of the human environment, such as population, employment, housing, and public services, might be affected. Section 1508.14 of the CEQ Regulations states that “economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and

economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment.” Therefore, the requirement to prepare socioeconomic analysis in a NEPA document is project specific and is dependent upon the existence of a relationship between natural or physical environmental effects and socioeconomic effects.

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. *Fair treatment* means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies. Meaningful Involvement means that:

- people have an opportunity to participate in decisions about activities that may affect their environment and/or health;
- the public’s contribution can influence the regulatory agency’s decision;
- their concerns will be considered in the decision making process; and
- the decision makers seek out and facilitate the involvement of those potentially affected.

This section describes the socioeconomic and environmental justice conditions in the ROI, including population characteristics, employment and income, and public services. The ROI for socioeconomic and environmental justice is the AIZ discussed in Section 3.6 and immediately adjacent areas. The AIZ includes much of the census blocks, the nearby communities of Watkins and Bennett, and includes most of the transportation routes used to access FTG.

3.9.2 Regulatory Setting

Environmental justice falls within the rubric of Title VI of the Civil Rights Act of 1964, which states that “No person in the U.S. shall, on the ground of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.” EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued in 1994, added low-income populations to those protected. EO 12898, the accompanying Presidential Memorandum, and Department of Transportation Order 5610.2(a), *Actions to Address Environmental Justice in Minority and Low-Income Populations* (DOT 2012), April, 1997, require the FAA to provide for meaningful public involvement by minority and low-income populations and analysis, including demographic analysis, that identifies and addresses potential impacts on these populations that may be disproportionately high and adverse.

3.9.3 Population

Due to the low population within the AIZ itself (and the associated Census Tracts), population statistics and economic indicators for the Town of Bennett and Census Block Group 1 (which covers a larger area than the AIZ) are provided. These data are compared with data for Adams and Arapahoe Counties, and the State of Colorado. For each of the various indicators, data is presented for either 2010 or 2011, which represent the most recent years for which published census data is available.

The population for the Town of Bennett, Adams and Arapahoe Counties, and the State of Colorado have all increased over the 10-year period from the year 2000 to 2010 (see Table 3-7). Adams County experienced a population increase of 18 percent during that 10-year period which was greater than the statewide average.

Table 3-7. Population Data 2000–2010

Jurisdiction/Region	2000	2010	Percent Change	Percent Children Under 18
Town of Bennett	2,021	2,308	12%	n/a
Census Tract 84.01	--	4,315	--	27.8%
Adams County	363,857	441,603	18%	28.5%
Arapahoe County	487,967	572,137	15%	25.7%
State of Colorado	4,301,261	5,029,196	15%	24.4%

Source: U.S. Census Bureau 2010; Adams County 2014a; U.S. Census Bureau 2014a and 2014b.

3.9.4 Environmental Justice

As defined in Department of Transportation Order 5610.2(a), a minority is a person who is Black, Hispanic or Latino, Asian American, American Indian and Alaska Native, or Native Hawaiian and Other Pacific Islander.

The racial composition for the Town of Bennett is predominantly white (approximately 87 percent), 11 percent Hispanic, and less than 1 percent black. In Adams County, approximately 53 percent of the population is white, 38 percent is Hispanic, and almost 4 percent black. In Arapahoe County, nearly 63 percent of the population is white, 18 percent is Hispanic, and 10 percent is black. In the state of Colorado, approximately 70 percent of the population is white, 21 percent is Hispanic, and 4 percent is black (Table 3-8).

Table 3-8. Race and Ethnicity 2010

	Town of Bennett	Adams County	Arapahoe County	State of Colorado
White, not Hispanic	86.5%	53.0%	63.2%	69.7%
Hispanic or Latino	10.7%	38.2%	18.4%	20.9%
Black	0.3%	3.5%	10.2%	4.3%
American Indian and Alaska Native	1.2%	2.1%	0.8%	1.6%
Asian	0.3%	3.8%	5.1%	2.9%
Native Hawaiian and other Pacific Islander	0.3%	0.2%	0.2%	0.2%
Persons Reporting two or more races	2.7%	2.8%	4.3%	2.7%

Source: U.S. Census Bureau 2014a and 2014b.

To determine if a minority population exists within the ROI, data from the U.S. Census Bureau was used to compare the minority population percentage for Block Group 1 to Adams County and Arapahoe County (Table 3-9). As shown in Exhibit 3-4, Census Block Group 1 includes Front Range Airport, the AIZ, the town of Watkins, and parts of Bennett. Census Block Group 1 also includes portions of both Adams County and Arapahoe County.

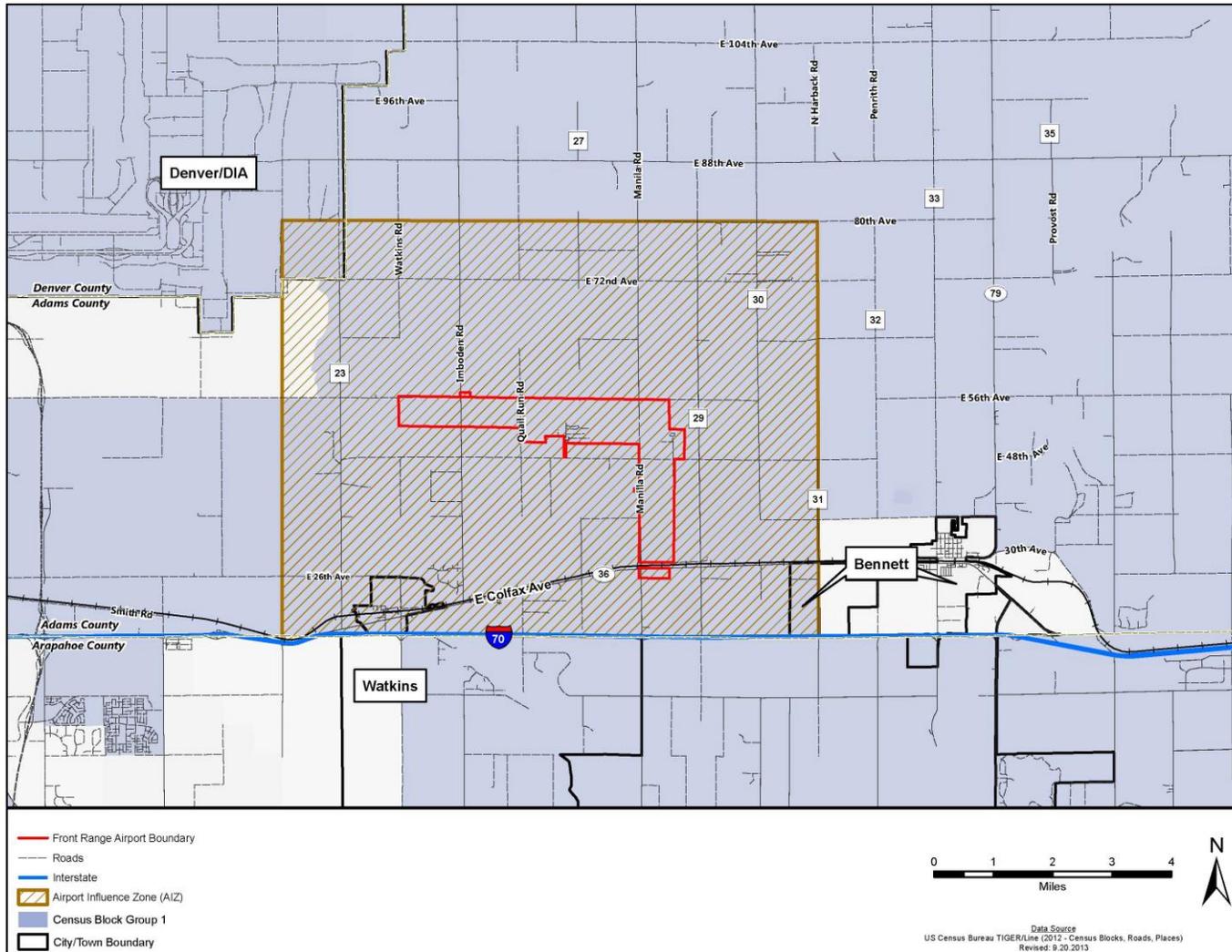


Exhibit 3-4. Minority Populations in the ROI

As shown in Table 3-9, the minority population within Block Group 1, at 20 percent, is lower than the minority population in either Adams County or Arapahoe County (47 percent and 37 percent, respectively).

Table 3-9. Minority Populations 2010

Geography	Total Population	Not Hispanic, White Only	Minority	Percent Minority
Adams County	441,603	234,970	206,633	47%
Arapahoe County	572,003	361,747	210,256	37%
Block Group 1	7,696	6,144	1,552	20%

Source: U.S. Census Bureau 2014a and 2014b.

3.9.5 Employment and Income

The unemployment rate for the Town of Bennett for the period 2012 through 2016 was 5.3 percent, which was higher than that of Adams County, at 4.3 percent, or Arapahoe County and the State of Colorado, which were both just over 4 percent for the same period (Table 3-10).

Table 3-10. Unemployment Data 2012–2016

	Unemployment Rate
Town of Bennett	5.3%
Adams County	4.3%
Arapahoe County	4.3%
State of Colorado	4.0%

Source: U.S. Census Bureau 2017

To determine if a low-income population exists within the ROI, data from the U.S. Census Bureau was used to compare the number of households, median income and the percentage of poverty for Colorado to Adams County and Arapahoe County. As shown in Table 3-11, the percentage of poverty in Arapahoe County is lower and the median income is higher than in the State of Colorado. In Adams County, the percentage of poverty and income is relatively the same as the State of Colorado.

Table 3-11. Low-Income Data 2012–2016

Geography	Total Households	Median Income	Percentage of Poverty
Adams County	158,748	\$61,444	11.7%
Arapahoe County	231,844	\$66,288	9.0%
State of Colorado	2,051,616	\$62,520	11.0%

Source: U.S. Census Bureau 2017.

3.9.6 Emergency Services

The Town of Bennett contracts with both the Adams and Arapahoe County Sheriff's Offices to provide police services for the Town. The area north of I-70 is covered by Adams County and south of I-70 is covered by Arapahoe County. FTG is within the jurisdiction of Bennett Fire and Rescue for fire related emergency services and Adams County Sheriff's Office for police services.

The Adams' County Sheriff's headquarters is in Brighton and the Sheriff's substation is in Commerce City. The Adams County Sheriff's Office is staffed by 528 full-time and 4 part-time employees. The nearest hospital is the Medical Center of Aurora.

FTG currently has an ARFF facility located in close proximity to the proposed Spaceport facilities. Basic ARFF Services are available during the FTG's normal business hours and would be provided by FTG for launches.

The Bennett Fire Protection District provides fire, emergency medical services, and hazardous materials response in the Town of Bennett and surrounding areas. The Bennett Fire Protection District has 4 stations staffed by 9 full time members and 56 volunteers that respond to an average of 850 calls per year within the 325 square mile service territory. In cases where additional resources are needed, the towns of Strasburg and Byers have volunteers and staff available, as needed.

3.9.7 Transportation and Access

Given its location in rural Adams County, existing transportation resources in the vicinity of FTG are limited; however, these resources include one interstate highway (I-70), several arterials, numerous local roads, and one railroad that passes through the area.

Major Roads and Highways

I-70 is a 4-lane limited-access freeway that runs east-west approximately 2 miles south of FTG. Existing interchanges on I-70 that provide access to FTG include Watkins Road which serves the town of Watkins, and Manila Road which provides access to the east side of FTG. An additional future interchange is planned at Quail Run Road as future development in the vicinity of FTG is realized.

As defined in the Adams County Transportation Plan, principal arterials near FTG include: US 36 (also designated as East Colfax Avenue), Manila Road, and East 56th Avenue. US 36 is a paved two-lane principal arterial that runs through eastern Adams County which ultimately becomes East Colfax Avenue in the more urban portion of Aurora. The section of Manila Road between I-70 and US 36 is presently unpaved; however, the Adams County Transportation Plan (Adams County 2012) identifies Manila Road as a future 2-lane paved major arterial. East 56th Avenue is a paved two-lane arterial that runs east-west between Imboden Road and Pena Boulevard and has an interchange at E-470. East 56th Avenue serves as a principal connector between DEN and FTG.

Other arterial routes near FTG include Imboden Road and East 48th Avenue. Most traffic arriving at FTG from the Denver area exits I-70 at Watkins Road, heads east on US 36, turns north onto Imboden Road, and then turns east onto 48th Avenue. Front Range Parkway, which intersects 48th Avenue, provides the primary access to the airport terminal building, offices, hangars, and the local airport road network.

Traffic accessing the east side of FTG, including the ARFF, would exit at Manila Road and head north. Access to the east side of Runway 17/35 is provided by East 30th Avenue and Front Range Airport Perimeter Road, both of which are on-airport roads. Traffic on Manila Road can also continue north to access East 48th Avenue and the main airport facilities.

As identified in the Adams County Transportation Plan, traffic volumes on the arterial roadways near FTG are quite low and range from approximately 300 vehicles per day on Manila Road, to 1,000 vehicles per day on 56th Avenue, to a high of 1,500 vehicles per day at the intersection of Imboden Road and US 36.

Vehicle to capacity ratios on these arterials, as defined in the Transportation Plan, are excellent (<0.80 vehicle to capacity ratio).

Railroads

Union Pacific Railroad operates a single set of tracks through Adams County and Aurora that runs parallel to and immediately north of US 36 in the vicinity of FTG. Freight train frequency on this line is low and is estimated to be less than 1 train per hour. Currently, Imboden Road and Manila Road cross the Union Pacific Railroad tracks at-grade. Future planning efforts for this area, including the City of Aurora Comprehensive Plan (City of Aurora 2013), identify grade-separated crossings of the Union Pacific Railroad tracks at Imboden Road, Manila Road, and the future Quail Run Road; however, no specific time-frame for the construction of these grade-separated crossings has been identified as development near FTG has not materialized as quickly as previously envisioned.

3.10 Visual Effects (including Light Emissions)

3.10.1 Background

Visual resources may include both natural features and elements of the built environment that contribute to the aesthetic value of an area. Potential impacts of an airport action on visual resources may include construction of new tall facilities such as control towers that are visible from off-site locations, or other facilities that increase the extent of facility lighting. In other instances, changes in airport operations that substantially increase the number of flights could result in visual impacts on sensitive areas such as Section 4(f) properties where the visual setting is an important resource of the property.

3.10.2 Applicable Regulations

Section 4-13-01 of the Adams County development Standards and Regulations sets forth operational standards for lighting such that lighting facilities shall be arranged and positioned so no direct light or reflection creates a nuisance or hazard on any adjacent property or right-of-way. Exterior lighting shall be compatible with that of adjacent properties.

3.10.3 Existing Conditions

FTG is surrounded by generally undeveloped gently rolling terrain that is typical of the non-urbanized portion of the Colorado Front Range. On most days, the Rocky Mountains are visible to the west from many parts of the airport property, and views in all directions generally include rolling pastures and dry farmland. Some farm buildings, grain storage silos, and weather radar facilities are visible in the distance from some viewpoints from airport property.

Most of the existing structures on airport property are one to two-story buildings, hangars, and other facilities typical of most medium to large GA airports. Due to their low profile and the rolling landscape surrounding FTG, the majority of on-airport structures are not generally visible from publicly traveled roadways. The one exception is the FTG Airport Traffic Control Tower which is the tallest GA tower in North America. The tower is visible from numerous vantage points surrounding the airport at a distance of several miles.

Existing lighting at FTG includes lighting on the tower, runway lighting (medium intensity on Runway 17/35 and high intensity on Runway 8/26), taxiway lighting, runway end identification lights, navigation aids including medium intensity approach lighting system with runway alignment indicator, and exterior lighting of the terminal, hangars, aprons, and parking areas (Federal Aviation Administration 2011).

3.11 Water Resources (including Wetlands, Floodplains, Surface Waters, and Groundwater)

3.11.1 Background

Water resources include natural and man-made sources of water that are available for use by and for the benefit of humans and the environment. Water resources relevant to this PEA include groundwater, surface water, floodplains, and wetlands. The ROI for water quality is the FTG property boundary and the immediately surrounding area. FTG is part of the Middle South Platte-Cherry Creek Watershed.

Wetlands. The U.S. Army Corps of Engineers defines wetlands as “those areas that are inundated or saturated with ground or surface water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (33 CFR Part 329). Wetlands perform several hydrologic functions, including water quality improvement, groundwater recharge and discharge, pollution mitigation, nutrient cycling, stormwater attenuation and storage, sediment detention, floodwater storage, and erosion protection. They also provide habitat for fish and wildlife.

Floodplains. The area of land that could be inundated as a result of a flood, including the area of land over which floodwater would flow from the spillway of a reservoir.

Surface Waters. Surface water resources generally consist of wetlands, lakes, rivers, and streams. Surface water is important for its contribution to the economic, ecological, recreational, and human health of a community. Stormwater is an important component of surface water systems because of its potential to introduce sediments and other contaminants that could degrade surface waters. Proper management of stormwater flows is important to the management of surface water quality and natural flow characteristics.

Groundwater. Groundwater is water that exists in the saturated zone beneath the earth’s surface, and includes underground streams and aquifers. It is an essential resource that functions to recharge surface water and can be used for drinking, irrigation, and industrial processes. Groundwater typically can be described in terms of depth from the surface, aquifer or well capacity, water quality, recharge rate, and surrounding geologic formations. Sole Source Aquifer designations are applied by the EPA to protect drinking water supplies in areas with few or no alternative sources to the groundwater resource.

3.11.2 Applicable Regulations

Wetlands. Wetlands are protected as “waters of the United States” under Section 404 of the Clean Water Act and under EO 11990, *Protection of Wetlands*. This EO requires that federal agencies provide leadership and take actions to minimize or avoid the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Federal agencies are to avoid new construction in

wetlands, unless the agency finds there is no practicable alternative to construction in the wetland, and the proposed construction incorporates all possible measures to limit harm to the wetland.

Surface Water. Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to issue permits for the discharge of dredge or fill into waters of the United States including wetlands. Waters of the United States are defined by the Clean Water Act and are protected by various regulations and permitting programs administered by the EPA and the U.S. Army Corps of Engineers. The Clean Water Act also established the National Pollutant Discharge Elimination System program, which regulates the discharge of point (end of pipe) and nonpoint (stormwater) sources of water pollution and requires a permit under Section 402 of the Clean Water Act for any discharge of pollutants into waters of the United States.

For all construction stormwater permits, the EPA identifies a series of mandatory BMPs relating to Erosion and Sediment Controls (40 CFR § 450.21(a)), Soil Stabilization BMPs (40 CFR § 450.21(b)), Dewatering BMPs (40 CFR § 450.21(c)), Pollution Prevention Measures (40 CFR § 450.21(d)), and Prohibited Discharges (40 CFR § 450.21(e)). Permittees can select management practices or technologies that are best suited for site-specific conditions.

Under Colorado regulations (5 Code of Colorado Regulations 1002-61), construction site owners and operators that disturb 1 or more acres of land are required to obtain a construction stormwater discharge permit, prepare a Stormwater Management Plan, and use BMPs to ensure that soil disturbed during construction activities does not enter nearby water bodies.

Groundwater. Groundwater quality and quantity are regulated under several different programs. The federal Underground Injection Control regulations, authorized under the Safe Drinking Water Act, requires a permit for the discharge or disposal of fluids into a well. The federal Sole Source Aquifer regulation, also authorized under the Safe Drinking Water Act, protects aquifers that are critical to water supply.

3.11.3 Existing Conditions

Wetlands. Based on the USFWS's online wetlands mapping program, the National Wetland Inventory Mapper (U.S. Fish and Wildlife Service 2017) and the EPA's NEPAAssist mapping tool, two wetlands are located on FTG property and two are located off FTG property along the unnamed ephemeral drainage to the east. One wetland on FTG property is an emergent wetland associated with Bear Gulch and is approximately 0.5 mile west of the end of Runway 8/26. The second wetland on FTG property is an emergent wetland immediately north of Runway 8/26 along an unnamed ephemeral drainage. The closest offsite wetland to the Proposed Action is a small emergent wetland located approximately 0.25 miles east of the proposed propellant storage area.

Floodplains. Based on the EPA's NEPAAssist mapping tool (U.S. Environmental Protection Agency 2014), a regulatory floodway and Federal Emergency Management Agency-designated Zone A floodplains are located along Bear Gulch and its larger tributaries on the western side of FTG property. Infrastructure assumed to be associated with the Proposed Action for purposes of this analysis is located on the main portion of FTG which is within Federal Emergency Management Agency-designated Flood Hazard Zone X,

which has less than a 0.2 percent annual chance of flooding (Federal Emergency Management Agency 1986).

Surface Water. FTG lies within the Middle South Platte-Cherry Creek Watershed within the 2,870-square-mile area of the South Platte River basin (U.S. Geological Survey 2013b). Droughts are common to the watershed as well as to the rest of the state. Approximately 75 percent of annual precipitation occurs from mid-April through late September, and the mean average annual precipitation ranges from 12 to 18 inches per year (U.S. Department of Agriculture 2009).

Several ephemeral drainages run south to north-northeast through the FTG property. On the western side of FTG, Bear Gulch runs north across FTG property east of Imboden Road and eventually feeds into Box Elder Creek just east of DEN. Stormwater from the west side of FTG drains into Bear Gulch.

An unnamed tributary of Bear Gulch runs parallel to 56th Avenue and drains the portion of FTG near Runway 8/26. Several unnamed drainages including an unnamed tributary of Newcomb Gulch flow south to north across the central and eastern portions of FTG and empty into West Sand Creek. These drainages are shown on Exhibit 3-5.

The existing drainage system within the airport industrial area consists of storm sewer inlets and pipes that collect flows and are conveyed to either Bear Gulch Basin or to an unnamed tributary basin to Newcomb Gulch Basin. The industrial area is located primarily in the Box Elder Creek Drainage Basin.

FTG has a Stormwater Management Plan and a state stormwater permit for discharge of stormwater associated with industrial activities (Permit number COR900211) (Front Range Airport 2012a). Under this permit, FTG is required to sample the storm sewer discharge during a significant storm event and inspect the storm sewer collection system on a quarterly basis. The Stormwater Management Plan includes good housekeeping practices that are designed to minimize the potential for spills of hazardous materials used at FTG.

Presently, stormwater is not treated at FTG; however, landscaping and vegetated swales along the drainages provide a measure of sediment control during runoff events. The airport follows state guidelines for control of sediment and the reduction of erosion on all construction projects. Several erosion-control practices have been implemented or are planned at FTG and include: plastic covering, natural vegetation preservation, permanent seeding, sodding, rip-rap, and erosion control blankets (Front Range Airport 2012a).

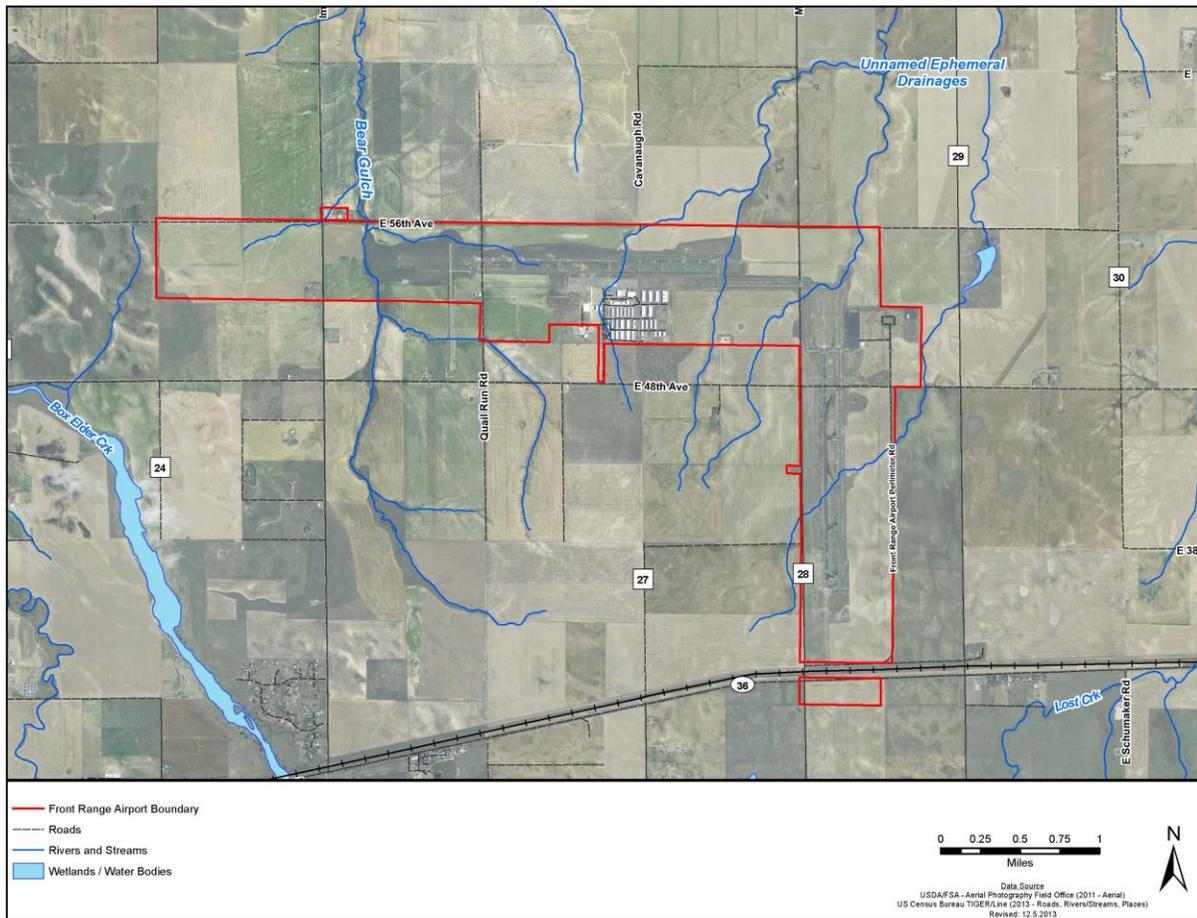


Exhibit 3-5. Surface Water Features

A Spill Prevention, Control, and Countermeasures plan pursuant to 40 CFR Part 112, has been developed for FTG and is incorporated into the *Front Range Airport Emergency Response Manual*. The plan covers procedures for the prevention and clean-up of spills of fuels and other related materials, and meets all requirements of the General Stormwater Permit (Front Range Airport 2012a).

Groundwater. The Denver Basin aquifer system consists of four aquifers—Dawson, Denver, Arapahoe and Laramie-Fox—that underlie the plains of Colorado to the east of the Rocky Mountains. The Denver Aquifer underlies FTG and extends through an area of about 3,000 square miles between Denver and Colorado Springs. The Denver Formation is a 600 to 1,100-foot-thick sequence of moderately consolidated, interbedded shale, claystone, siltstone, and sandstone. Water-yielding layers of sandstone and siltstone occur in poorly defined irregular beds and generally occur from 1 to 50 ft below ground surface (U.S. Geological Survey 2013a). Data from the Colorado Division of Water Resources indicated that there are 64 permitted groundwater wells within 2 miles of FTG (Colorado Division of Water Resources 2014). Of these, one well is listed as “Abandoned” and 33 are listed as “Permit Expired.” The remaining 30 wells are presumed to be potentially operational and are listed as “Permit Extended” (4 wells), “Permit Issued” (11

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wells), “Well Constructed” (8 wells), and “No Status” (7 wells). The Secondary main water supply well for FTG is located approximately 0.5 mile northeast of the north end of Runway 17/35, serving only one building at present. The main water supply well for FTG is located approximately 1 mile south of Runway 8/26 and is off-airport. The City of Aurora operates both of the wells that supply FTG. The airport-owned WWTP drains into Bear Gulch and treats domestic wastewater from FTG property only. At present it treats approximately 5,000 to 6,000 gallons per day.

There are no Sole Source Aquifers designated in Colorado (U.S. Environmental Protection Agency 2009c).

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter presents an analysis of the potential impacts on the environment that could result from implementation of the Proposed Action per FAA Order 1050.1F and 5050.4B. The potential impacts analyzed include those associated with assumptions made regarding future launches and launch site related infrastructure as explained in Chapters 1 and 2 above and in Appendix A. For purposes of the analysis conducted in this PEA, the FAA made these assumptions based upon the type of vehicle most likely to be proposed for launch at FTG (the conceptual reusable launch vehicle (RLV)) and the infrastructure needed to accommodate the conceptual RLV. These assumptions were based on the operational parameters set forth in Section 1.0 above. Thus, in this chapter the term “Proposed Action” should be interpreted to include those assumptions. Both the direct and indirect impacts of the Proposed Action are considered in this chapter.⁹

The FAA’s significance thresholds and factors to consider for each environmental impact category are provided in Exhibit 4-1 of FAA Order 1050.1F and have been used in this PEA to evaluate significance. As described in the sections that follow, the Proposed Action is not anticipated to result in any impacts that would exceed any significance thresholds established in FAA Order 1050.1F.

The analyses in this PEA are based on assumptions regarding conceptual project components, including the location of propellant storage, mission preparation activities and related facilities, and the surface movement of RLVs associated with operation of a horizontal RLV at FTG. The purpose of describing these components is to conservatively assess the potential environmental impacts of launch vehicle operations at FTG. These conceptual components are not being approved as part of the Proposed Action in this PEA, and this information does not necessarily reflect the exact type of facilities that would be needed to support the launch vehicle. Instead, it defines the scope (or bounds) of the analysis. When a prospective launch operator applies for a license to operate a launch vehicle at FTG, a separate environmental document, tiering off this PEA, would be required.

4.1 Air Quality

4.1.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and thus would also not issue launch licenses to commercial operators to launch RLVs from FTG. The concrete pads for propellant tanks, engine testing, and mission preparation would not be constructed. The No Action Alternative would not result in emissions of any new air pollutants. Therefore, there would be no additional impact on regional air quality.

⁹ In accordance with Paragraph 4-1 of FAA Order 1050.1F, construction impacts are considered within each environmental impact category (e.g., air quality) that could be affected by construction activities.

4.1.2 Proposed Action

During scoping, comments regarding air quality were received from the Colorado Department of Public Health and Environment Air Pollution Control Division and EPA (Appendix F, *Agency Consultation and Tribal Coordination*). These comments concerned evaluating construction and carbon dioxide (CO₂) emissions, the filing of APENs associated with stationary sources and land development as applicable, and the need for a General Conformity Analysis.

Air Quality Methodology

Potential impacts on air quality were evaluated based on calculated direct and indirect emissions associated with implementation of the Proposed Action. Potential impacts on air quality could result from engine testing and the proposed operation of the RLV at FTG, with maximum emissions resulting from conducting up to 52 launches per year.

Emissions from a source are calculated by multiplying the source's activity rate by an emission factor that expresses the amount of pollutant emitted per unit of activity. For example, to calculate construction equipment exhaust emissions, the activity is expressed as horsepower-hours (average engine output in horsepower times number of hours operated) and the emission factor is expressed as grams per horsepower-hour. The result of this calculation is emissions in grams for the time period over which the construction equipment is operating. For motor vehicles, the activity typically is expressed as vehicle-miles traveled and the emission factor in grams per vehicle-miles traveled. For launch vehicles, the activity is expressed as mass of propellant burned (e.g., in pounds) and the emission factor as pounds of emission per pound of propellant. Emission factors are pollutant-specific and are taken from the scientific literature and agency models and guidance documents. For each pollutant, emissions are summed over a 1-year period and the result expressed as tons per year. These totals are compared to applicable thresholds or guidelines to determine whether the levels of emissions are of concern with respect to the ability of the area to meet the national and State of Colorado ambient air quality standards.

Air quality impacts associated with the Proposed Action were determined by calculating emissions during both the construction phase and the operational phase of the spaceport. Construction activities include installation of propellant and water storage tanks, concrete pads, security fencing, access roads, and underground utilities. Detailed construction emission calculation sheets are provided in Appendix C, *Air Quality Emissions Calculations* (Tab A - Construction). The primary emission sources during construction are standard types of heavy-duty diesel construction equipment and highway trucks that would deliver construction materials to the site. Separate calculations are provided in Appendix C, Table 1 for the following activities: excavation and grading, asphalt demolition, gravel work (including truck delivery), concrete work (including truck delivery), utility trenching, and construction of the water tank. Appendix C, Table 2 provides a summary of these construction emissions.

Appendix C, Table 3 includes detailed emission calculations associated with construction of roads and the rehabilitation of asphalt pavement at FTG. Separate tables are presented for the following phases of construction: excavation and grading, asphalt demolition, gravel work, and paving. Appendix B, Table 4 provides a summary of these road construction and asphalt paving emissions.

Appendix C, Table 5 includes an estimate of fugitive dust emissions (PM₁₀ and PM_{2.5}) that would be generated as a result of construction activities at FTG and Table 6 provides an overall total of emissions from all construction activities.

Operational emissions from the spaceport include emissions from launches, pre-launch run-up tests, static hot-fire engine testing on the mobile test stand, commuter emissions, and emissions from delivery vehicles. Launch emissions were estimated based on the Concept X vehicle analyzed in the FAA's Final EA for the Oklahoma Spaceport (Federal Aviation Administration 2006). For the remaining emission sources, detailed emission calculation sheets are provided in Appendix C (Tab B – Launch Operational and Engine Testing Emissions).

Air Quality Analysis Results

Construction

Construction under the Proposed Action could include:

- Installation of aboveground fuel and oxidizer storage tanks
- Construction of concrete pads for mission preparation
- Construction of a concrete pad for static hot-fire engine testing
- Installation of security fencing
- Installation of an aboveground water storage tank and non-potable water line
- Installation of high-speed fiber optic communication lines and access roads

The oxidizer storage area would include an approximately 100-by-100-ft concrete pad and a 15,000-gallon tank for LOX storage. A separate fuel storage area would be constructed on the existing asphalt surface to include one 800-gallon tank for LH₂; one 10,000-gallon tank for CH₄; and one 10,000-gallon tank for kerosene. Additional space would be allocated in the fuel storage area for forty 55-gallon drums of kerosene, and a small number of gas cylinders (6), each containing approximately 50 cubic ft of methane.

The construction of concrete pads to support launch operations would occur in the proposed Mission Preparation Areas #1 and #2. At Mission Preparation Area #1, the existing asphalt would be replaced with a concrete pad of approximately 100 ft by 100 ft. At Mission Preparation Area #2, a new concrete pad approximately 100 ft by 100 ft would be installed. In order to access the storage areas, approximately 1,000 ft of new access roads would be constructed and approximately 500 ft of existing roadway would be rehabilitated. Additionally, an area of approximately 400,000 square ft of existing asphalt between the Mission Preparation Area #1 and the proposed static hot-fire engine test stand area would be rehabilitated.

To accommodate launch operations, an aboveground steel water storage tank, capable of storing up to 1.5 million gallons, would be installed next to one of the existing hangars proposed to be used as the flight support hangar. A non-potable water line, approximately 2,000 ft in length, would be connected to an existing line that feeds to the existing WWTP. The non-potable water would support the daily operations, consisting of mission preparation, recovery, upkeep, administration, and storage, at the flight support hangar and a sprinkler system. Installation of high-speed fiber optic communication lines would require

placement of approximately 20,000 linear ft of underground conduits containing the cable. Dust control measures that could be employed during construction include watering of unpaved areas, establishing speed limits on unpaved roads, reducing track-out of mud and dirt from construction areas, stabilizing areas as soon as possible following completion of earthmoving, covering haul trucks, and curtailing construction activities during high wind episodes.

Emissions from these construction activities are presented in Table 4-1. As can be seen from the table, construction emissions are expected to be quite low and are substantially lower than the General Conformity Rule *de minimis* thresholds. Emissions from construction are estimated to be either very small or, for applicable pollutants, below the General Conformity thresholds and therefore are not significant.

Table 4-1. Construction Emissions

Activity	VOCs Tons	CO Tons	NO _x Tons	SO ₂ Tons	PM ₁₀ Tons	PM _{2.5} Tons	CO _{2e} Metric Tons
Concrete Pads/Tank/trenching	0.15	0.73	2.63	0.04	0.14	0.13	264
Roads/asphalt	0.61	2.23	5.60	0.13	0.38	0.37	560
Fugitive Dust	NA	NA	NA	NA	0.945	0.0945	NA
Total	0.76	2.96	8.23	0.17	1.46	0.59	824
<i>De Minimis</i> Thresholds ¹	100	100	100	NA	100	NA	NA
Exceedance of Thresholds?	No	No	No	NA	No	NA	NA
² Adams County Emissions, 2011	NA	NA	NA	8,033	NA	4,346	2,453,089

Source: ¹General Conformity Rule *de minimis* thresholds from 40 CFR § 93.153

² Adams County emissions from 2011 National Emission Inventory (U.S. Environmental Protection Agency 2013).

Notes: NA = not applicable; VOCs = volatile organic compounds; CO = carbon monoxide; NO_x = nitrogen oxide; SO₂ = sulfur dioxide; PM₁₀ = particulate matter less than or equal to 10 microns in diameter; PM_{2.5} = fine particulate matter 2.5 microns or less in diameter; CO_{2e} = carbon dioxide equivalent.

New stationary sources, such as aboveground fuel tanks, would require the filing of an APEN form and approval from the Air Pollution Control Division of the Colorado Department of Public Health and Environment prior to the commencement of construction.

Operations

The proposed conceptual RLV launch schedule includes a maximum of 52 launches per year. Static hot-fire testing of engines would involve approximately 100 tests per year. In addition, up to 20 staff would be located at FTG. It is assumed that the average one-way commute distance for each worker would be 33 miles (from Denver), or 66 miles per day roundtrip. Commuters were conservatively estimated to drive individual vehicles rather than carpool. Emissions from refueling operations were not quantified in this PEA due to the small size of the conceptual RLV and modest fuel volume required per flight. Only minimal emissions would be generated from refueling operations. Detailed emission calculations for RLV operations other than launch emissions which are based on FAA (2006) are included in Appendix C, *Air Quality Emission Calculations*. Operations were evaluated based on the maximum estimated flight operations per year (52), material deliveries associated with flight operations and aircraft maintenance, a maximum of 20 new

employees working onsite at FTG, static hot-fire engine testing throughout the year, and static run-up testing for each engine prior to each launch.

Static hot-fire testing was estimated for 100 tests per year. Of these, 90 were estimated to be performed using kerosene/LOX as the propellant and 10 estimated to be performed using methane/LOX as the propellant. It is possible that over time, static hot-fire engine testing activities may increase, resulting in an increase in the use of methane as a fuel for static hot-fire engine testing. Emissions from tests using methane/LOX are expected to be similar to or slightly less than emissions using kerosene/LOX. However, for the purposes of this analysis, the 90/10 ratio has been used for a conservative (high) emissions estimate. Table 4-2 presents the operational emissions of criteria pollutants, which depict the maximum launch operations.

Emissions of HAPs would be minimal and were not quantified, in accordance with FAA guidance (Federal Aviation Administration 2009b) that provides criteria for determining whether a HAP emissions inventory should be prepared. Based on the criteria given in the guidance, a HAP emissions inventory is not warranted.

Table 4-2. Annual Operational Emission Estimates, Conceptual RLV Operations at FTG

Activity	VOCs Tons/yr	CO Tons/yr	NO _x Tons/yr	SO ₂ Tons/yr	PM ₁₀ Tons/yr	PM _{2.5} Tons/yr	CO _{2e} Metric Tons/yr
52 Launches	0.46	46.43	0.11	0.023	1.26	1.26	94
100 Static Hot-Fire Engine Tests	0.00	0.19	0.00	0.00	0.00	0.00	12
Commuter/Delivery Emissions	0.19	5.61	0.79	0.00	0.03	0.03	55
Total	0.65	52.23	0.90	0.023	1.29	1.29	161
<i>De Minimis Thresholds</i> ¹	100	100	100	NA	100	100	NA
Exceedance of Thresholds?	No	No	No	NA	No	No	NA
² Adams County Emissions, 2011	NA	NA	NA	8,033	NA	4,346	2,453,089

Source: ¹ General Conformity Rule *de minimis* thresholds from 40 CFR § 93.153

² Adams County emissions from 2011 National Emission Inventory (U.S. Environmental Protection Agency 2013).

Notes: NA = not applicable; VOCs = volatile organic compounds; Tons/yr = tons per year; CO = carbon monoxide; NO_x = nitrogen oxide; SO₂ = sulfur dioxide; PM₁₀ = particulate matter less than or equal to 10 microns in diameter; PM_{2.5} = fine particulate matter 2.5 microns or less in diameter; CO_{2e} = carbon dioxide equivalent.

The pollutant with the largest quantity of emissions as a result of conceptual RLV operations would be CO. The annual CO emissions from 52 launches, 100 static hot-fire engine tests, and commuter emissions for 20 additional workers at FTG are estimated to be 52.23 tons per year, which is well under the General Conformity Rule *de minimis* threshold of 100 tons per year for CO. The remaining pollutant emissions are very small compared to the remaining conformity thresholds and the 2011 County emissions. The estimated PM_{2.5} emissions, for example, are expected to be less than 0.03% of the 2011 Adams County PM_{2.5} emissions. Comparison of the emissions to the General Conformity Rule *de minimis* thresholds and

regional emissions indicates that expected emissions from operations would be below threshold levels; therefore, they would not result in any NAAQS violations and would not be significant.

Compared to the existing level of aircraft activity at FTG (84,345 operations in 2016) the number of launch vehicle operations (52) associated with the Proposed Action is very small. Similarly, the emissions associated with the Proposed Action, as given in Table 4-2, would represent a very small incremental increase in the total emissions at FTG and would not lead to any violation of the NAAQS.

4.2 Biological Resources (including Fish, Wildlife, and Plants)

4.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and the mission preparation areas, propellant storage area, and static hot-fire test stand area would not be constructed. Conditions would remain as described in Section 3.2, *Biological Resources (including Fish, Wildlife, and Plants)*. The No Action Alternative would have insignificant impacts on biological resources. Conditions would remain as described in Section 3.2, *Biological Resources (including Fish, Wildlife, and Plants)*.

4.2.2 Proposed Action

Construction

Vegetation. Impacts on vegetation would be minor and would only occur at the static hot-fire test stand area since all other proposed construction activities would occur on paved and/or previously disturbed areas. Approximately 1.5 acres of upland mowed grass would be removed at this site to facilitate construction of the static hot-fire test stand area. Storage and staging areas would occur on previously disturbed or paved areas to the extent feasible. Areas temporarily disturbed by construction that are not needed for infrastructure would be reseeded upon completion. Construction activities would disturb soils which could create a potential for the introduction and spread of noxious weeds. Methods to reduce the spread of noxious weeds include minimizing the extent of soil disturbance, cleaning construction equipment prior to bringing on-site, treating or removing existing weed infestations, and reseeded disturbed areas with native vegetation as soon as practicable following construction. The Colorado Department of Transportation provides a comprehensive discussion of appropriate BMPs in Chapter 5 of their 2014 *Erosion Control & Stormwater Quality Guide* (Colorado Department of Transportation 2014). Through the implementation of such BMPs, no significant construction-related impacts on vegetation are expected.

Wildlife and Special-Status Species within the Vicinity of FTG. Construction activities, including noise from heavy equipment operation, could result in localized disturbance to birds and small terrestrial mammals near the construction site. Construction of the static hot-fire test stand area would remove 1.5 acres of upland mowed grass, thus reducing a small amount of marginal habitat for grassland bird and mammal species. Because the area is already heavily disturbed, this loss of marginal habitat would not result in an appreciable impact on birds or mammals. No hazardous wildlife attractants, such as vegetation or water features, would be added at FTG.

No trees are located on airport property within areas where new facilities would be constructed; therefore, there would be no construction-related impacts on raptors and other tree-nesting birds. If any active bird nests are identified during construction activities, appropriate buffer distances would be established or construction would be delayed in that area until the young have fledged from the nest. As discussed in Section 3.2.3, *Existing Conditions*, no federally listed or state-listed species occur at FTG. Therefore, no significant construction-related impacts on wildlife are expected.

Operations

Vegetation. No impacts on vegetation would result from routine operational activities. In the event of a launch failure, minor vegetation impacts could occur as a result of falling debris or fire. Similar to any such event with a conventional aircraft, routine airport emergency response would extinguish any fire.

Wildlife and Special-Status Species within the Vicinity of FTG. Impacts on wildlife and special-status species in the ROI resulting from operational activities would include increased vehicular and airfield traffic, jet engine and rocket engine noise, noise from engine testing operations, and potential launch failures.

Increased vehicular traffic and airfield operations may disturb or kill individual animals (e.g., birds) near the access road and airfield. There is the potential for the RLV to strike wildlife either on take-off or landing; however, the launch operator would comply with the requirements of the FTG Wildlife Hazard Management Plan to minimize the potential for striking wildlife. Additionally, that potential is approximately equivalent to any other regularly operating aircraft at FTG.

Noise levels within the airfield environment and near the proposed static hot-fire test stand area would increase. Noise levels from launches or engine testing greater than 80 dBA could result in startle reactions in wildlife in the immediate area (Golden et al. 1980). Studies have shown that birds startled from their nests or from foraging during shuttle launches at Cape Canaveral returned within 2 to 4 minutes (Federal Aviation Administration 1996). Since the RLV is expected to take off and land using conventional turbine engines, the expected noise level in the vicinity of the airport would be equivalent to other jet aircraft operating from FTG, and much lower than the noise produced by shuttle launches. Another study showed that animal responses to noise decreased with increased exposure, suggesting they habituate to noise over time (Weisenberger et al. 1996). Wildlife in the vicinity of FTG are already exposed to aircraft noise from existing airport operations; therefore, the additional noise resulting from launches and engine testing is expected to have only a minor, short-term effect on wildlife, primarily startle reactions from rocket engine testing.

In the event of a launch failure, wildlife within the ROI may be impacted by falling debris or fire.

As discussed in Section 3.2.3, *Existing Conditions*, no federally listed or state-listed species occur at FTG. FTG is surrounded by agricultural land that lacks potential habitat for any federally listed threatened or endangered species with the potential to occur on airport property. Therefore, operations at FTG would have no effect on ESA-listed or state-listed species.

Similarly, bald and golden eagles are not known in the area, but may occur as transients during feeding activities or migration. If an eagle was present during launch operations, temporary disturbance may occur from launch-related noise. No take of bald or golden eagles is anticipated.

Wildlife and Special Status Species within the Sonic Boom Footprint. Sonic booms are another potential source of disturbance to wildlife. As discussed in Section 4.8.2, the sonic boom generated during rocket powered ascent is not expected to reach the ground due to the steep angle of ascent. The sonic booms associated with descent would occur at altitudes of approximately 59,000 and 51,000 feet. Most areas within the sonic boom footprint would experience overpressures ranging from 0.2 and 0.7 psf, with the 0.7 psf value occurring in a relatively small area. These booms would be low magnitude, infrequent, and very short duration events (less than 1 second) that would be generated twice per flight on descent. Although the sonic booms would be noticeable under most conditions, they are expected to be similar to a clap of thunder (see Section 4.8.2). Minor disturbances to individual animals, including state-listed and federally listed species, may occur. Under the Proposed Action, sonic booms could occur up to once per week.

Regarding federally listed species (Table 3-3), the only animal species that may have suitable habitat in the area exposed to a sonic boom are the Preble's meadow jumping mouse and black-footed ferret. There is no suitable habitat for the Mexican spotted owl (old growth forests) in the sonic boom footprint. The closest reintroduction site for black-footed ferrets is at the Rocky Mountain Arsenal National Wildlife Refuge, approximately 12 miles west of FTG. Because the sonic boom footprint would lie entirely to the east of FTG and black-footed ferrets are not expected to range more than approximately 0.5 mile (USFWS 2013), the FAA has determined the Proposed Action would have *no effect* on the black-footed ferret. The FAA previously determined that the Proposed Action *may affect, but is not likely to adversely affect* the Preble's meadow jumping mouse in a December 21, 2015 letter. The USFWS concurred with the FAA on January 20, 2016. Since then, FTG has changed the proposed project to offer the site for vehicles that use jet engines to take off from the runway. Because of the project changes, the FAA has reinitiated consultation with the USFWS.

The FAA determined the Proposed Action "*may affect, but is not likely to adversely affect*" the Preble's meadow jumping mouse. The FAA sent a letter dated April 11, 2018 to USFWS requesting concurrence with this determination and the USFWS concurred with the FAA on June 4, 2018. Copies of the consultation letters are included in Appendix F, *Agency Consultation and Tribal Coordination* of this PEA.

Based on the analyses in Section 4.2, the FAA has determined that the Proposed Action would not result in significant impacts on biological resources.

4.3 Climate

4.3.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and thus would also not issue launch licenses to commercial operators to launch RLVs from FTG. The concrete pads for propellant tanks, engine testing, and mission preparation would not be constructed. The No Action Alternative would not result in emissions of any additional GHGs; therefore, there would be no additional climate impacts.

4.3.2 Proposed Action

Emissions of GHGs, primarily CO₂ from fuel combustion, are presented in Tables 4-1 and 4-2. Greenhouse gas emissions from launch emissions and pre-launch run-up tests are presented in Appendix C, Tables 1 and 2. Greenhouse gas emissions from static hot-fire engine tests are presented in Appendix C, Tables 3 and 4. While launch operations under the Proposed Action would produce emissions of GHGs, these emissions when combined with emissions from other FTG operations would be extremely small in the context of regional, national, and global emissions.

At present, no methodology exists that would enable estimating the specific impacts (if any) that this incremental addition to global emissions would produce. Currently, there are no formally adopted or published NEPA thresholds of significance for GHG emissions stemming from Proposed Actions. In addition, formulating such thresholds is problematic, as it is difficult to determine what level of proposed emissions would substantially contribute to global climate change. The incremental contribution to cumulative air quality and climate impacts from conceptual RLV operations would be negligible.

4.4 Hazardous Materials, Solid Waste, and Pollution Prevention

4.4.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC, and thus FTG would not be offered as a site for potential launch operators to launch RLVs from FTG. Existing GA operations, as described in Section 1.1, *Background*, would continue at FTG under the No Action Alternative. Existing conditions would remain the same with regard to hazardous materials and pollution prevention. No new wastes or additional quantities of solid or hazardous wastes would be generated. The potential for encounter with contaminated media (e.g., soil, groundwater) during site development and construction activities would be eliminated.

4.4.2 Proposed Action

Construction

Information obtained through inquiries with local agencies maintaining environmental records and through a search of ascertainable environmental records did not reveal known contamination on or in the vicinity of the FTG property. Consequently, the potential to encounter contaminated media (e.g., surface and subsurface soils, groundwater) during site development and construction activities at FTG is anticipated to be low.

Aboveground fuel and oxidizer storage tanks could be installed at FTG for use by the commercial launch operator(s) as described in Section 2.1.2, *Conceptual Launch Activities*. The commercial launch operator(s) would be required by FTG to obtain required permits and approvals for the designation of hazardous materials and the propellant storage areas, the construction and placement of hazardous materials and propellant containers and tanks, and the delivery of hazardous materials and propellants to the facility. The commercial launch operator(s) would also be required by FTG to notify the appropriate local, State, and federal agencies of their hazardous materials handling and storage and to manage hazardous materials in

accordance with applicable laws and regulations, including but not limited to the Emergency Planning and Community Right-to-Know Act.

Additional solid wastes (above the current level of generation) could be generated at FTG as a result of construction. It is expected that the commercial launch operator(s) would arrange for collection of solid waste, including construction debris, by a private hauler for off-site recycling and/or disposal. The quantities of nonhazardous solid waste generated as a result of construction would be expected to be accommodated by the existing capacity at the nearest waste recycling facilities and landfills (e.g., East Regional Landfill, located in Commerce City, Colorado).

Operation

Prior to commencement of commercial launch operations, launch operators would need to develop accident prevention and emergency response procedures to address the potential for spills and leaks of the specific propellants that would be used in the launch operations and ancillary (e.g., maintenance) activities. The procedures would need to address regulatory requirements, including reporting and notification, training of personnel, delivery/receipt and transfer operations, routine storage, emergency response, remediation, and contingency provisions.

Prior to commencement of commercial launch operations, the bulk fuel and oxidizer products would be delivered to FTG by authorized suppliers and transferred into the aboveground storage tanks and drum storage areas. Deliveries of fuel and oxidizer products in support of commercial launch operations would be arranged and overseen by the commercial launch operator(s).

The receipt, management, storage, and handling of hazardous materials, including the propellant products described above, would be managed in accordance with existing FTG spill prevention and emergency response plans and procedures, as well as relevant and applicable federal, state, and local laws and regulations, including but not limited to EPA regulations contained in 40 CFR Part 112, Spill Prevention Control and Countermeasure Rule. Under these conditions, no direct impacts on the environment would be expected to result from the receipt, management, storage, and handling of hazardous materials associated with commercial launch operations at FTG.

Fueling of launch vehicles and engines (used in static hot-fire engine testing) would be conducted in designated fueling and mission preparation areas using tanker trucks or specialty fuel transfer equipment designed for fueling space vehicles and rocket engines. Helium for the commercial launch operations would be delivered in compressed gas cylinders (K bottles) by authorized suppliers and stored in the flight support hangar (refer to the existing hangars as depicted in Exhibit 2-2).

All hazardous pre-flight ground operations would be conducted in a specified location, for which appropriate safety clear zones would be established in accordance with the FTG and launch operator licenses.

Under the Proposed Action, small quantities of hazardous waste would be generated as a result of commercial launch operations; therefore, the overall quantity of hazardous waste generated at FTG would

increase. The commercial launch operator(s) would be required by FTG to notify the appropriate federal, state, and local agencies of their hazardous waste activities and to manage and dispose of their generated hazardous waste in accordance with applicable laws and regulations. The quantities of hazardous waste generated as a result of construction and commercial launch operations at FTG would be expected to be accommodated by the existing capacity at the nearest appropriately permitted hazardous waste treatment, storage, and disposal facilities. The Colorado Department of Public Health and Environment website lists permitted hazardous waste treatment, storage, and disposal facilities in the state (https://www.colorado.gov/pacific/sites/default/files/HM_hw-permitted-facilities.pdf). The operator would develop procedures for waste stream characterization in accordance with applicable regulations.

The ground track for a nominal trajectory does not include flights over populated areas. In the unlikely event of a launch failure, the debris impacts would be expected to be contained within the FAA-approved hazard area, as defined during the launch licensing process. Due to the limited number of launches per year (52) and the limited quantities of propellants and other hazardous materials on board each RLV, the risk of impacts related to a launch anomaly would be minimal. For each flight track and vehicle, FTG would work with the launch operator and the FAA to establish hazard areas to ensure public safety according to regulations in 14 CFR Part 431. Should a launch failure occur, the commercial launch operator(s) would coordinate the emergency response with FTG and the local response and regulatory agencies as required to ensure that the area of impact would be identified, hazardous materials characterized and recovered, and contaminated media cleaned up and/or restored to their pre-release conditions to the maximum extent feasible.

4.5 Historical, Architectural, Archaeological, and Cultural Resources

4.5.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and no facilities would be constructed. There would be no impacts on historical, architectural, archaeological, and cultural resources.

4.5.2 Proposed Action

The FAA previously requested concurrence from the SHPO in an October 6, 2015 letter. The SHPO concurred with the finding of no historic properties affected on January 6, 2016. The SHPO also noted that if unidentified archaeological resources are discovered during construction, work must be interrupted until the resources have been evaluated in terms of the NRHP criteria, 36 CFR § 604, in consultation with the SHPO. Since then, FTG has changed the proposed project to offer the site for vehicles that use jet engines to take off from the runway. Because of the project changes, the FAA reinitiated consultation with the SHPO in a letter dated April 11, 2018 (Appendix F).

As discussed in Section 3.5.3, *Existing Conditions*, there are no known historic properties in the APE. Therefore, in accordance with 36 CFR § 800.4(d), the FAA made a finding of *no historic properties affected*. The SHPO provided concurrence with this finding in a letter dated May 3, 2018 (Appendix F). Construction crews and supervisors would be advised to halt work if anything unexpected is encountered during

construction. Examples of cultural resources that may be identified during construction include archaeological remains (lithic materials, charcoal or charred flakes, rock alignments, foundations, or human remains). Should cultural resources be identified, the discovery would be protected and FTG would contact the FAA. The procedure in 36 CFR § 800.13(b)(3) would be followed and would include development and implementation of a treatment plan to mitigate adverse effects to the discovery.

4.6 Land Use

4.6.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and thus would also not issue launch licenses to commercial launch operators to launch RLVs. Existing GA operations would continue at FTG and land use would remain the same as exists today.

4.6.2 Proposed Action

The construction and operation of the Proposed Action would be consistent with current land use, which is zoned and used primarily for aviation purposes and the surrounding land, which is used for agriculture. The adopted planning documents for Adams County and the City of Aurora support the Proposed Action and have the stated purpose to support multi-modal transportation and aviation uses and take advantage of the existing airport. The Proposed Action would be consistent with the zoning of parcels located in the AIZ and would not generate impacts that would create non-conforming parcels. Therefore, the Proposed Action would not result in a change in land use designations or result in a land use that is inconsistent or incompatible with its zoning designation.

4.7 Natural Resources and Energy Supply

4.7.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and thus no facilities would be constructed or conceptual RLVs launched from FTG. Energy use, water use, and fuel consumption at FTG would be comparable to previous years.

4.7.2 Proposed Action

Construction

No new buildings are anticipated to be constructed as part of the Proposed Action. Based on the current planning efforts, it is anticipated that a currently vacant hangar at FTG would be re-purposed for use as the primary launch vehicle hangar. There would be minor increases in electricity and natural gas use as this vacant facility becomes an active component of the airfield complex; however, no new electric or gas utility infrastructure is anticipated to be required to meet this additional demand. In addition, the expected 20 new permanent full-time employees associated with build-out of the spaceport would result in a minor increase in water use; however, this increased water usage is well within the design capacity of FTG and would result in only minor impacts.

The construction of the new water tank, propellant storage area, and mission preparation areas could result in additional energy use for the manufacture and transportation of the construction materials; however, these impacts are expected to result in negligible to minor impacts on natural resources and energy supply. Given the small quantities of materials required, the construction of these spaceport-related facilities would not result in any shortages of materials or energy in the Denver metropolitan area.

Operations

The most substantial potential impact of the spaceport on natural resources and energy supply would be related to the consumption of fuels and oxidizers in the RLV. At the maximum number of launches expected during the 5-year initial license term (52 launches per year) and an estimated kerosene fuel consumption of 300 gallons per launch (2,500 pounds), the Proposed Action would result in consumption of approximately 15,600 gallons of kerosene per year. This would result in a negligible impact on natural resources and energy supply. The Proposed Action would not result in shortages of kerosene in the Denver metropolitan area, as there are two refineries as well as numerous bulk fuel distributors in the area that would likely be able to meet this increased demand.

LOX is a very common industrial chemical and launch operations would not appreciably impact the supply of this chemical in the Denver metropolitan area. Engine testing would only consume small quantities of fuels and oxidizers, and would only use those chemicals that are on-hand at the time of the test. No impacts on chemical availability are anticipated from engine testing operations.

4.8 Noise and Noise-Compatible Land Use

4.8.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and thus would also not issue launch licenses to commercial launch operators to launch RLVs. Existing GA operations would continue at FTG and noise impacts would generally remain consistent with current levels, although there would be variations from year to year depending on actual aircraft activity and fleet mix.

4.8.2 Proposed Action

Construction

Demolition and construction activities would create noise above ambient levels. Table 4-3 lists typical noise levels associated with various types of construction equipment. Noise from construction equipment often exceeds ambient sound levels at nearby receptors by 20 to 25 dBA in an urban environment and up to 30 to 35 dBA in a quiet suburban area.

Table 4-3. Predicted Noise Levels for Construction Equipment

Construction Equipment	Predicted Noise Level at 50 ft (dBA)
Backhoe	72 to 93
Concrete mixer	74 to 88
Crane	75 to 87
Front loader	72 to 83
Grader	80 to 93
Jackhammer	81 to 98
Paver	86 to 88
Pile driver	95 to 105
Roller	73 to 75
Truck	83 to 94

Source: U.S. Environmental Protection Agency 1971

Construction activities would be temporary and occur at fairly remote locations on FTG property. Construction noise would not be expected to be audible beyond airport property. The highest potential for impacts on nearby residents would stem from trucks delivering construction materials and supplies to FTG. As described in Section 4.9, *Socioeconomics and Environmental Justice*, an average of five to ten trucks would access the site on a given day; however, during short periods of more intensive activity, the number of trucks accessing the site could increase to 20 or 30 trucks per day. These trucks could expose residents along the haul routes to moderate levels of increased noise during the construction period. To minimize potential disturbance from truck noise, truck deliveries would be routed along Manila Road where there are a small number of residences and businesses. In addition, these deliveries would only occur during daylight hours. In summary, construction noise would not result in significant impacts.

Operation

Operational noise would be generated by the conceptual RLV during take-off, flight, and descent, as well as from static hot-fire engine tests. The conceptual RLV analyzed in this PEA takes off under jet engine power and subsequently is powered by its rocket engine once the vehicle is at a sufficient altitude and distance from FTG. The jet engine noise analysis was performed using the U.S. Air Force's NOISEMAP computer model. The rocket engine portion of the flight and the static hot-fire engine tests were analyzed using FAA's Launch Noise Model (see Appendix D for details of the analysis, including input parameters). On February 26, 2018, the FAA Office of Environment and Energy determined the methodology was appropriate for this analysis and provided its approval of the methodology, as required by FAA Order 1050.1F, Appendix B, Paragraph B-1.2 (see Appendix D of this PEA).

In addition to engine noise, the RLV would generate sonic booms during descent while the vehicle is travelling at supersonic speeds (above Mach 1). The FAA-approved sonic boom computer program PCBOOM was used to generate overpressure (psf) contours at ground level. For many commercial space launches such as this one, the launch vehicle's orientation upward during ascent results in no sonic boom impinging on the earth. In this case, the vehicle generates sonic booms during descent which do impinge on the earth.

Rocket Engine Launch Noise

Because the rocket engine would be ignited at 45,000 ft, rocket engine noise at ground level would be minimal. The predicted noise contours from the rocket engine portion of the flight are shown in Exhibit 4-1. DNL noise contours at such low levels essentially are non-existent. Instead, maximum sound level (dBA) contours from 52 dBA to 55 dBA, are shown. These non-criteria-based noise levels (i.e., arbitrary values), however, indicate rocket engine noise would likely be audible in these areas, since these noise levels would likely be above typical ambient noise levels. These noise levels are far below FAA significance criteria and well below any conventional human noise annoyance standard.

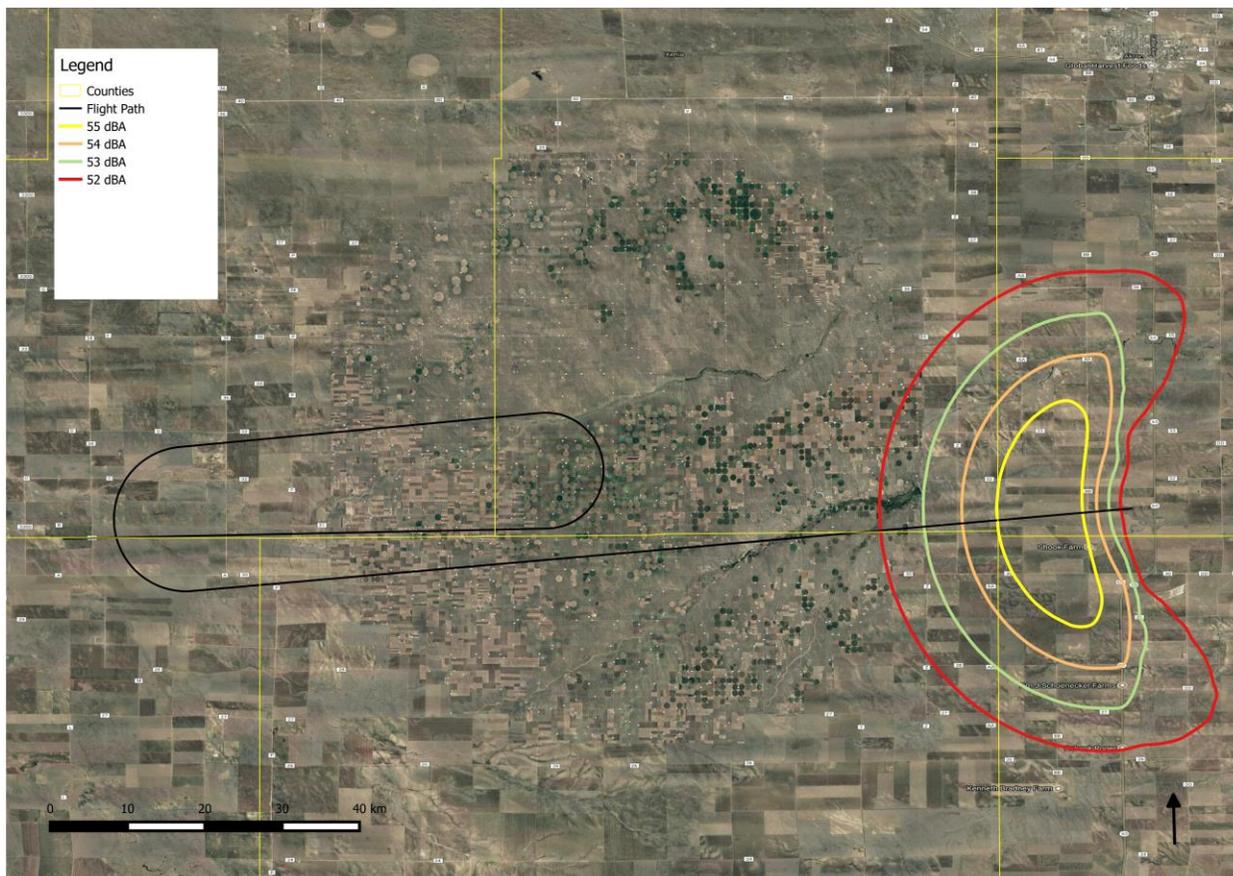


Exhibit 4-1. Rocket Engine Noise at 52-55 dBA (L_{max})

Jet Engine Departure and Arrival Noise

Exhibit 4-2 shows the 65 DNL contours generated by NOISEMAP for the operation of the RLV based on 52 operations per year. The 65 DNL contours are entirely within airport property and barely extend beyond the runway, which is primarily driven by the low number of annual operations.

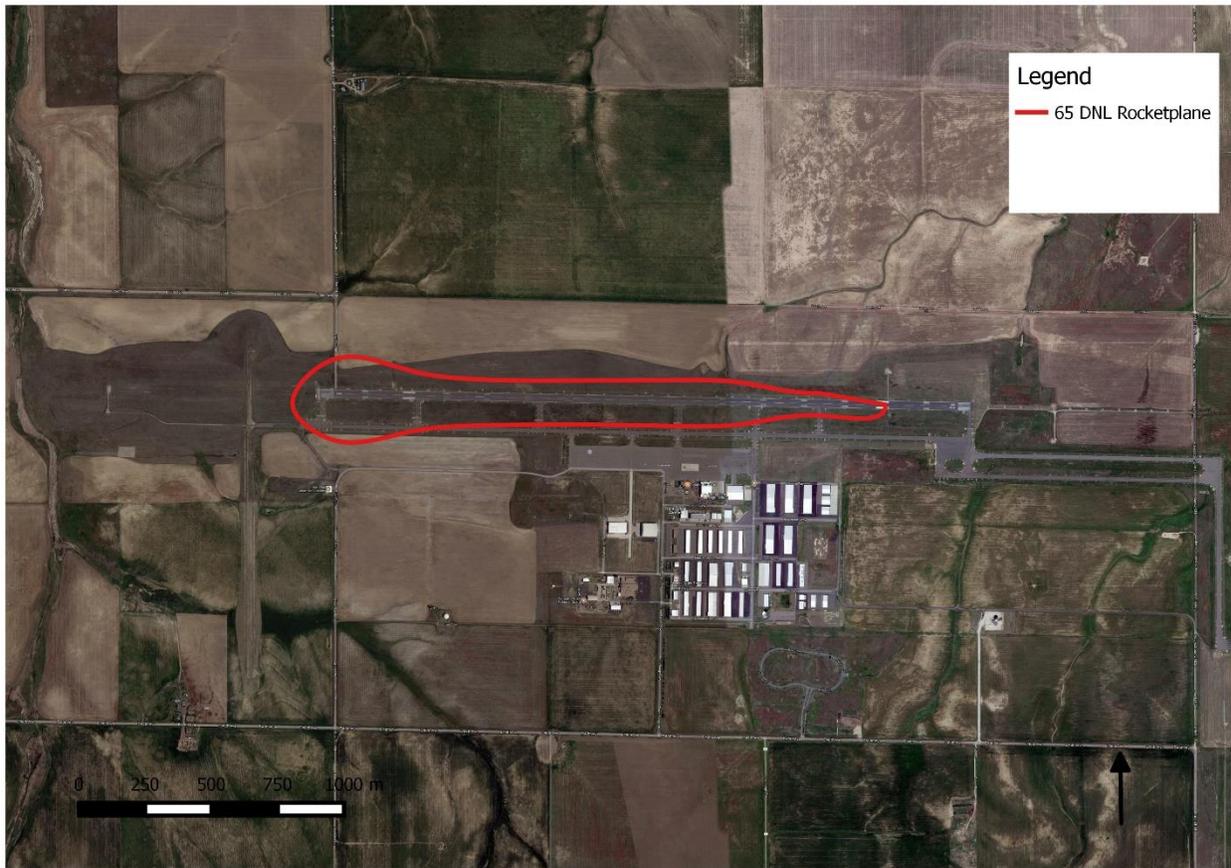


Exhibit 4-2. RLV Airfield 65 DNL Contours

Proposed Action 65 DNL Noise Contours

The 65 DNL noise contours associated with RLV departures and arrivals, as well as the proposed static hot-fire engine testing, is shown in Exhibit 4-3. The only differences between the Proposed Action's contours and the baseline contours (Exhibit 3-3) are the static engine contours (circular in the exhibit) and the slight bulge at the eastern part of the runway. The Proposed Action does not comprise a significant noise impact since all 65 DNL contours are on airport property and the increase is less than 1.5 dBA.

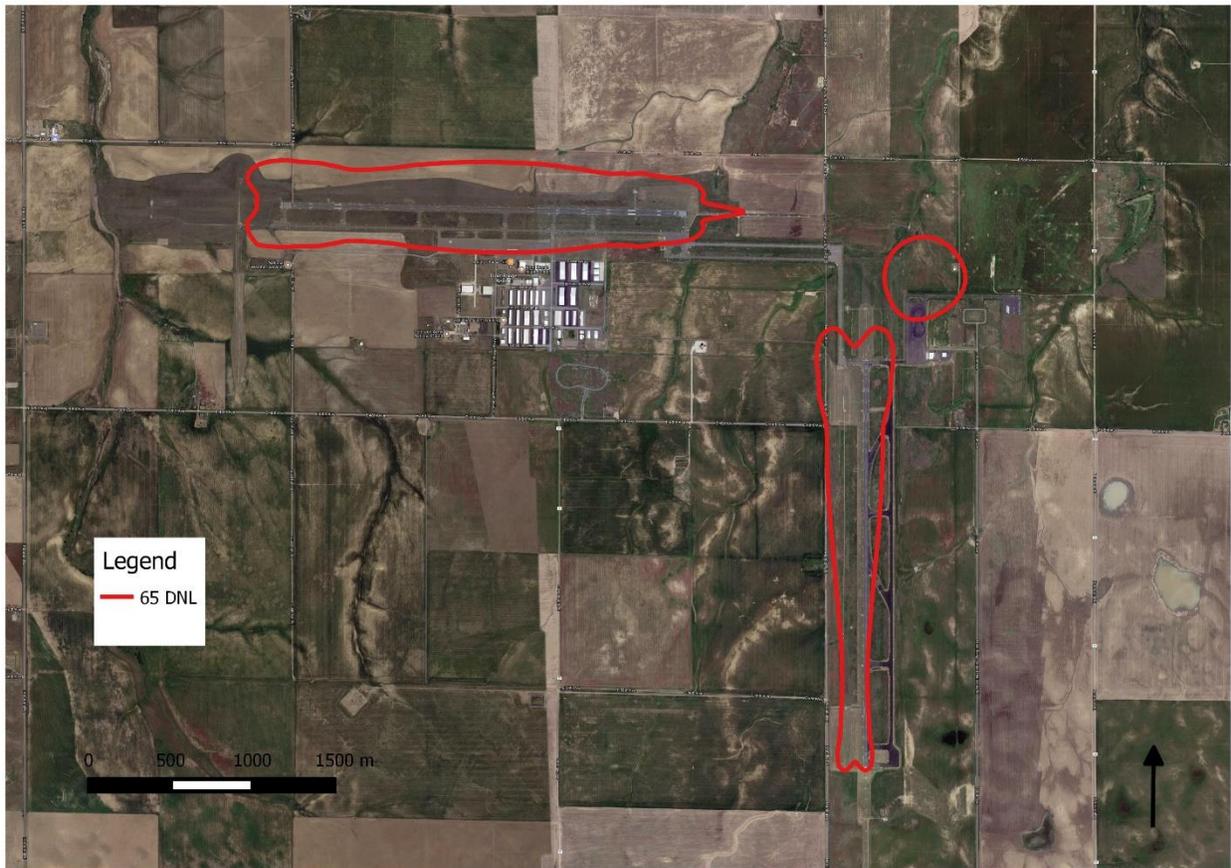


Exhibit 4-3. Proposed Action 65 DNL Contours (Baseline + RLV + Static Fire Engine Testing)

Sonic Boom Footprint

As the RLV descends, it transitions from supersonic to subsonic twice, once at 59,000 feet and again at 51,000 feet. As a result, the sonic boom footprint is spread over a relatively large area, but at relatively low overpressure values. Exhibit 4-4 shows the resulting sonic boom footprint. The sonic boom footprint ranges from 0.2 psf to 0.7 psf with the 0.7 psf value occurring in a relatively small area. The sonic boom overpressure footprint is approximately 60 to 80 miles east of FTG.

These overpressure values are well below the 2 psf building damage threshold, and therefore building damage would be extremely unlikely. At 52 sonic booms per year, the 0.7 psf contour is approximately equivalent to CDNL 41 which is substantially lower than FAA's significance criteria. However, sonic booms of this magnitude would be noticeable and would be similar to a clap of thunder. The majority of the area within the sonic boom footprint consists of agricultural fields and is sparsely populated. There are no major towns or cities within the footprint.

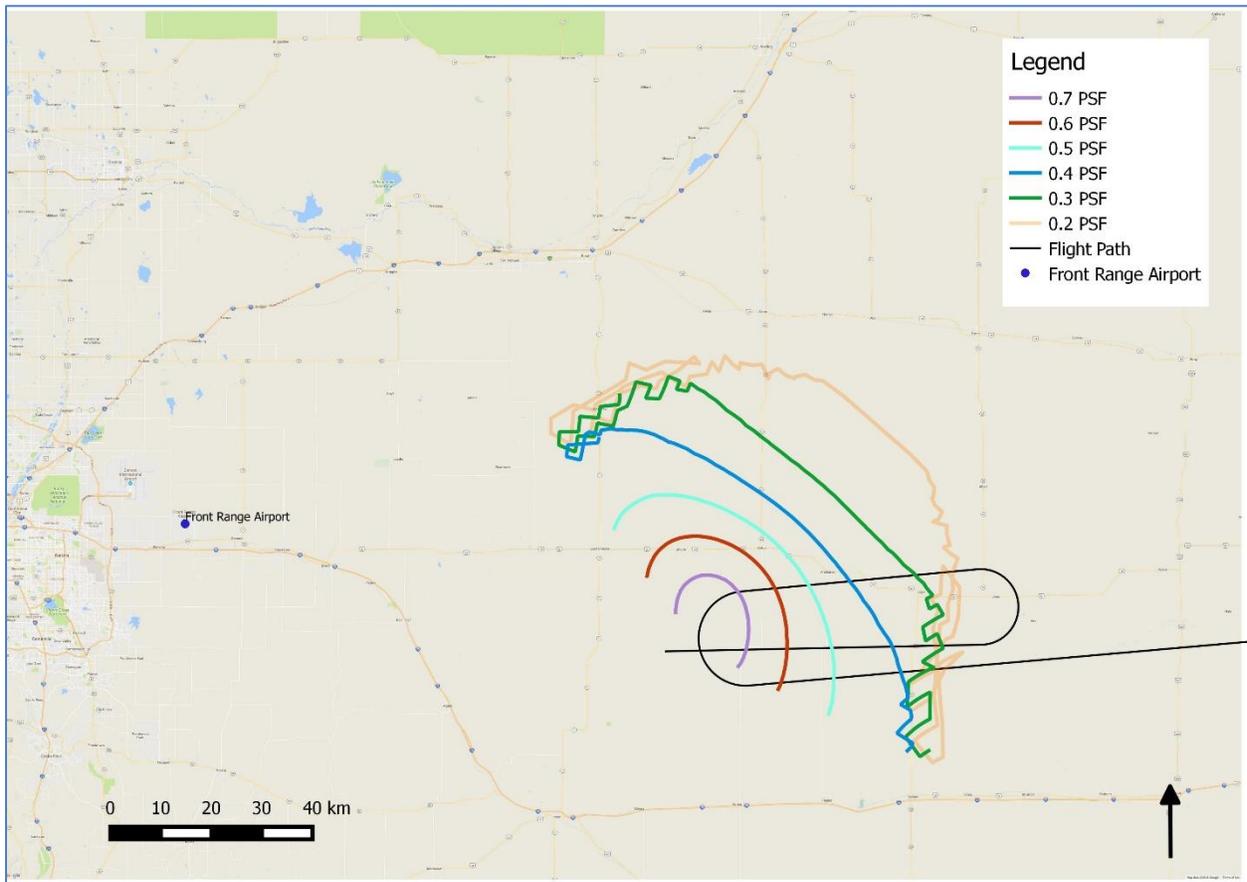


Exhibit 4-4. RLV Sonic Boom Footprint

Noise-Compatible Land Use

FAA Order 1050.1F states the compatibility of existing and planned land uses in the vicinity of an airport is usually associated with the extent of the airport's noise impacts. Therefore, there must be assurances that the action's predicted noise levels would be compatible with zoning laws, current infrastructure, and the adoption of new zoning regulations.

The land use compatibility guidelines in 14 CFR part 150 are used in this analysis to evaluate noise impacts. In general, residences, schools, hospitals, nursing homes, and places of public assembly, including places of worship, are considered noise-sensitive areas and are not generally compatible with aircraft operations when those noise-sensitive areas are within the 65 DNL noise contour.

Construction and operations would be consistent with current land use, which is zoned and used primarily for aviation purposes and agriculture. As shown in Exhibit 4-3, the predicted 65 DNL contours are basically the same as the baseline contours and are located within the airport's boundary. In addition, FTG is surrounded by the AIZ, which precludes residential development and ensures that future development will remain compatible with aviation-related uses. Therefore, the Proposed Action would be compatible with existing land use.

4.9 Socioeconomics and Environmental Justice

4.9.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and thus would also not issue launch licenses to commercial launch operators to launch RLVs. While there would be no new adverse impacts to socioeconomics or environmental justice under the No Action Alternative, the beneficial socioeconomic effects of development of the Proposed Action would not be realized. No new jobs would be created since the Proposed Action would not be implemented. The No Action Alternative would have no effect on airport operations and visitation and deliveries to FTG would be comparable to previous years under this alternative.

4.9.2 Proposed Action

Population, Employment, and Housing

Construction Impacts

Because the Proposed Action is situated at the site of an existing airport, it would not directly affect private properties, including residences and community facilities, and no changes in residential or community development patterns or relocations of residents or businesses would occur. In addition, spending on materials and supplies, and worker salaries would have beneficial economic impacts on the surrounding region.

The Proposed Action could result in a number of temporary jobs during construction. The construction workforce would likely be comprised of existing construction workers in the Denver metropolitan area. No unusual or specialized construction skills are anticipated, and existing workers in the Denver area are anticipated to have the required skills.

The indirect effect of increased employment during construction and operation would positively impact existing businesses located in Watkins, Bennett, and other nearby towns. During construction of the Proposed Action, there is anticipated to be a short-term, minor revenue boost to the local economy due to construction worker salaries and spending on materials. Construction activities for the initial phase of facility development (likely including fencing, roads, fuel storage, and mission preparation areas) are anticipated to last a total of approximately 3 months; however construction activities for other facilities (rocket engine test stand, water tank, etc.) could be spread over a longer time period depending on funding, launch operator, or facility user requirements.

Operational Impacts

The Proposed Action would result in approximately 20 new permanent full-time employees being located at the airport. The new permanent employees could be drawn from the Denver metropolitan area; although some specialized positions may require candidates to relocate from other parts of the country. Due to the small size of the permanent workforce, this additional population could be easily accommodated by existing housing and services in the vicinity of FTG and the greater metropolitan area. The Proposed

Action is not expected to disrupt or divide the physical arrangement of established communities, or cause extensive relocations of population or businesses.

In addition, launch events at the Spaceport are anticipated to attract visitors that could also have an indirect positive economic impact. The majority of visitors to launch events are expected to come from the Denver metropolitan area and locations in Colorado; however, visitors from other locations could also be attracted to the launch events. Out-of-town visitors would likely stay in Denver-area hotels and would contribute to the local tourism economy of the state. Since Colorado is already a major tourist destination, visitors to space launch events would be easily accommodated by the existing tourist infrastructure in the Denver metro area and any impacts would be minor, and primarily beneficial.

This PEA reflects assumptions regarding how commercial space operations may affect other types of civil aeronautical activity at Front Range Airport and its environs based on the information that is currently available to the FAA regarding planned launch operations. At such time as a prospective launch operator applies for a license to operate a launch vehicle at FTG, a separate environmental document, tiering off this PEA, would be required to support the issuance of that launch operator license. This tiered EA will evaluate the potential impacts (including economic impacts) of launch vehicle operations based on the specific type, trajectory, performance characteristics, arrival and departure procedures, and frequency and duration of actual commercial space operations, as proposed in the operator's launch license application.

Environmental Justice

The Proposed Action would not result in adverse impacts in any environmental resource category. Additionally, there are very few residential structures near the airport, and none of those structures would be adversely impacted by noise or any other effect of the Proposed Action. As noted in Section 4.8, *Noise and Noise-Compatible Land Use*, the sonic boom would be perceptible in areas within the sonic boom footprint, but is below the level determined to constitute an impact as the maximum overpressures were calculated to be 0.7 psf or less. Therefore, since the Proposed Action would not result in a disproportionately high and adverse effect on any population, it would not result in an adverse effect on a low-income or a minority population.

Emergency Services

The Proposed Action would not result in any changes to emergency services at FTG. As is currently the case, initial ARFF response will be provided by FTG's ARFF personnel with support from Bennett Fire Department, who has local jurisdiction. FTG's internal ARFF staff will provide ARFF support during normal business hours and will make arrangements to handle launches that occur outside of those times. Standard ARFF equipment will be sufficient to handle RLV operations and both FTG ARFF staff and Bennett Fire Department staff will receive any additional training necessary to provide service for the specific conceptual RLV prior to it becoming operational from the specific launch provider.

Transportation and Access

The development of the Proposed Action is anticipated to have minor to moderate impacts on transportation and access, as discussed below. These impacts would occur during both the construction

and operation of the Proposed Action and would include the installation of security gates and fencing, the transportation of materials to the site, and increased visitation to the site resulting from operations.

Construction Impacts

During construction, worker vehicles and trucks bringing materials would need to access the site. Depending on the phase of construction and the activities occurring on any given day, the number of construction workers is anticipated to range from 20 to as many as 50 workers on site. The largest number of workers is expected to be associated with concrete pours for the mission preparation areas and the duration of these activities would be limited.

In addition, trucks bringing various types of construction materials would need to access the site. It is anticipated that an average of five to ten trucks would access the site on a given day; however, during short periods of more intensive activity, the number of trucks accessing the site could increase to 20 or 30 trucks per day.

Since most construction activities would be occurring on the east side of FTG, the most direct route from I-70 would be Manila Road, which is anticipated to handle the majority of construction related traffic. Manila Road is classified as a principal arterial. Due to low existing traffic volumes on Manila Road, this increase in construction traffic would be noticeable; however, the increase in trips would only occur for a short period since construction of the Proposed Action is only expected to take approximately 3 months. In addition, the overall effect of this construction-related traffic is expected to be minimal since there are only a handful of properties along Manila Road north of I-70 that would be directly affected. Traffic volumes would be well-below the vehicle to capacity ratio on roads surrounding FTG and no peak hour impacts from construction-related traffic are anticipated. Adams County and FTG personnel would monitor pavement conditions during construction and Adams County road crews would be dispatched when needed to repair damage.

Operational Impacts

As part of the site security upgrades required for the Proposed Action, a new access gate would be installed on E. 30th Avenue at Manila Road to control access to the east side of FTG. In addition, new security fencing would be installed around key facilities associated with the Proposed Action including the propellant storage area and the static hot-fire test stand area on the east side of FTG, and the flight support hangar in the main airport hangar complex. These security upgrades are necessary to restrict public access to these sensitive areas and would contribute to the overall security improvement of FTG property. Since E. 30th Avenue and Front Range Airport Perimeter Road are already closed to public access via signage, these general security upgrades would have minimal impact on the traveling public. Security upgrades will include badge access points into those areas that are used in common with other airport users and all users that have a legitimate requirement to have access to those areas will be able to apply for and receive an access badge. Public access to the main airport facilities would be maintained along Manila Road, Imboden Road, 48th Avenue, and Front Range Airport Parkway.

During operations, the main sources of traffic to the site would be permanent workers, trucks delivering fuels and oxidizers to the site, and visitors observing launches on launch days. The total number of new employees associated with the launch site is expected to reach 20 within 5 years. These employees would reside in the general Denver metropolitan area and could access FTG either via Imboden Road or Manila Road. Given the low numbers of permanent employees, traffic impacts would be negligible.

Traffic and roadway impacts associated with fuel and oxidizer deliveries to the site are also expected to be negligible as trucks delivering these materials would likely arrive at the site using I-70 and Manila Road. At the peak anticipated launch frequency of 1 launch per week, the frequency of truck trips associated with fuel and oxidizer deliveries is anticipated to be one or more fuel and oxidizer deliveries per week. Given the low existing traffic volumes on Manila Road, the increase in truck traffic on this principal arterial would be minimal. In accordance with 49 CFR § 392.10, trucks carrying hazardous materials are required to stop at all at-grade railroad crossings and to visually verify that no trains are approaching the crossing before proceeding. Given this requirement, there may be short delays for vehicles that are following these trucks at the railroad crossings, but these effects are expected to be negligible.

Given the novelty of space tourism and the proximity of the Proposed Action to the Denver metropolitan area, the initial launches from the launch site are expected to attract a significant amount of media attention as well as draw a number of visitors to the site to witness the first series of launches. For planning purposes, it was estimated that as many as 2,000 vehicles would visit the site for each of the launches during the first year of operation.

FTG operations personnel have extensive experience managing large number of visitors to FTG for the annual Classic Aircraft and Car Show and other events. During these events, the majority of visitor vehicles access FTG via Imboden Road and 48th Avenue. The visitors are then directed to temporary parking areas on the west side of Front Range Parkway. For launch days, it is anticipated that visitor traffic flow would be similar. Given the experience of airport personnel with managing visitation during events, it is anticipated that the overall traffic impacts on the surrounding streets and communities including Watkins would be moderate and short-term. These impacts are expected to occur within an hour or two following the launch event as a result of large numbers of vehicles exiting the site simultaneously. To mitigate visitor traffic flow associated with launch events, it is recommended that FTG operations personnel review traffic flow before and after the launches and make adjustments to the event traffic management plan as necessary.

4.10 Visual Effects (including Light Emissions)

4.10.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and therefore the facilities associated with the spaceport would not be constructed. There would be no additional lighting or visual effects aside from those features that are already associated with FTG.

4.10.2 Proposed Action

Construction

Potential impacts associated with construction of the Proposed Action could include the visual impacts of new facilities constructed at FTG and light emissions associated with those new facilities and new security systems.

Replacing the pavement at the mission preparation areas is not expected to result in any significant long-term visual effects as there would be no aboveground structures built at those locations. The color of the pavement may change from darker asphalt to lighter concrete, but these effects are not expected to be significant.

The new water storage tank near the flight support hangar and the oxidizer and the propellant tanks in the propellant storage area would be new structures on FTG property that could have minor to moderate visual impacts. The nominal size of a 1.5 million gallon tank would be approximately 86 feet in diameter and 40 feet high. The visual impact of these new structures would be lessened somewhat since there are existing structures in close proximity to the new structures. For example, the proposed water storage tank would be located immediately north of the existing hangar building and the propellant storage area would be located immediately east of the existing GA aircraft hangars. The new tanks are expected to be of similar size and height of the existing structures, so their visual impact would be minor to moderate and they would not be visually dominant structures from public viewpoints.

Security fencing around each of the new facilities associated with the Proposed Action would not likely be visually dominant; however, night lighting at these newly secured facilities would be visible from some distance from FTG. Any lighting that is installed would need to be consistent with Adams County code requirements that exterior lighting be controlled as to prevent glare on public streets and adjoining property (Adams County 2016b, Section 4-13-01). In addition, lighting on FTG would also need to conform with FAA requirements (FAA Advisory Circular 150/5300-13A - Airport Design). Given these requirements, and the fact that there are existing lit facilities in close proximity to the proposed new facilities, the visual impacts of additional security lighting would be minor and incremental.

Operation

In addition to the facilities located on FTG property, launches and landings of the RLVs would have a negligible to minor visual impact. The vehicles themselves would be visible for a short time on launch and descent; however, these visual effects are expected to be similar to existing air traffic in the vicinity of FTG. The vehicles would be traveling through airspace that has existing GA traffic from FTG and existing commercial aviation traffic from DEN. Under certain atmospheric conditions, contrails from the rocket engine may be visible for extended periods; however, these conditions would also likely result in visible contrails from commercial aircraft operating in the area. Given the infrequent launches from the Proposed Action and the number of existing aircraft in the vicinity of the two airports, the additive visual impacts of RLV launches and landings would be negligible to minor.

4.11 Water Resources (including Wetlands, Floodplains, Surface Waters, and Groundwater)

4.11.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to the Adams County BOCC and the mission preparation areas, propellant storage area, and static hot-fire engine test pad would not be constructed. Conditions would remain as described in Section 3.11.3, *Existing Conditions*; therefore, no impacts on water resources would be expected.

4.11.2 Proposed Action

Construction

Wetlands. Due to the lack of wetlands in portions of the FTG property that would be affected by construction, it is unlikely that construction would result in direct impacts on wetlands.

Construction of the propellant storage area, Mission Preparation Areas #1 and #2, and construction of the engine test pad could result in sediments and other contaminants being transported into wetlands downstream. Implementation of BMPs and erosion control measures during construction would reduce the potential for impacts.

The onsite emergent wetland immediately north of Runway 8/26 along an unnamed ephemeral drainage is not located in a portion of FTG that would be affected by construction associated with the Proposed Action. Therefore no impacts on this wetland/pond feature are expected.

Floodplains. Since no floodplains are located within the portions of FTG property that would be affected by construction, construction would have no direct or indirect impacts on floodplains.

Surface Waters. Construction activities including the construction of Mission Preparation Areas #1 and #2, the propellant storage area, and construction of the engine test pad could result in increased transport of sediment and contaminants via stormwater runoff to surface water bodies. Runoff from construction of Mission Preparation Area #1 and the engine test pad could flow into the unnamed drainages running to the northeast of FTG. Construction of Mission Preparation Area #2 could result in sediments being transported into Bear Gulch. Construction activities in the other portions of FTG could result in pollutants being transported into the tributaries of West Sand Creek. However, adverse effects would be minimized by implementing erosion and sediment control and stormwater management practices in accordance with the construction stormwater permit to minimize potential adverse effects associated with increased runoff.

Groundwater. During construction, potential impacts on groundwater could occur from spills or leaks from construction vehicles and equipment. FTG's Storm Water Management Plan includes material handling procedures and BMPs that would help to minimize the potential for accidental spills and releases of hazardous materials. All materials used during construction would be handled and stored properly and any

spills would be cleaned up immediately. BMPs employed during construction would help ensure that potential risks to groundwater are minimized.

Operations

Wetlands. Impacts to the off-site fresh water pond/wetland located northeast of the propellant storage area during operation could include spills of fuel or other propellants resulting from fueling incidents or storage tank failures. Proper storage of fuels and oxidizers, including secondary containment as appropriate, would reduce the risk of fuel spills reaching offsite waterways and wetlands.

Floodplains. The increase in impervious surface associated with the engine test pad is insignificant in terms of increasing stormwater runoff from the site, and there would be no discernable increase in flooding associated with storm events.

Surface Waters. In the event of a spill or leak of fuel, there could be adverse effects on surface water quality; however secondary containment and immediate spill cleanup would reduce the risk of contaminants entering surface water. All propellants and other potentially hazardous materials associated with operation of the launch site would be contained and stored in accordance with applicable regulations, thereby reducing the risk of spills. FTG's Spill Prevention, Control, and Countermeasures plan would be updated to include the new propellant storage area as required, and fuel and oxidizer storage tanks and containers would be subject to regular inspections to identify leaks.

In the unlikely event of a launch failure, the debris impacts would be expected to be contained within the FAA-approved hazard area. The commercial launch operator(s) would coordinate emergency response efforts with FTG. These response efforts would include cleanup and restoration of contaminated water resources.

Groundwater. The water supply well for FTG is located approximately 1000 feet northwest of the propellant storage area and north of the rocket engine test stand. The water for the storage tank will come from the well for FTG. Because the volume of water used and frequency of use will be minimal, impacts from using the groundwater for the storage tank will be negligible. The propellant storage area would be located on an impervious surface and would employ secondary containment to reduce the risks of leaks or spills of propellant leaving the site and impacting groundwater. Fueling activities would be conducted at Mission Preparation Area #1 and any spills would be immediately contained and cleaned up by site crews. Given that Mission Preparation Area #1 and the propellant storage area are located downstream of the well and that secondary containment would be employed at the propellant storage area, the risk of groundwater contamination is small. Potential impacts associated with the storage and handling of propellants associated with launch operations are described in more detail in Section 4.4.2, *Proposed Action*.

The engine test pad and the oxidizer storage area represent the only new impervious surface associated with the Proposed Action. Together, the two pads represent 10,400 square feet of new impervious surface. However no impacts on groundwater recharge capabilities are anticipated. The engine test pad would also be equipped with secondary containment to prevent any spills from leaving the pad. In the unlikely event of a launch failure occurring at or within the vicinity of FTG, potential impacts on water quality would be

addressed by emergency responders. Groundwater resources would also be protected by adherence to the FTG's Spill Prevention, Control, and Countermeasures plan and other relevant regulations.

Overall, the potential impacts on wetlands, floodplains, surface water, and groundwater from construction and operation of the Proposed Action would be negligible to minor.

5.0 CUMULATIVE IMPACTS

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 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 the National Environmental Policy Act* 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 will 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 effects.

Past, present, and reasonably foreseeable future actions at FTG and the surrounding area potentially occurring within the term of the launch site operator license include the development activities listed below. Unless noted, all of these activities are considered future activities with limited potential to occur within the 5-year timeframe of the launch site operator license:

- Increased strengthening of FTG Runway 17/35.
- Strengthening of FTG Taxiway D.
- Expansion of east and west ramps at FTG.
- The DEN Concourse Expansion Project.
- High-temperature airflow ground testing conducted by Reaction Engines, Inc.
- Potential commercial and industrial development on FTG property spurred by the Proposed Action.
- Planned development south of FTG associated with the TransPort Framework Development Plan.
- The Aurora Campus for Renewable Energy (past and future).
- The Denver Metroplex airspace redesign.
- Potential oil and gas development and associated access roads and pipelines within Adams County.

Ongoing airfield operations at FTG represent past, current, and reasonably foreseeable future activities, and these airfield operations are included in the cumulative impacts analysis. As shown in Exhibit 3-2, aircraft operations had been steadily decreasing between 2007 and 2013 and only began increasing again in 2014. Operations in 2015 remained well below the long-term average of 80,641 operations between 1993 and 2014. Should future operations at FTG continue to increase, there would be minor cumulative effects on air quality, noise, and traffic impacts; however, these impacts will likely remain below the long-term averages.

The DEN Concourse Expansion Project includes construction of 33 new mainline gates and 9 replacement gates within the concourse area to meet existing and future needs for gates through 2025. A Draft EA was

prepared and was available for comment until April 10, 2018. Construction is projected to start on this project in 2018 and conclude in 2022. Due to DEN's close proximity to FTG (just under 5 statute miles from the westernmost runway end at FTG to the southeasternmost existing runway end at DEN), there would be minor effects on air quality, noise, and traffic impacts as well as minimal indirect impacts on biological resources; however, these impacts will likely remain below the long-term averages.

The 2011 EA for Increased Published Pavement Strength (Federal Aviation Administration 2011) identified the strengthening of Runway 17/35, the strengthening of Taxiway D, and the expansion of east and west ramps at FTG as projects with the potential to result in cumulative impacts on that project. FTG also completed a taxiway rehabilitation project in 2014; however, this rehabilitation project consisted primarily of repair to the taxiway surface and did not result in a substantial strengthening of the taxiway to accommodate larger aircraft. The construction projects anticipated in the 2011 EA are dependent on funding and have not been scheduled to date. Consequently, these projects are not considered further in the cumulative impacts analysis as the timing of these projects is uncertain, and they are unlikely to occur within the next 3 to 5 years.

Reaction Engines, Inc. is constructing a new ground test facility on the east side of the airport, near the ARFF. The facility includes two buildings, a main test building and a control room. External to the buildings there are two shipping containers used for storage, a large 50Hz electrical generator, a 4,000 gallon run tank for diesel fuel, and Sabre jet engine. This engine is the same type in F-16 aircraft, and is connected to a stainless steel vessel such that the hot exhaust air is ducted inside the building. A small rental air compressor and a bulk helium storage trailer will be parked on the north wall. A Spill Prevention Containment and Countermeasures (SPCC) plan is being prepared for the use of fuel and fueling operations on site. Generator hours will be less than 300/year and does not require an APEN for this unit. The facility generates hot air flow (1800F, 30lb/s) for testing of aerospace heat exchangers. Current technology uses high-pressure gaseous helium to transfer heat to a water boiler (all process water is to be trucked off-site for treatment). Items under testing will be entirely inside the building, but some of the equipment is located outside (jet engine, ducting, control valves, fuel tank and pumps). Test procedure is to have all components controlled remotely from the control building. The testing will occur during daylight hours, up to 3 times per day, with a duration of up to 25 minutes/test. The initial test campaign is anticipated to be 5 months long (Aug – Dec 2018). Future testing could be further heat exchanger tests, or other testing that could include materials testing or testing of other aerospace components in a hot airflow. Future testing is not yet planned, but could be expected to have durations of 3 months for each test campaign, with significant downtime between campaigns.

Other potential commercial and industrial development on FTG property spurred by the Proposed Action and additional development associated with the TransPort Framework Development Plan are anticipated to occur outside of the 5-year timeframe for the initial launch site operator license and are not considered further in the cumulative impacts analysis. TransPort is a planned, private light industrial business development located directly south of FTG. In 2007 a Framework Development Plan was approved for TransPort that divided the 6,300-acre development into smaller subareas. Each subarea requires additional refinement and approval. In January 2009, the first Sub Area Master Plan was approved. This subarea,

approximately 1,000 acres in size, allows rail-served heavy industrial uses. No development has occurred related to this plan as of this study and none is anticipated within the next 3 to 5 years. There are no other known active development proposals for properties on or near FTG.

The Aurora Campus for Renewable Energy is a 1,762-acre master planned campus designed for the advancement of alternative, renewable energy research, development and production that is located approximately 4 miles southwest of FTG. To date, only a small portion (68 acres) of the campus has been developed by the Solar Technology Acceleration Center (SolarTAC), with much of the initial development occurring in 2012. Planned future additions include a 100-acre expansion of the solar site and a 4-acre power tower; however, the timing of those additions is not known with certainty. Based on projections made in the City of Aurora 2009 Comprehensive Plan, Solar Technology Acceleration Center was estimated to be completed and fully operational in 20 to 40 years once water is available to the site. There is currently no firm schedule for providing water to these outlying parcels within the Aurora city limits. As this site is located west of Watkins and west of FTG, there would be minimal additive effects on any of resources analyzed in this PEA and this site is not considered further in the cumulative impacts analysis.

The Denver Metroplex airspace redesign is an effort to optimize air traffic procedures and airspace on a regional scale. This is accomplished by developing procedures that take advantage of technological advances in navigation, such as Area Navigation (RNAV), while ensuring that aircraft not equipped to use RNAV continue to have access to the National Airspace System. This approach addresses airspace congestion and other factors that reduce efficiency in the Metroplex and accounts for procedures at the following airports:

- Denver International Airport (DEN)
- Centennial Airport (APA)
- Greeley-Weld County Airport (GXY)
- Fort Collins - Loveland Municipal Airport (FNL)
- Buckley Air Force Base (BKF)
- Front Range Airport (FTG)
- Rocky Mountain Metropolitan Airport (BJC)

The airspace redesign project may involve changes in aircraft flight paths and altitudes in certain areas, but would not result in any ground disturbance or increase the number of aircraft operations at any of the above airports. The FAA solicited comments on a notice of intent to prepare a draft EA for this project until June 7, 2016 and the FAA plans to publish the draft EA in 2018. At present, there is no firm schedule for development of the EA or finalization of the procedures. While these design changes have the potential to alter the noise contours of aircraft operations at FTG, the location of these changes in the Metroplex is still in development, and therefore it is not foreseeable how these changes will interact with existing or future operations at FTG.

Oil and gas development has been ongoing throughout Adams County. Within Adams County, there are 325 wells on 22 well pads that have recently been approved, and 181 wells on 13 well pads are in the permitting process to gain approval (Adams County 2018). According to the Colorado Oil and Gas

Conservation Commission (COGCC) data, there are currently 9 producing wells within the 6-mile square Township (Township 3 South, Range 63 West) in which FTG occurs and no pending wells (COGCC 2018). Oil and gas development including drilling and production of wells and associated construction of pipelines and roads could result in effects on air quality, noise, traffic, and biological resource impacts.

Cumulative environmental impacts related to vehicle operation under a launch operator vehicle license would need to be analyzed in a subsequent document tiered off this PEA. Nevertheless, as it is reasonably foreseeable that future commercial space launch vehicle operations may take place at FTG, the FAA has used this PEA to analyze such launches, as well as other potentially connected actions that could reasonably be expected to result from issuance of a launch site operator license, in the above sections of this PEA. This “programmatic approach” and the concept of “tiering” are explained in detail in Chapters 1 and 2, above, and in Appendix A.

In accordance with FAA Order 1050.1F, FAA Order 5050.4B, and the CEQ Regulations, the FAA analyzed the potential cumulative impacts on the resources that would be adversely affected by implementation of the No Action Alternative or the Proposed Action. Based on the findings and potential impacts described in Chapter 4, *Environmental Consequences*, the cumulative impacts analysis focuses on air quality and noise, which would be expected to be the most affected resource areas and are therefore analyzed in more detail below. The FAA has determined that the potential impacts for all other resource areas described in Chapter 4 would not meaningfully interact in time and space with the potential effects of other past, present, and reasonably foreseeable future actions. Therefore, no cumulative impacts are anticipated on resource areas other than air quality and noise.

5.1 Air Quality: NAAQS

The proposed conceptual RLV launch schedule includes a maximum of 52 launches per year which would result in an additional 52.23 tons/year (0.14 tons/day) of CO emissions in the Denver metropolitan area. As shown in Table 5-1, these additional emissions would represent approximately seven-tenths of 1 percent of the projected CO aircraft emissions in the Denver metropolitan area. The cumulative impact of these additional CO emissions would be negligible and these additional emissions would not result in an exceedance of the CO standard. Similarly, cumulative emissions of the other criteria pollutants would not be expected to lead to a new violation of the NAAQS or worsen any existing violation.

Table 5-1. Projected Aircraft CO Emissions in the Denver Metropolitan Area (2015–2020)

Source	2015 CO Emissions (tons/day)	2020 CO Emissions (tons/day)	Growth 2015 to 2020 (tons/day)
Denver International Airport	11.2	12.4	1.2
Other Airports	8.7	9.3	0.6
TOTAL REGIONAL AIRCRAFT EMISSIONS	19.9	21.7	1.8
Conceptual RLV Launches	0.14	0.02	--
Percentage of Total Regional Aircraft Emissions	0.72%	0.66%	--

Source: City and County of Denver 2005; Regional Air Quality Council 2005.

5.2 Noise

The noise generated from launch operations under the Proposed Action would be similar to that of existing operations at the airport, as the vehicle will depart from FTG and return using its jet engines.

Receivers on the ground under the sonic boom footprint (Exhibit 4-4) would also be exposed to low level sonic booms during each descent. These booms would be noticeable; however, they would not be expected to cause exceptional levels of disturbance or annoyance.

The noise from the Proposed Action would incrementally add to the noise currently experienced by Adams County residents from aircraft takeoffs and landings at DEN and FTG and other noise sources such as vehicle traffic. The Proposed Action is expected to have a minor to moderate cumulative noise impact due to launch noise and sonic booms.

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6.0 LIST OF PREPARERS AND CONTRIBUTORS

6.1 Lead Agency

The Federal Aviation Administration is the lead agency in the preparation of this PEA.

6.2 List of Preparers and Contributors

Table 6-1 lists the principal preparers, reviewers, and contributors to this PEA.

Table 6-1. List of Preparers and Contributors

Name and Affiliation	Education	Years of Industry Experience	PEA Responsibility
Stacey Zee, FAA Office of Commercial Space Transportation	B.S. Natural Resource Management; M.S. Environmental Policy	22	FAA PEA Manager
Michon Powell Air Traffic Organization, Mission Support Services	B.S. Environmental Science; M.S. Environmental Management and Technology	25	Review
Kandice Krull, FAA Denver Airports District Office, Office of Airports	M.S. Environmental Science	12	Review
Frank Smigelski, FAA Headquarters, Office of Airports	B.S. Biology; M.S. Engineering	30	Review
Contractor Preparers – ICF			
Hova Woods	M.P.A. Environmental Policy & Science; B.S. Finance	16	Senior NEPA advisor
Shawna Barry	B.A. Environmental and Resource Policy; B.S. Biology	10	PEA Project Manager
Jack Rogers	B.A. Environmental Studies: Policy	4	PEA Project Coordinator; Socioeconomics and Environmental Justice; Land Use
Nick Baker	MEM Conservation Science & Policy; B.S. Wildlife Biology	10	Biological Resources (including Fish, Wildlife, and Plants); Historical, Architectural, Archaeological, and Cultural Resources; Noise and Noise-Compatible Land Use
David Coate	M.S. Nuclear Engineering, B.A. Mathematics, B.A. Physics, B.A. Chemistry	38	Noise and Acoustics Analyst
Alex Bartlett	B.G.S. Environmental Policy; Concentration: Biology	12	Water Resources (including Wetlands, Floodplains, Surface Waters and Groundwater); Meeting support

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Name and Affiliation	Education	Years of Industry Experience	PEA Responsibility
Jessica Feldman	M.A. Historic Preservation Planning; B.A. History/Art History	19	Historical, Architectural, Archaeological, and Cultural Resources
Andrew Johnson	M.A., Public Policy, University of Southern California B.A., Business Administration, Pepperdine University	4	Hazardous Materials, Solid Waste, and Pollution Prevention; Natural Resources and Energy Supply; Visual Effects (including Light Emissions)
David Ernst	M.C.R.P. Environmental Policy; B.S. Engineering	38	Air Quality; Climate
Contractor Preparers – HDR Engineering, Inc.			
Sirena Brownlee	B.S., Ecology, Arizona State University	14	Biological Resources
Tim Casey	B.S. Biology, St. Xavier College	24	Noise
Nathan Clements	M.S., Atmospheric Sciences; B.S., Meteorology, Texas A&M University	15	GIS/mapping/PEA graphics
Elliot Dick	B.S. in Noise and Vibration Control, University of Minnesota (expected 2014)	18	Noise
Lorena Jones	B.S. Education, English Father Saturnino Urios University (Philippines)	15	Technical Editing
Tara Kent	M.S. Ecology, University of Wisconsin, B.S. Biology, University of Wisconsin	5	Water Resources
Jared Latimer	M.A., anthropology, University of New York, Albany	8	Cultural and Archaeological Resources
Sumant Mallavaram	ME Environmental Engineering	12	Noise
Gina McAfee, AICP	B.S., Landscape Architecture/Recreation Resources, Colorado State University	36	Cumulative Impacts, QA
Marjorie Nowick	M.Phil., New York University, History and Historical Archaeology; M.S. Historic Preservation, Columbia University	25+	Historic Resources

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Spaceport Colorado

Name and Affiliation	Education	Years of Industry Experience	PEA Responsibility
Tanya Perry	B.S., Environmental Science, University of Rochester	10	Noise/Sonic Boom Modeling
Kathryn Plimpton	M.S. Historic Preservation, University of Colorado Denver	15	Cultural, Historic, and Archaeological Resources
Lled Smith	Business Administration, A.A. Geographic Information Systems, Western Oregon State University	10	Noise/GIS modeling and graphics
Karen Stackpole	M.S., Environmental Science and Education; B.S., Biology; A.S., Agriculture	19	Senior biologist/QC
Suzanne Stone	M.A., Archaeology and Heritage, University of Leicester	16	Cultural, Historic, and Archaeological Resources
John Van Kirk	M.A., Geography, B.A., Geography and Environmental Studies, University of California – Santa Barbara	29	PEA Task Manager, Natural Resources and Energy Supply, Visual Resources and Light Emissions, Transportation and Access, Airspace
Wendy Waites	Major: Air Transportation Seattle Central College	8	Project support, word processing, document formatting

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