Federal Aviation Administration

DRAFT

Environmental Assessment For The Blue Origin West Texas Commercial Launch Site

DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BLUE ORIGIN WEST TEXAS COMMERCIAL LAUNCH SITE

FEDERAL AGENCY: Federal Aviation Administration (FAA), Office of Commercial Space Transportation (AST)

PUBLIC REVIEW PROCESS: In accordance with the National Environmental Policy Act of 1969 (NEPA) the FAA has initiated a public review and comment period of the Draft Environmental Assessment (EA) for the Blue Origin West Texas Commercial Launch Site. Public information meetings were held in Van Horn, Texas on June 14, 2005 and in Dell City, Texas on June 15, 2005 to record comments from the public.

ABSTRACT: The Draft EA for the Blue Origin West Texas Commercial Launch Site addresses the environmental impacts of the proposed action of the FAA issuing one or more experimental permits, and/or licenses to Blue Origin. Blue Origin proposes to launch reusable launch vehicles (RLVs) on suborbital, ballistic trajectories to altitudes in excess of 325,000 feet. To conduct these operations, Blue Origin plans to construct a private launch site, which would include a vehicle processing facility, launch complex, vehicle landing and recovery area, a space flight participant training facility, and other minor support facilities.

Potential impacts of the proposed action on resource areas including air quality; airspace; biological resources; cultural resources; geology and soils; hazardous materials and hazardous waste management; health and safety; land use; noise; socioeconomic impacts and environmental justice; traffic and transportation; visual and aesthetic resources; and water resources were considered in this EA. In addition, the following topics required under 1050.1 E are covered in the EA under the following sections: the analysis of Farmlands and DOT Act § 4(f) resources appears in the "Land Use" section, and the analysis of Wetlands and Wild and Scenic Rivers appears in the "Water Resources" section. Cumulative impacts from the proposed action were also considered.

CONTACT INFORMATION: Questions and comments regarding the proposed action and the Draft EA for the Blue Origin West Texas Commercial Launch Site can be addressed to Mr. Doug Graham, FAA Environmental Specialist, Blue Origin Environmental Assessment, c/o ICF International, 9300 Lee Highway, Fairfax, VA 22031; e-mail BlueOriginEA@icfi.com or fax (703) 934-3951.

This Environmental Assessment becomes a Federal document when evaluated and signed and dated by the responsible FAA official.

Responsible FAA Official:

Patricia Grace Smith
Associate Administrator for
Commercial Space Transportation

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EXECUTIVE SUMMARY

Blue Origin, LLC (Blue Origin) is a commercial venture that proposes to construct and operate a privately-owned space launch site in Culberson County, Texas. In accordance with the Commercial Space Launch Act, the Federal Aviation Administration's Office of Commercial Space Transportation (AST) is responsible for regulating certain aspects of the construction and operation of the proposed launch facility by, among other things, issuing required permits or licenses. This environmental assessment has been prepared to comply with the National Environmental Policy Act regarding AST's decision on issuing such permits and licenses.

Proposed Action

The proposed action is for AST to issue one or more experimental permits and/or licenses to Blue Origin. Blue Origin proposes to launch reusable launch vehicles (RLVs) on suborbital, ballistic trajectories to altitudes in excess of 99,060 meters (325,000 feet). To conduct these operations, Blue Origin would construct a private launch site, which would include a vehicle processing facility, launch complex, vehicle landing and recovery area, space flight participant training facility, and other minor support facilities.

Candidate launch sites included two privately-owned parcels in Culberson County, Texas, the proposed state-sponsored Southwest Regional Spaceport in Upham, New Mexico, and the Pecos County Aerospace Development Corporation-sponsored Pecos County West Texas Spaceport at Fort Stockton, Texas.

Blue Origin subsequently elected to conduct a more detailed analysis of the Culberson County sites. Blue Origin determined that launching from a remote, privately-owned, launch site would offer significant cost, schedule, and operational benefits for its proposed activities.

For these reasons, Blue Origin determined that the Culberson County alternatives would best permit the company to conduct innovative, flexible RLV operations consistent with its program, schedule and cost requirements.

Affected Environment

Overview

The proposed Blue Origin launch site is approximately 40.2 kilometers (25 miles) north of Van Horn, Texas. It lies within a larger, privately-owned property known as the Corn Ranch.

Air Resources

The proposed launch site is located in an air quality control region that has always been in attainment with Federal and state ambient air quality standards, and therefore analysis of conformity to the Clean Air Act is not required. The air quality in Culberson County can be generally considered as unimpaired. There are no air monitoring stations in Culberson County, therefore, the county is deemed unclassifiable/attainment for all National Ambient Air Quality Standards (NAAQS). (40 CFR 81.344)

Ecological Resources

The Corn Ranch is within the Chihuahuan Desert, where the dominant vegetation community is known as Chihuahuan Desert Scrub. Wildlife in the area consists of typical Chihuahuan Desert species, and includes a variety of birds, small mammals, and reptiles found throughout the Trans-Pecos region of Texas.

Cultural/Native American Resources

A cultural resources inventory was conducted to identify prehistoric and historic resources. A total of 36 prehistoric and historic resources were identified: seven sites and 29 isolated occurrences. Two of the seven sites are eligible for application for inclusion in the National Register of Historic Places. Plans have been developed to protect these cultural resources during the construction phase of the project.

Hazardous Materials/Waste Management

Current activities at the proposed launch site require very limited use of hazardous materials (fuel for portable generator) or waste management. There is currently no hazardous waste or wastewater generation at the site.

Land Use (including Farmland and Section 4(f) Resources)

Most of the land within a 40.2 kilometer (25-mile) radius of the proposed launch facility is privately-owned. This land includes working farms and cattle ranches and former ranch properties that are now leased to groups of hunters and managed for game species, primarily mule deer.

No state or county parks or recreation areas lie within 80 kilometers (50 miles) of the proposed launch site. Guadalupe Mountains National Park (Texas) and Carlsbad Caverns National Park (New Mexico) are 35 and 60 kilometers (22 and 37 miles), respectively, north of the proposed launch site. Guadalupe Mountains National Park is a 348-square kilometer (86,000-acre) park that receives approximately 180,000 visitors annually. Carlsbad Caverns National Park, a 190-square kilometer (47,000-acre) park, receives more than 400,000 visitors annually.

Visual Resources

The Corn Ranch property encompasses a broad valley at elevation 1,097-1,189 meters (3,600-3,900 feet) above mean sea level with a northwest-southeast orientation. The valley, which is approximately 16 kilometers (10 miles) wide, consists of desert scrubland and arid grassland. The existing conditions at the Corn Ranch would be rated as moderate to high visual sensitivity.

Current light sources include a dozen homes in the valley, vehicle headlights on State Highway 54 and warning lights on the Delaware Mountain Wind Farm.

Noise

The baseline noise levels in the region of the proposed launch site are those typical of a remote desert – approximately 22 to 38 dBA. (FAA 2001) There is occasional road noise on State Highway 54 and aircraft noise, from commercial jetliners and low-level military aircraft. Low-level military aircraft flights can produce maximum noise levels ranging from 88 to 115 dBA at 152 meters (500 feet) altitude. (United States Air Force [USAF] 1998)

Geology and Soils (including Floodplains)

The proposed launch site is located in West Texas within the Trans-Pecos region of the Basin and Range Physiographic Province in West Texas. Seismic activity in this area is mostly associated with the Rio Grande Rift region west of the site. However, the facilities would be sited, designed, and built to prevent damage from a possible earthquake.

Although average annual rainfall is low (28 centimeters [11 inches] per year) (Larkin and Bomar 1983) at the launch site, and it would not be located in the 100-year floodplain (Federal Emergency Management Agency Flood Insurance Rate Map), localized flooding is possible. The potential for flooding in the proposed facility areas is low.

Soils at the proposed site fall into two broad classifications. Generally the Reakor-Verhalen association is found in the eastern portion of the site and the Holloman-Reeves association is found in the western portion. These soil associations are well to moderately well drained.

Topographic relief at the proposed launch site is generally moderate with an average slope of about 9.5 meters per kilometer (50 feet per mile). There is a fairly prominent ridge located in the southwestern portion of the site that separates the proposed facility locations from State Highway 54. Surface water generally flows from east to west in the area of the proposed launch site. On the infrequent occasions that it rains, water in the vicinity of the launch site would tend to flow to the west into the salt basin(s) between the site and State Highway 54. Runoff water from the Sierra Diablo Mountains would flow eastward into the same basin(s) and would not affect the launch site.

Socioeconomics (including Natural Resources and Energy Supply)

The government sector employs the greatest number of workers in the region; other important sectors of employment include farming, retail trade, and services. (BEA 2005) The labor force in the region decreased at the same time that the labor force increased in the state of Texas. The average per capita income in the two-county area was $16,040, compared to the state of Texas average of $29,074. (BEA 2005)

Between 1990 and 2004, the region's population decreased, while for the same period, the population in the state of Texas increased. Culberson and Hudspeth counties are both among the 25 least densely populated counties in the continental U.S.

There are three school districts in the region serving 890 students. The region is served by the Culberson County Hospital District in Van Horn.

The existing energy demands at the proposed site are met by the intermittent use of a diesel power generator. The current activities at the site do not require the use of water supplies.

Traffic and Transportation

The proposed launch site is approximately 40 air kilometers (25 air miles) and 48 road kilometers (30 road miles) north of Van Horn. Access to the proposed launch site is from Texas Highway 54, which is approximately eight kilometers (five miles) west of the proposed project's center of operations.

Union Pacific operates a major rail line from El Paso to Dallas, approximately 40 kilometers (25 miles) to the south of the proposed site, running approximately parallel to I-10 and passing through Van Horn. The nearest major air service is at El Paso International Airport, which serves several national and international passenger airlines and cargo carriers. There is a small county airport in Van Horn.

Traffic on Highway 54 is extremely light. Although a Level-of-Service analysis has not been performed, traffic on Highway 54 can be characterized as free flow or Class A as defined by the National Research Council. (NRC 1985) There is no traffic accident data for this highway, but given the infrequent traffic, the rate would be very small.

Water Resources (including Wetlands and Wild and Scenic Rivers)

There are no permanent, naturally occurring surface waters or open freshwater systems, or federally protected wetlands, as defined by section 404 of the Clean Water Act, on the proposed site. There are no major aquifers within approximately 80 kilometers (50 miles) of the proposed Blue Origin site. The site does lie over a minor aquifer, referred to as the West Texas Bolsons. (Ashworth and Hopkins 1995)

The only wild and scenic river in Texas is a 307-kilometer (191-mile) stretch of the United States side of the Rio Grande River along the Mexican border beginning in Big Bend National Park. This wild and scenic river is not in the ROI for this project; therefore, impacts to the river are not considered in this EA.

Water from eight existing wells on and in the immediate vicinity of the proposed Blue Origin site was analyzed to characterize site specific ground water quantity and quality. Total dissolved solids concentrations indicated water that was slightly saline at five of the wells, moderately saline at two of the wells, and very saline at one well.

Airspace

Air traffic within a 7.4-kilometer (4-nautical mile) radius of the test pad has been examined using data provided by FAA Air Traffic Control. During the period December 12, 2005 through December 16, 2005, aircraft tracks through this airspace ranged from 102 to 129 per day. The majority of these aircraft, 92 to 122 per day, were non-military. The Department of Defense currently notes two low-level training routes that pass within a 7.4-kilometer (4-nautical mile)

distance of the proposed launch site, 1R 102 and 1R 194. Commercial air-route V-198 also passes within a 7.4-kilometer (4-nautical mile) radius of the proposed launch site.

Environmental Justice

For Culberson County, the aggregate of minority races is 31.1 percent. Persons of Hispanic or Latino origin (ethnicity) accounted for 72.2 percent of the total County population. White persons accounted for 68.9 percent of the total County population. None of the 2000 minority populations for the two census tracts are meaningfully greater than the corresponding minority population in Culberson County.

Environmental Consequences

Air Resources

Impacts on air quality would occur during the construction and operation of the launch site. The estimated increases in emission concentrations from planned construction activities would be small fractions of either state or Federal ambient air quality standards. Construction impacts are expected to be localized and short-term. The estimated increases in ambient background concentrations from operations would be negligible. No significant impacts on air resources would be anticipated.

Ecological Resources

Construction activities would result in the clearing, grading, or disturbance of approximately 308 hectares (760 acres), which is approximately 4.1 percent of the 7,527 hectares (18,600 acres) contained within the launch site perimeter fence line. Almost all construction activity would be in vegetation characterized as creosote bush community, which comprises approximately 5,595 hectares (13,825 acres) of the launch site. Because this plant community type is common on the launch site and throughout the Chihuahuan Desert, the anticipated loss would represent only a small portion of this habitat type and would not adversely affect local or regional diversity of plants and plant communities.

Construction activities would cause impacts on wildlife through elimination of vegetation communities (i.e., habitats) and their associated fauna. Small numbers of less-mobile, burrow-dwelling animals (e.g., pocket gophers, chipmunks) inhabiting the construction area could be displaced by construction activity or killed if burrows are filled, crushed, or paved. More mobile animals such as birds and larger mammal species (e.g., jackrabbits, pronghorn) would be expected to disperse to less-disturbed areas of the proposed launch site or off site.

Launch noise and sonic booms would have potential for disturbing wildlife. Launch noise could disrupt movement and feeding of wildlife, especially birds and mammals, for approximately one minute after lift-off within a 12.9-kilometer (8-mile) radius of the launch site. Sonic booms could have the same effect on wildlife during landings. In both cases, the disturbance would be short lived and would have no more effect on local wildlife than military aircraft that routinely fly over the Corn Ranch property on low-level training missions. Birds and mammals typically return to normal activities a relatively short time after being exposed to aircraft and launch noise.

No state or federally listed species was observed in surveys of the proposed Blue Origin site conducted in January and April 2005. Based on the habitats present, three state-listed species (Chihuahuan Desert lyre snake, Trans-Pecos black-headed snake, Texas horned lizard) and one federally-listed species (Northern aplomado falcon) could occur in limited numbers in the vicinity of the site. It is conceivable that small numbers of these state listed reptiles or an individual Northern aplomado falcon could be disturbed by construction activities, launch noise or sonic booms. Any disturbance from launch activities would be brief (less than approximately one minute) and create impacts similar to those currently experienced as a result of military aircraft overflying the proposed launch site. Depending on the species and its sensitivity to noise, there would likely be some level of startle response, with normal activity ceasing for a minute or so, then resuming when the launch noise or sonic boom noise diminished. The proposed launch site does not contain suitable habitat for six of the 12 state-listed species (common black hawk, gray hawk, zone-tailed hawk, Pecos pupfish, Chihuahuan mud turtle, and mountain short-horned lizard), so construction of the proposed launch site would have no effect on these species. The black bear, state-listed as threatened, is occasionally found in desert lowlands in west Texas, but prefers mountainous forest, and bears have not been observed by Blue Origin personnel or contractors in the vicinity of the proposed launch site. The American peregrine falcon (state-endangered) and Arctic peregrine falcon (state-threatened) might pass through the vicinity of the proposed launch site during migration, but would not nest there. Thus, construction of the proposed launch site would have no impact on the black bear, the American peregrine falcon, or the Arctic peregrine falcon.

The remaining three state-listed special status species that could potentially occur in vicinity of the proposed launch site are the Chihuahuan Desert lyre snake, the Texas horned lizard, and the Trans-Pecos black-headed snake. Potential habitat for the Chihuahuan Desert lyre snake within the proposed launch site is very limited, and occurs along the limestone ridge bisecting the western portion of the site. No construction is planned for this area, and thus, the proposed action would have no effect on this species. The Texas horned lizard is found in a variety of habitats and could occur within the proposed launch site. Potential habitat for the Trans-Pecos black-headed snake at the proposed launch site consists of mesquite-creosote scrub. Although neither the Texas horned lizard nor the Trans-Pecos black-headed snake was observed during biological surveys, their existence at the proposed launch site cannot be ruled out. Nevertheless, construction activities would impact only a relatively small portion of either species' habitat in Culberson County or the Trans-Pecos region, and population impacts on these two species would not be expected.

The FAA contacted the U.S. Fish and Wildlife Service (USFWS) regarding potential impacts to threatened or endangered species. The USFWS concurred with the FAA's determination that it is unlikely that any federally listed threatened or endangered species occur within the proposed site boundaries; therefore, no impacts to these species are expected.

Cultural/Native American Resources

The proposed locations where construction activities would occur for the launch site contain two archaeological sites determined to be eligible for the National Register of Historic Places. Mitigation measures have been proposed to protect these sites during construction. If previously unknown cultural deposits are discovered, construction activities in the area would halt, and a

qualified archaeologist would evaluate the discovery. Appropriate treatment activities would be determined, if necessary, in consultation with the Texas State Historic Preservation Officer (SHPO). Direct impacts to cultural resources from maintenance or operating activities would be unlikely since these activities would take place within areas already disturbed by construction. The FAA, SHPO, and Blue Origin signed a Memorandum of Agreement regarding avoidance of adverse effects to site 41CU695 and mitigation of adverse effects to site 41CU696, Culberson County, Texas.

Hazardous Materials/Waste Management

The construction activities would use small quantities of hazardous materials, which would result in generation of small volumes of hazardous wastes. The hazardous materials that are expected to be used are common to construction activities and include diesel fuel, gasoline, and liquefied natural gas to fuel the construction equipment, hydraulic fluids, oils and lubricants, welding gases, paints, solvents, adhesives, and batteries. Appropriate hazardous material management techniques would be followed to minimize their use and ensure safe disposal.

Nonhazardous and hazardous waste generated during construction of the launch site would include construction debris, empty containers, spent solvents, waste oil, spill cleanup materials (if used), and lead-acid batteries from construction equipment. Blue Origin would ensure that construction contractors safely remove these wastes from the site for recycling or disposal in accordance with applicable federal, state and local requirements.

The hazardous material management practices described above for construction would also be followed during launch site operations. The majority of the hazardous materials used in launch operations are the propellants for the launch vehicle and compressed gases. Other hazardous materials would be used in much smaller amounts with on site storage limited to less than 379 liters (100 gallons). Substantial impacts to the environment are not expected from the presence of hazardous materials and wastes during launch site operations.

Land Use (including Farmland and Section 4(f) Resources)

Construction of the launch site would permanently cover about 90.3 hectares (223 acres) of desert scrubland with impermeable surfaces, such as building foundations, test pad, parking lots, etc. This relatively small area represents 1.2 percent of the launch site. Operation of the launch site would necessitate the fencing and enclosure of approximately 7,527 hectares (18,600 acres) of desert scrubland and grassland that are currently used as a private wildlife management area. This acreage will continue to provide habitat for wildlife, particularly species that are more tolerant of noise and human presence. Land use would be essentially unchanged; only the core facility areas would be converted to industrial use.

No farmlands or agricultural use lands are located on the proposed site. No prime farmland, unique farmland, farmland of state importance, or general farmland would be converted to a non-agricultural use as a result of the proposed action. No conflicts with existing agricultural uses would occur as a result of the proposed action.

Section 4(f) properties would not be significantly impacted by the proposed action because it does not require the use of any section 4(f) properties, and it does not create a "constructive use" that substantially impairs the properties. Section 4(f) properties are not substantially impaired because the impacts of the proposed action are not sufficiently serious that the value of the site in terms of its prior significance and enjoyment are substantially reduced or lost.

Visual Resources

During construction, the visual landscape would be impacted primarily by construction activities associated with the two launch site access road improvements that would intersect State Highway 54 and the associated vehicle traffic traveling to and from the launch site. This is because the launch site facilities would be built eight kilometers (five miles) to the east of State Highway 54. Facilities and infrastructure including buildings, storage tanks, launch and landing pads, access roads, parking areas, fencing, and lighting would be constructed. A fire break would be cleared along the perimeter fence to prevent the spread of fire on or off the launch site. The tallest building would be approximately 26 meters (84 feet) high, and would be located eight kilometers (five miles) to the east of State Highway 54. Portions of the facility may be visible to motorists traveling on Highway 54, but the proposed construction and operation of the facility would not result in a significant impact on visual resources.

Noise

Construction activities would include excavating, digging and pouring foundations, erecting buildings, and developing roads and utilities. These activities would temporarily increase the ambient noise levels at the proposed launch site. Such activities could potentially create individual noise sources ranging from 70 to 100 A-weighted decibels (dBA) at 30.5 meters (100 feet) from the activities. Traffic noise from commuting workers and trucks on the road to the launch complex would also increase. The construction-related noise could last approximately 12 months, but would not be appreciable off site, given the size of the property and the distance of the construction activities from the surrounding population.

The nearest public access to the launch and landing platforms would be approximately 8.5 kilometers (5.3 miles) away on Highway 54. Launch noise at that location would be approximately 85 dBA, approximately the same as that experienced by a person standing 9.1 meters (30 feet) from a highway when a heavy truck passes. The nearest residence is approximately 10.9 kilometers (6.8 miles) away and would experience slightly less than 85 dBA. The noise would be much lower in frequency than the truck example, and thus typically less irritating to humans. The duration of launch noise would be approximately one minute, with the peak noise lasting from 5 to 15 seconds after launch. The nearest population center, Van Horn, is approximately 40.2 kilometers (25 miles) away. At this distance, the launch noise would be less than 65 dBA, the threshold of significance.

Because Blue Origin's launch vehicle would ascend and descend vertically, sonic booms would propagate away from the Earth's surface during launch and towards the Earth's surface during descent. The peak overpressure, 7.8 kilograms per square meter (1.6 pounds per square foot), would occur at approximately 1.3 kilometers (0.8 mile) from the landing pad. At the closest location that would be occupied by workers or visitors, the overpressure would be 4.9 kilograms

per square meter (1.0 pound per square foot), which approximates 85 dBA. At 12.9 kilometers (8 miles) the sonic boom sound level would drop to about 80 dBA, and at 37 kilometers (23 miles) the sonic boom would probably be indiscernible.

Geology and Soils (including Floodplains)

Construction activities have the potential to disturb approximately 308 hectares (760 acres) of soil. Of this total, approximately 90.3 hectares (223 acres) are expected to be permanently covered with impermeable surfaces such as buildings and parking areas. Because of the clay content of the site soils, it may be necessary to strip 0.3 to 1.2 meters (1 to 4 feet) below existing grade prior to construction of the facilities. Depending on the depth of excavation, the volume of soil excavated would range from approximately 10,930 to 43,800 cubic meters (14,300 to 57,300 cubic yards).

Soil erosion due to runoff and wind would be of concern during construction. Best construction management practices would be employed to limit soil loss below significant levels.

The proposed site would not be located in the 100-year floodplain (Federal Emergency Management Agency Flood Insurance Rate Map); however, localized flooding is possible. The potential for flooding in the proposed facility areas is low.

Socioeconomics (including Natural Resources and Energy Supply)

Construction would require a monthly average of approximately 45 workers. Virtually all the workers would have permanent residences outside of the immediate area. However, some of the wages and salaries earned by these construction workers would help to stimulate the local economy and would create a small number of additional indirect jobs. The economic benefit would be small; however, because the bulk of the construction-generated wages would be spent in the home communities of the construction workers.

Staffing for the daily operations phase of the proposed project is expected to be 20 to 35 personnel. Although the professional staff would likely be imported to the area, a portion of the security and support personnel would be expected to be drawn from the local area. The additional employment opportunities created by the proposed action would have modest impact on the employment statistics for the area. The proposed action would represent an increase of less than one percent in the region's labor force.

In accordance with FAA Order 1050.1E, the proposed action was examined to identify any proposed major changes in stationary facilities or the movement of ground vehicles that would have a measurable effect on local supplies of energy or natural resources. If there are major changes, power companies or other suppliers of energy would be contacted to determine if projected demands can be met by existing or planned source facilities. The use of natural resources other than for fuel need be examined only if the action involves a need for unusual materials or those in short supply. The proposed action does not create any major changes that would have a measurable effect on local supplies of energy or natural resources. The proposed action does not utilize unusual materials or materials in short supply.

Traffic and Transportation

Highway 54 would be the road most impacted by construction activities. It is the only access to the construction site and is an infrequently used highway. During the peak period of construction, approximately 70 construction workers would be commuting to the site. The monthly average construction workforce is expected to be approximately 45. In addition there would be deliveries of equipment, supplies, and building materials on a daily basis. Highway 54 is expected to undergo improvements at the beginning of 2006; therefore no deterioration of the highway should occur.

During facility operations, the commuting workforce would be approximately 20 to 35 workers. During launches, customers and other visitors would be visiting the site. Shipments of rocket propellants would be needed to fuel the launch vehicles. There would also be shipments of gaseous helium and nitrogen. Diesel fuel would be needed for diesel generators. There would be other shipments of supplies and materials. However, the traffic from operations is expected to be less than that for construction. Existing roads would be well able to handle the traffic without congestion.

Water Resources (including Wetlands and Wild and Scenic Rivers)

Construction activities would require an estimated 5.7 to 7.6 liters (1.5 to 2 gallons) per minute continuous flow of ground water for a period of one year. Aquifer drawdown for this withdrawal would be less than 3.8 centimeters (1.5 inches) within 9.1 meters (30 feet) of the wells (conservatively assuming withdrawal from a single well). Thus, the effects of this withdrawal on off site water use would be small. Best management water control practices, including storage and control of liquids, would be employed for all construction activities in accordance with Texas state regulations.

On site wells would be used to supply water for launch site operations. Water use rates are expected to be less than 11.4 liters (3 gallons) per minute, continuous flow. Aquifer drawdown, conservatively assuming this rate is pumped from a single well, would be approximately 6.3 centimeters (2.5 inches) at 9.1 meters (30 feet) from the wells after 10 years of pumping. Impacts of this water withdrawal on other possible on site and off site water uses would not be a significant impact.

No ponds would be used for water storage. The launch site would use a combination of wastewater treatment and septic systems. Effluent from the wastewater treatment plant would be discharged to an on site pond. The launch site design would incorporate water management methods for all building sites, parking lots and areas where a change in grading or ground cover has occurred as a result of construction. Facilities in which potentially contaminated wastewater or solutions may be inadvertently discharged would have fixed containment barriers.

There are no permanent, naturally occurring surface waters or open freshwater systems, or federally protected wetlands, as defined by section 404 of the Clean Water Act, on the proposed site. The only wild and scenic river in Texas is a 307-kilometer (191-mile) stretch of the United States side of the Rio Grande River along the Mexican border beginning in Big Bend National

Park. There are no wetlands or wild and scenic rivers within the ROI for this project; therefore, there would be no impacts to either of these resources.

Airspace

The airspace above and around the launch site is used by commercial and military aircraft. Prior to scheduling flight countdown activities, Blue Origin would request the Federal Aviation Administration's approval for exclusive use of the airspace directly above the launch site for a specific launch and recovery time window, expected to not exceed three hours. The steep flight ascent profile of the Blue Origin reusable launch vehicle ensures that at no time in any nominal ballistic trajectory would the vehicle's ground track depart from the boundaries of the Corn Ranch.

Environmental Justice

Because construction and operations impacts would not significantly impact the surrounding population, and no means were identified for minority or low-income populations to be disproportionately affected, no disproportionately high and adverse impacts would be expected on minority or low income populations..

Health and Safety

Based on Bureau of Labor Statistics data for the five-year period between 1997-2001, it was estimated that during construction, 1.8 total lost workdays, no fatalities, and 3.8 total recordable cases of injury, illness, or death could be expected during the 12-month construction period. Using the same statistical data it was estimated that 0.5 total lost workdays, no fatalities, and 1 recordable case of injury, illness, or death could be expected from the operation of the Blue Origin facility.

There are no health impacts expected to members of the public (adults or children) from the operation of the proposed launch site. Therefore, the requirements of Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks" are not applicable to this action.

During the operation of the vehicle, there is the possibility of an accident or off-nominal situation. In the majority of foreseeable off-nominal scenarios, the crew capsule, abort module, and propulsion module would all land within the perimeter fence of the launch site. In some rare cases, the vehicles may land outside the fence line. However, in nearly all cases, the vehicles will stay within the boundaries of private land controlled by Blue Origin and present no danger to the public. In the unlikely event the vehicles impact outside the privately controlled Blue Origin land, the surrounding properties consist of extremely sparsely populated rangeland. During any landing away from the landing pad, the potential exists for crushing vegetation and animals as the vehicle touches down to ground, fire, and, for the propulsion module and abort module, the dispersal of unused propellant.

Current activities at the proposed launch site require very limited use of hazardous materials (fuel for portable generator) or waste management. There is currently no hazardous waste or

wastewater generation. Therefore, there are no safety and health risks to workers or members of the public associated with the proposed Blue Origin site.

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Table of Exhibits

ACRONYMS and ABBREVIATIONS

AGL	Above Ground Level
APE	Area of Potential Effect
AST	Office of Commercial Space Transportation
ATC	Air Traffic Control
CAA	Clean Air Act
CC	Crew Capsule
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
dB	Decibel
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FR	Federal Register
FTE	Full Time Equivalent
HAP	Hazardous Air Pollutant
HCl	Hydrogen Chloride
HTP	High Test (Hydrogen) Peroxide
IIP	Instantaneous Impact Point
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
National Register	National Register of Historical Places
OCC	Operations Control Center
O_3	Ozone
OSHA	Occupational Safety and Health Act
PM	Particulate Matter
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RCS	Reaction Control System
RLV	Reusable Launch Vehicle
ROI	Region of Influence
RP-1	Rocket Propellant-1
SHPO	State Historic Preservation Officer
SO_2	Sulfur dioxide
TAC	Texas Administrative Code

TCEQ	Texas Commission on Environmental Quality
USAF	United States Air Force
U.S.	United States
USCB	United States Census Bureau
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compound
VPF	Vehicle Processing Facility

1 PURPOSE AND NEED FOR PROPOSED ACTION

1.1 Introduction

Blue Origin, LLC (Blue Origin) is a commercial venture that wants to operate reusable launch vehicles (RLVs) from a privately-owned launch site in the southwestern United States (U.S.). Blue Origin proposes to construct and operate a commercial space launch site to be located on privately-owned property in Culberson County, Texas (Exhibit 1-1). Blue Origin proposes to develop this site to launch RLVs carrying space flight participants[1] on suborbital, ballistic trajectories to altitudes in excess of 99,060 meters (325,000 feet) above sea level. Operations at the launch facility would include pre-flight processing, launch, flight, landing, and recovery activities. To accommodate these operations, Blue Origin proposes to construct a vehicle processing facility, launch complex, vehicle landing and recovery area, space flight participant training facility, and other minor support facilities.

To conduct commercial launch operations, Blue Origin must obtain authorization from the Federal Aviation Administration (FAA). Under the proposed action the FAA would issue experimental permits, a launch site operator license, RLV mission-specific licenses, and/or RLV operator licenses, as appropriate.

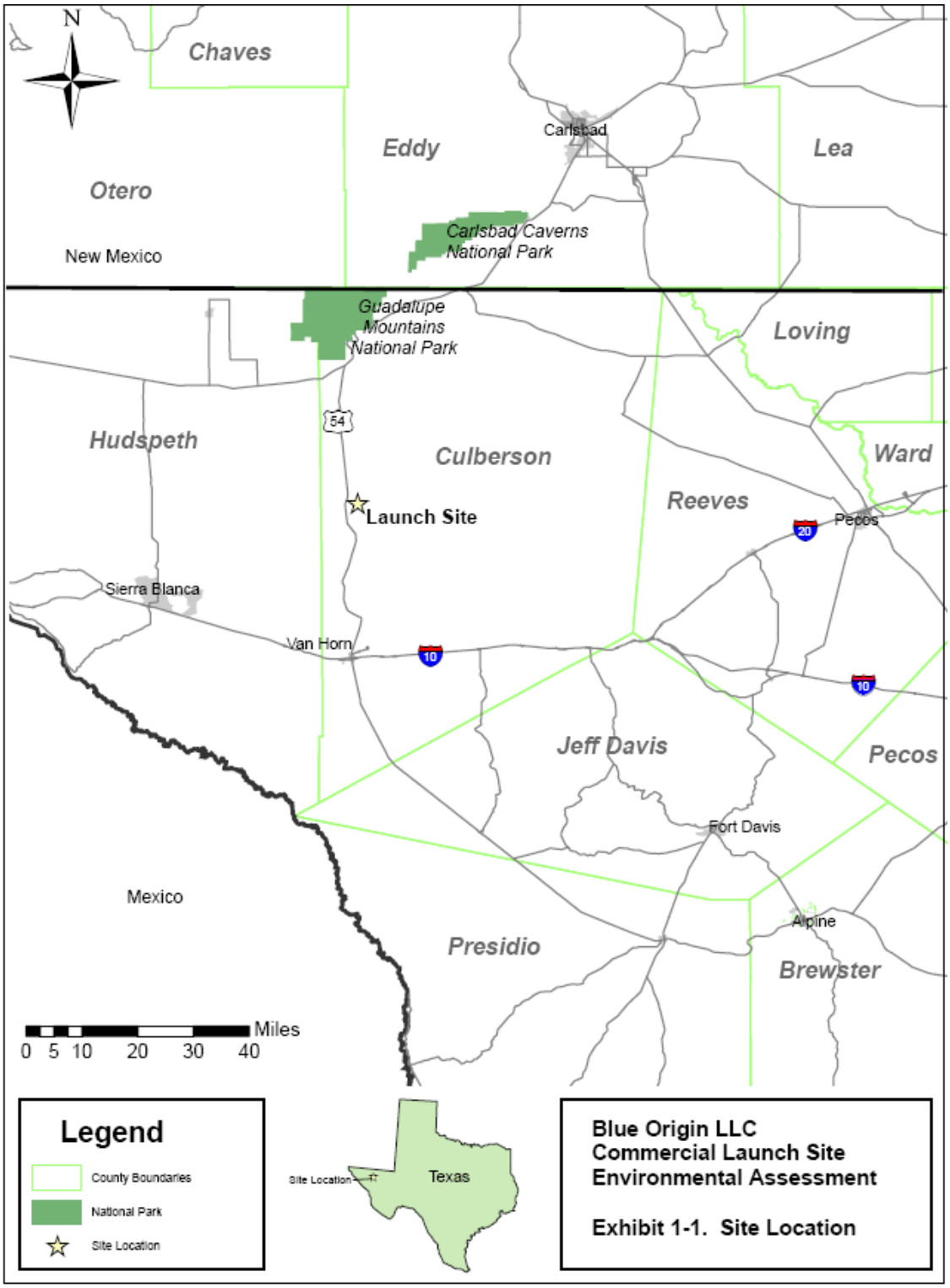
An experimental permit would allow Blue Origin to conduct testing of reusable suborbital rockets that would be launched or reentered solely for

- Research and development to test new design concepts, new equipment, or new operating techniques;
- Showing compliance with requirements as part of the process for obtaining a license; and
- Crew training prior to obtaining a license for a launch or reentry using the design of the rocket for which the permit would be issued.

An RLV mission-specific license authorizing an RLV mission authorizes a licensee to launch and reenter, or otherwise land, one model or type of RLV from a launch site approved for the mission to a reentry site or other location approved for the mission. A mission-specific license authorizing an RLV mission may authorize more than one RLV mission and identifies each

[1] Space flight participant means an individual, who is not crew, carried within a launch vehicle or reentry vehicle. 49 United States Code (U.S.C.) § 70102(17) Flight crew means any employee of a licensee or transferee, or of a contractor or subcontractor of a licensee or transferee, who is on board a launch or reentry vehicle and performs activities in the course of that employment directly relating to the launch, reentry, or other operation of the launch vehicle or reentry vehicle. See 49 U.S.C. § 70102(2) (defining crew).

Exhibit 1-1. Site Location



flight of an RLV authorized under the license. An RLV operator license authorizes a licensee to launch and reenter, or otherwise land, any of a designated family of RLVs within authorized parameters. A licensee's authorization to conduct RLV missions terminates upon completion of all activities authorized by the license, or the expiration date stated in the reentry license, whichever comes first. Issuance of an experimental permit or license does not relieve its holder of the obligation to comply with any other laws or regulations, nor does it confer any proprietary, property, or exclusive right in the use of airspace or outer space. (14 Code of Federal Regulations [CFR] 420.41)

The FAA is the lead Federal agency responsible for authorizing the proposed launch activities at the Blue Origin facility. Issuing permits and licenses are Federal actions and are subject to review as required by the National Environmental Policy Act (NEPA) of 1969, as amended, 42 United States Code (U.S.C.) § 4321, et. seq.

Under NEPA, this Environmental Assessment (EA) has been prepared to describe the proposed action and alternatives considered, the affected environment, the potential effects of the proposed action on that environment, and measures to be taken to mitigate those potential effects.

1.2 Background

The FAA, in accordance with its responsibilities under Title 49, U.S.C., Subtitle IX, Sections 70101-70121 (formerly the Commercial Space Launch Act), designated the Office of Commercial Space Transportation (AST) to regulate the commercial space launch industry by licensing launches and reentries occurring in the U.S. and those conducted by U.S. citizens outside of the U.S., and the operation of facilities that support these activities. The purpose of AST's oversight of commercial space transportation activities, as defined by Congress in 49 U.S.C. Subtitle IX, Ch. 701, § 70101(b), is

- To promote economic growth and entrepreneurial activity through use of the space environment for peaceful purposes;
- To encourage the U.S. private sector to provide launch vehicles, reentry vehicles, and associated services by
  - Simplifying and expediting the issuance and transfer of commercial licenses, and
  - Facilitating and encouraging the use of government-developed space technology;
- To ensure that the Secretary of Transportation provides oversight and coordinates the conduct of commercial launch and reentry operations, issue and transfer commercial licenses authorizing those operations, and protects the public health and safety, safety of property, and national security and foreign policy interests of the U.S.; and
- To facilitate the strengthening and expansion of the U.S. space transportation infrastructure, including the enhancement of U.S. launch sites and launch-site support facilities, and development of reentry sites, with Federal, state, and private sector involvement, to support the full range of U.S. space-related activities.

The Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and FAA Order 1050.1E, Environmental Impacts: Policies and Procedures, direct FAA lead agency officials to consider the environmental consequences when planning for, authorizing, and approving Federal actions. When the FAA issues a license or permit, it is considered a Federal action and is subject to review as required by NEPA. FAA Order 1050.1E states that for actions subject to NEPA that do not qualify for a categorical exclusion, like those proposed by Blue Origin, an EA or Environmental Impact Statement (EIS) is required. An EA is an analysis of environmental consequences of a proposed action and reasonable alternatives (including no action), cumulative impacts, and mitigation actions. The purpose of an EA is to determine whether a proposed action or its alternatives has the potential to significantly affect the environment. If the EA indicates that the proposed action's impacts would meet or exceed a significance threshold for the affected resource or resources, or that mitigation would not reduce the significant impacts below the applicable threshold, the FAA must prepare an EIS. FAA Order 1050.1E states that an EIS provides additional, detailed evaluations of the proposed action and its alternatives including the no action alternative. This EA has been prepared to support the NEPA analysis for this proposed action. The FAA is the lead Federal agency for this NEPA process.

Under this proposed action, the FAA would issue appropriate experimental permits and/or licenses to Blue Origin, which would allow Blue Origin to launch and land vertical launch/vertical landing reusable suborbital rockets. In addition to the environmental review and determination, the FAA must complete a policy review and approval, safety review and approval, payload review and determination, and a financial responsibility determination. However, this EA only analyzes potential environmental impacts from the proposed project. Safety and policy implications of the proposed project that are outside the scope of the environmental impacts analysis are analyzed in documents other than this EA. The FAA licenses and permits launches based on the evaluation of the safety of the proposed activities and their associated environmental impacts.

Upon issuance of the required FAA experimental permit(s) and/or license(s), Blue Origin would be able to conduct commercial launch operations. Early developmental and test flights may be conducted under experimental permits, which would also require an environmental and safety review by the FAA. Blue Origin may also seek to obtain a launch site operator license from the FAA. Blue Origin may also seek RLV mission-specific licenses and RLV operator licenses, as appropriate. The issuance of these types of experimental permits and licenses requires an environmental and safety review. The FAA may use the analysis in this document as the basis for an environmental determination of the impacts of these launches whether they are conducted under experimental permits, launch site operator licenses, RLV mission-specific licenses, RLV operator licenses, or any combination of these.

Blue Origin's operations would be conducted from a site located on privately-owned land located between Van Horn, Texas and the Guadalupe Mountains National Park. The proposed operation would require the construction of a number of support facilities on the site, including upgraded roads, operations and storage buildings, a launch and a landing pad, and others.

1.3 Purpose and Need for Action

Purpose

The proposed Blue Origin launch facility would provide Blue Origin with an alternative to launching the New Shepard vehicle from a Federal or other FAA-licensed launch facility. The proposed facility would provide a location from which to transport space flight participants to the edge of space and return them to the same launch area after a short flight. These activities are consistent with the purposes of the CSLA. Given the infrastructure and development costs associated with constructing launch facilities, the Federal government has been the owner/operator of, has leased/sold unused or excess infrastructure, and has provided expertise to commercial launch operators for the majority of commercial launches. However, with increasing demand for access to space, commercial launch site operators have begun to develop proposals to offer launch sites, not collocated with Federal facilities or operated by the Department of Defense and National Aeronautics and Space Administration (NASA), to meet the demand for lower cost access to space.

Need

The proposed Blue Origin launch site would provide the infrastructure necessary to support testing and operation of Blue Origin's New Shepard RLV. Accordingly, the proposed action would permit Blue Origin to pursue its objective of developing safe, inexpensive and reliable human access to space.

1.4 Public Involvement

The CEQ implementing regulations for NEPA describe the public involvement requirements for agencies. (40 CFR 1506.6) Public participation in the NEPA process not only provides for and encourages open communication between the FAA and the public, but also promotes better decision making. Blue Origin hosted two public information meetings on June 14, 2005 in Van Horn, Texas and June 15, 2005 in Dell City, Texas. Each of these public information meetings was preceded by announcements that ran in local newspapers (i.e., the Van Horn Advocate, the Hudspeth County Herald & Dell Valley Review, and the Midland Reporter-Telegram). Each announcement was published in English and Spanish. During the meetings, Spanish translators were present. More than one hundred members of the public attended the meetings.

Representatives from the FAA and Blue Origin provided information briefings and answered the public's direct questions. Additional opportunities for the public to comment were provided by the distribution of question and comment cards and the e-mail address for the FAA representative. In addition, copies of the briefing given by the FAA were made available to the public. Further details regarding these meetings are provided in Appendix A of this EA.

Fourteen tribes and Native American organizations with potential regional ties to the Trans-Pecos area were notified by the FAA of Blue Origin's proposed activities in Culberson County, Texas. These tribes were notified in writing of the proposed activities and the FAA contacted each tribe by phone to further discuss their potential interests in the affected area.

1.5 Prior Environmental Analyses

The Department of Transportation (DOT) and NASA have previously analyzed the environmental effects of launches from a variety of locations. The documentation identified below has been incorporated by reference in this EA. The information and analyses contained in these documents were used in the development of this EA and have been summarized as appropriate. These EAs and EISs have previously been prepared to support launch systems that may be similar to the proposed Blue Origin operations. Other planning and site-specific documents that were used as references in the preparation of this EA are cited in Section 3.13 and Section 4.16 of this document, as appropriate.

- *X-33 Advanced Technology Demonstrator Vehicle Program, Final Environmental Impact Statement,* NASA, September 1997.

- *Environmental Assessment of the Kodiak Launch Complex,* June 1996.

- *Final Environmental Assessment for the Launch Re-entry and Recovery Operations at the Kistler Launch Facility, Nevada Test Site,* April 2002.

- *Final Environmental Assessment for the East Kern Airport District Launch Site Operator License for the Mojave Airport,* February 2004.

In accordance with the CEQ regulations for NEPA documents, this EA tiers from the following programmatic documents.

- *Final Programmatic Environmental Impact Statement for Licensing Launches* (PEIS LL), Department of Transportation, Office of the Associate Administrator for Commercial Space Transportation, May 24, 2001.

- *Final Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicles,* Department of Transportation, Federal Aviation Administration, Office of Commercial Space Transportation, December 2005.

Where applicable, relevant sections of these documents are summarized and referenced to eliminate repetitive discussion and to focus analysis in key decision areas.

2 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 The Proposed Action

The proposed action is for the FAA to issue one or more experimental permits and appropriate licenses to Blue Origin to authorize Blue Origin to conduct the activities described in this EA.

Blue Origin proposes to launch space flight participant-carrying RLVs on suborbital, ballistic trajectories to altitudes in excess of 99,060 meters (325,000 feet) above mean sea level. The proposed location for the Blue Origin launch site is privately-owned land in Culberson County, Texas. Operations at the launch site would include pre-flight processing, launch, flight, landing, and recovery activities.

To conduct these operations, Blue Origin proposes to construct a private launch site, including a vehicle processing facility, launch complex, vehicle landing and recovery area, a space flight participant training facility, and other minor support facilities. Descriptions of the specific facilities to be constructed at the proposed Blue Origin launch site are provided in Section 2.1.1.4 of this EA. Exhibit 2-1 shows the relative location of these facilities on the Blue Origin site.

Blue Origin proposes to develop, launch, and land a suborbital RLV referred to as the New Shepard Reusable Launch System. Blue Origin proposes to develop the New Shepard RLV incrementally, beginning with low-altitude vehicle testing, progressing to higher-altitude testing, and culminating with commercial flights. Early testing would use prototype vehicles that are smaller and/or less capable than the proposed end design. There would be fewer impacts associated with pre-commercial development and testing than those associated with the commercial activities described below.

According to the FAA regulations, an applicant is responsible for providing the FAA with information sufficient to conduct environmental and policy reviews and determinations for the proposed action. This EA is intended to fulfill the NEPA requirements for issuing experimental permits and appropriate licenses to Blue Origin. The successful completion of the environmental review process does not guarantee that the FAA would issue these permits and/or licenses to Blue Origin. The project also must meet all FAA safety, risk, and financial responsibility requirements. Additional environmental analysis would be conducted for any activity proposed by Blue Origin that is not addressed in this EA or in previous environmental analyses.

Description of the Proposed Commercial Launch and Reentry Activities

Blue Origin proposes to develop and operate commercial launch and landing/recovery facilities for Blue Origin-developed RLVs. Each New Shepard RLV would be capable of transporting three or more space flight participants to the edge of space using a suborbital trajectory.

Blue Origin proposes to construct a launch site, located on private property in Culberson County, Texas. This EA addresses the overall impacts to the environment of the proposed operations anticipated for the five-year period under consideration in this EA. A more detailed outline of

the proposed schedule for Blue Origin's operations is included in Section 2.1.1.3 of this EA. Blue Origin's proposed activities would include

- Construction of an RLV launch site and a landing/recovery area,
- Launch and landing/recovery operations,
- Space flight participant training activities, and
- Sustained commercial launch, flight, landing and recovery of space flight participants.

2.1.1 Blue Origin New Shepard Reusable Launch System

The New Shepard RLV system would be comprised of a propulsion module and a crew capsule (CC) capable of carrying three or more space flight participants to space. The CC is stacked on top of the propulsion module. The stacked vehicle would have a roughly conical shape with a base diameter of approximately 7 meters (22 feet) and a height of approximately 15 meters (50 feet).

The propulsion module would be fully reusable, would carry its own avionics, and would operate autonomously under the control of on-board computers. The propulsion module would use 90 percent concentration hydrogen peroxide, called high test peroxide (HTP) and rocket propellant (RP) grade kerosene as the propellants. The propulsion module would have a combined propellant load of HTP and RP of approximately 54,431 kilograms-mass (120,000 pounds-mass). The propulsion module would have a thrust capability of approximately 1,023,091 Newtons (230,000 pounds-force) at liftoff. The propulsion module may have a low-thrust Reaction Control System (RCS) using either monopropellant HTP or pressurized gas, such as helium or nitrogen, also known as a cold-gas system.

The CC would also be fully reusable, would carry its own avionics, and would operate autonomously under the control of on-board computers. The cabin would be pressurized and have systems for maintaining temperature, humidity, and oxygen and carbon dioxide partial pressures. The CC would carry small solid rocket motors for use in an emergency abort situation. The solid rocket motors proposed for use have a DOT/Department of Defense explosive hazard classification of Class 1.3. Class 1.3 explosive hazards are described as materials that burn vigorously, but have limited explosive potential. These motors would be composed of an aluminum hydroxyl-terminated polybutadiene composite propellant with a total mass of 500 kilograms-mass (1,100 pounds-mass) or less. These motors produce an average combined thrust of approximately 533,787 Newtons (120,000 pounds-force) approximately two seconds. The CC may have a low-thrust RCS using either monopropellant HTP or cold gas.

The New Shepard RLV would have three possible flight scenarios - two nominal scenarios and one emergency scenario. In the first nominal scenario, the New Shepard RLV would perform a vertical takeoff from the test pad; fly a suborbital trajectory nearly straight up; shut down engines after approximately two minutes and coast to an altitude in excess of 99,060 meters (325,000 feet) before descending; and restart its engines several thousand feet above the ground for a precision vertical powered landing on the landing pad. The time from engine restart to landing would be less than 15 seconds, and the propulsion module would use less than 444,822 Newtons (100,000 pounds-force) of thrust for landing. During this entire mission, the propulsion module

and CC would remain attached. Total mission time from liftoff to landing would be less than 10 minutes.

In the second nominal scenario, the New Shepard RLV would fly a similar trajectory as the first scenario during ascent, except that shortly after main engine cutoff, the propulsion module and CC would separate. The separation would be accomplished using a combination of springs and possibly a low-impulse RCS burn to assure collision avoidance. The small solid rocket motors used for emergency separation would not be ignited and would remain on the propulsion module as the CC separates. Both the propulsion module and CC would reach an altitude in excess of 99,060 meters (325,000 feet) before beginning their descent. The propulsion module would perform a precision vertical powered landing on the landing pad as in the previous scenario, while the CC would land within the launch site perimeter fence using devices to induce atmospheric drag, such as parachutes.

The emergency scenario involves the emergency separation of the CC from the propulsion module. If an anomaly is detected autonomously or if a command is sent by a ground operator prior to liftoff or during ascent flight, the propulsion module and CC would separate to protect space flight participant safety. Emergency separation would be accomplished by use of the small solid rocket motors on the CC. In this instance, the CC would be jettisoned and the propulsion module would attempt to land back at the landing pad if it is in-flight. After solid rocket motor burnout, an abort module containing the spent and any unfired solid rocket motors would be jettisoned from the CC and would follow a ballistic free-fall trajectory to the ground. The CC would also follow a ballistic free-fall trajectory to a predefined lower altitude, where a parachute or other drag system would deploy and return the crew capsule to the launch site recovery area safely. In some rare cases, the vehicles may land outside the fence line of the proposed launch site. However, in nearly all cases the vehicles would stay within the boundaries of private land controlled by Blue Origin and present no danger to the public. The vehicle's thrust would be terminated if the RLV's instantaneous impact point (IIP) moves more than 4 nautical miles from the test pad. In the unlikely event the vehicles impact outside the privately controlled Blue Origin land, the surrounding properties consist of extremely sparsely populated rangeland.

2.1.2 New Shepard Prototype Test Vehicles

Before flying the human-carrying operational New Shepard RLV for commercial operation, Blue Origin proposes to develop and flight test a series of unmanned prototypes at the West Texas launch site. The first of these vehicles would be a low-altitude demonstrator of the propulsion module using approximately 2,042 kilograms (4,500 pounds) of HTP as a monopropellant, capable of reaching an altitude of no more than 610 meters (2,000 feet) with a mission time of less than one minute. This first demonstrator vehicle, and all other New Shepard prototypes, would have less performance capability and therefore, fewer environmental impacts than the operational New Shepard RLV. The prototypes would use the same or a subset of the same types of propellants as the operational New Shepard RLV in smaller quantities; use the same ground facilities, infrastructure, and equipment; and generate less noise, less air pollution, and fewer impacts in all categories under study. Each new prototype would fly to higher altitudes and/or demonstrate additional subsystems than the previous prototype. Eventually, Blue Origin proposes to perform multiple flight tests of the actual operational New Shepard RLV system carrying Blue Origin personnel before commencing commercial operation.

Rather than providing detailed information on potential configurations of these prototype vehicles, this study uses the final operational New Shepard RLV configuration as the basis for assessing environmental impacts. This analysis bounds the potential impacts of the earlier vehicles and results in a conservative analysis of the potential impacts associated with the testing and operation of RLVs from the proposed site.

2.1.3 Development Schedule

Blue Origin proposes to conduct the following activities at the West Texas launch site during the next five years.

- 2006: The majority of facility construction at the site would occur during this period. In the third and fourth quarters of 2006, Blue Origin would ship the first prototype low-altitude test vehicle to the site and conduct the first flight tests. Ten or fewer flight tests could be conducted in 2006, each to an altitude of approximately 610 meters (2,000 feet) for less than one minute.

- 2007-2009: Continued flight testing of prototype vehicles with incrementally increasing capability. During these years, Blue Origin proposes to gradually expand the operational envelope of its vehicles, conducting 25 or fewer launches per year. A wide range of tests are anticipated, ranging in altitude from under 610 meters (2,000) feet to greater than 99,060 meters (325,000 feet), lasting one minute or less to over 10 minutes. Development tests of the crew capsule abort system would be conducted during this time frame. During this time, some construction to upgrade the facility would also occur, adding additional infrastructure to support the increasing capabilities of the system.

- 2010: Commercial operations may commence with the operational New Shepard vehicle in this timeframe. The flight rate would depend on market demand, but Blue Origin anticipates rates up to approximately 52 launches per year of the New Shepard RLV. Although Blue Origin proposes to continue operations at roughly the same rate beyond the 2010 timeframe, these operations are outside the scope of this analysis and are analyzed in this EA only with respect to potential cumulative impacts.

2.1.4 Ground Facilities, Operational Processes and Flow Description

2.1.4.1 Ground Facilities

Blue Origin intends to design and construct a launch site from which to complete development flight tests associated with RLV designs, as well as to conduct future roundtrip space flight participant flights to suborbital space. In general, the Blue Origin New Shepard launch system would require the construction of three primary functional areas within the launch site perimeter fence (see Exhibit 2-1).

- Home Base area for assembly and pre-flight testing of the New Shepard RLV,
- Launch Complex consisting of the test pad and propellant storage area, and
- Landing Pad.

Other minor support facilities proposed to be developed include a guard security post of less than 233 square meters (2,500 square feet) made of metal, wood or concrete, smooth-wire perimeter fence approximately 1.2 meters (4 feet) high and 34,412 meters (112,900 feet) long, under 20.9 kilometers (13 miles) of access roads, approximately 744 square meters (8,000 square feet) of parking areas, and a metal, wood or concrete building of approximately 75 square meters (800 square feet) as infrastructure for water distribution/wastewater management.

At least two wells would be drilled for freshwater, which would be stored in ground-level metal tanks. The first tank would be near the Home Base. It would be 5.5 meters (18 feet) high and 13.7 meters (45 feet) in diameter, and hold approximately 757,082 liters (200,000 gallons), fed by a pump with a capacity of 6,814 liters (1,800 gallons) per minute. The second tank would be located adjacent to the Launch Complex. It would be 5.5 meters (18 feet) high and 9.6 meters (32 feet) in diameter, holding approximately 378,541 liters (100,000 gallons), fed by three pumps each with a capacity of 2,839 liters (750 gallons) per minute.

During the construction phase, a cement batch plant could be developed. A construction staging and material lay down area would be located on a site to the west of the vehicle processing facility.

The following paragraphs describe each of the major ground facilities to be located on the launch site during flight operations.

Home Base

The Home Base area of the launch site would include the vehicle processing facility (VPF), the administrative support center, space flight participant training center, electric power plant, a vehicle garage, and an explosives storage area. Although the current concept has each of these functions split into a separate facility, the site as constructed may combine multiple functions into single buildings.

Vehicle Processing Facility

The VPF is proposed to be initially constructed of metal and concrete, covering up to approximately 1,486 square meters (16,000 square feet), and approximately 26 meters (84 feet) in height. The VPF would have a high bay, labs and shops to assemble, test, and repair the New Shepard RLV system. The New Shepard RLV components manufactured elsewhere would be transported to the VPF by commercial trucks. The RLV would be assembled and tested in the VPF without propellants prior to transporting to the launch complex. The VPF high bay would be equipped with overhead cranes, compressed air, gaseous nitrogen and helium services as well as standard aerospace electrical services.

Ground support equipment would transport the New Shepard RLV from the VPF to the test pad, and back to the VPF from the landing pad. The transporter would be a low-speed hoist with a small (100 – 400 horsepower) engine.

Administrative Support Center

The administrative support center is proposed to be constructed of metal and concrete, and cover approximately 836 square meters (9,000 square feet). The administrative support center would house the control room and communications infrastructure for supporting flight operations, employee offices, conference rooms, lavatories, personnel break rooms, and other service-associated work areas. Blue Origin has no plans to provide accommodations for public viewing of launches.

Astronaut Training Facility

The Astronaut Training Facility would consist of administrative offices, flight instruction classrooms, simulators and space flight participant medical screening areas, and test and evaluation areas for space flight participants. The facility is expected to be made of metal, wood or concrete and be less than 1,394 square meters (15,000 square feet).

Power Generation Facility

Blue Origin plans to seek extension of the public electric grid to the launch site and to operate a back-up power generation facility. In providing back-up power, Blue Origin would use commercially-available U.S. Environmental Protection Agency (EPA)-approved mobile generators to supply both three-phase and single-phase alternating current (AC) power throughout the launch site. Uninterruptible power supply backup power systems would be installed at all critical operations and control point areas.

Extension of the public electric grid to the launch site would involve extending a three-phase power line approximately 88 kilometers (55 miles) from the existing substation in Dell City, Texas to the proposed launch site. This is expected to include recommissioning and upgrading the existing substation, building a new three-phase overhead power line and upgrading existing single-phase overhead power lines to three-phase, as well as installing appropriate step transformers at the proposed launch site if required for power distribution.

The Power Generation Facility is proposed to be a maximum of 465 square meters (5,000 square feet).

Wastewater Treatment Plant

A central wastewater treatment plant of 18,927 liters (5,000 gallons) per day capacity would be constructed west of Home Base Road and the power generation facility. The equipment building would cover an area less than 93 square meters (1,000 square feet). Effluents would be treated in accordance with the wastewater permit issued by the state of Texas and discharged to a percolation/evapotranspiration pond occupying approximately 0.4 hectares (one acre). Some remote facilities, such as the Guard House, could use a septic system.

Vehicle Garage

The vehicle garage would be approximately 929 square meters (10,000 square feet) in area. The vehicle garage would be used to store and maintain launch site support vehicles and equipment.

Explosives Storage Area

The explosives storage area (ESA) would be located to the west of the VPF and the other operations and administrative support buildings. Explosive storage buildings or approved mobile storage containers would provide safe and secure areas for ordnance normally incorporated into launch vehicle systems. The ESA would hold up to 11,793 kilograms (26,000 pounds) of Class 1.3 propellant, occupying 1,101 square meters (11,856 square feet) situated at least 62.7 meters (206 feet) from inhabited buildings and transportation routes, and be constructed of concrete, metal and earthen materials. The explosives would be stored in DOT approved shipping containers. The ESA would conform to all applicable regulations for storage of such material.

Launch Complex

The launch complex area of the launch site would include the test pad and the propellant storage area.

Test Pad

The test launch pad (which may also serve as a landing pad during testing) would be located approximately 2.9 kilometers (1.8 miles) north of the VPF. The test pad design would provide equipment necessary for tanking and de-tanking of propellants and pressurants, static testing, and launching. The test pad would have electrical, pneumatic, fire detection/suppression, lightning protection, and data infrastructure services. The proposed test pad would be up to 3,000 square meters (32,292 square feet) in area. The immediate area surrounding the test pad may be cleared of vegetation to reduce the possibility of starting brush fires during the launch and landing activities. The area to be cleared would be approximately 0.9 hectares (2.2 acres).

Propellant Storage Areas

The propellant storage areas would be located outside of the calculated minimum safety explosive quantity distance established for the amount of propellants stored at the launch complex. The HTP oxidizer would be stored in an enclosure separated from the RP fuel enclosed storage area. HTP would be stored in three peroxide-certified aboveground storage tanks with a capacity of 37,855 liters (10,000 gallons) each, for a total capacity of 113,565 liters (30,000 gallons) or 157,397 kilograms-mass (347,000 pounds-mass), and a fourth 60,566-liter (16,000-gallon) tank for dilution of hydrogen peroxide. The HTP storage area would include a perimeter wall to contain fuel in the event of a spill or other leak, with a further sump trench downhill of the storage area. The perimeter wall around the HTP tanks would be able to hold approximately 56,782 liters (15,000 gallons), and the sump an additional 170,344 liters (45,000 gallons). The HTP storage area would occupy approximately 706 square meters (7,600 square feet). Tank configuration for RP fuel is being proposed for storage in an above-ground storage tank with a total capacity of 37,854 liters (10,000 gallons) or 30,844 kilograms-mass (68,000

pounds-mass). The RP tank would utilize integral secondary containment with double wall construction, and would be equipped with over-fill protection devices and hydrocarbon leak detectors monitoring the space between the tanks walls. Trenches approximately 0.6 meters (2 feet) deep would be dug, in which pipes would be laid for transporting propellant to the test pad. These trenches would be concrete lined, and have removable covers to allow vehicle traffic to drive over them.

The propellant storage areas would also accommodate the storage of high pressure nitrogen and helium gases used to support the RLV propulsion system and preflight test operations. The propellant storage areas would have fire detection/suppression, alarm, announcing and area warning systems, lightning protection, and data infrastructure.

Landing Pad

A separate landing pad would be located 6.1 kilometers (3.8 miles) north of the VPF. The landing pad would be nominally used to recover the New Shepard RLV. The landing pad would be constructed of concrete and would be configured as a flat pad up to 3,000 square meters (32,292 square feet). The immediate area surrounding the landing pad may be cleared of vegetation to reduce the possibility of starting brush fires during the landing activities. The area to be cleared would be approximately 0.9 hectares (2.2 acres).

The landing pad area would have fire detection/suppression, alarm, announcing and area warning systems connected to the Administrative Support Center. The landing pad would have power, lightning protection, and data infrastructure.

2.1.4.2 Process Operations and Flow Descriptions

Blue Origin would ship the New Shepard propulsion module and CC RLVs to the West Texas Launch Site separately. The RLVs would originate at Blue Origin's manufacturing and assembly facilities in the state of Washington and would travel via ground to West Texas. Blue Origin plans no more than ten total RLV shipments during the five-year period from 2006-2010. The RLVs may be fully assembled or partially disassembled during transportation. Some of these loads may be classified as oversized, but would be within the scope of loads routinely transported long distances for aerospace applications, such as aircraft fuselages and launch vehicle stages.

Upon arrival at the launch site, Blue Origin would unpack the RLV, perform any reassembly required, and conduct an integrated test and checkout of subsystems. Once the RLV has successfully completed a series of flight simulation tests and the Flight Director has provided authorization, the flight-ready vehicle would then be transported to the launch complex, positioned on the test pad, and fueled by the launch site team.

After final system checks are completed, the Flight Director would verify with the FAA Air Traffic Control (ATC) the time when the flight window is open and closed for the scheduled operation. Communications between the Flight Director and the ATC flight controller would be maintained from lift-off to recovery of the RLV at the landing pad. By maintaining constant voice communication with ATC during the flight operation, as well as voice communication with

members of the ground crew serving as spotters for unauthorized aircraft, the Flight Director would ensure the airspace is clear prior to launch. Specific procedures for airspace coordination will be prepared as part of the safety analysis for Blue Origin's license and/or permit application.

The nominal flight time for the New Shepard RLV is anticipated to be less than 10 minutes from lift-off to touchdown at the landing pad.

2.1.4.3 Developmental Test Operations

Blue Origin proposes to start limited RLV development testing in the last quarter of 2006. Initial testing would focus on the evaluation of rocket engine designs and performance with prototype vehicles as described in Section 2.1.1.2. The flight test program would consist of a number of test flights under varying flight conditions. These test flights are further described in Section 2.1.1.3 above. The flight test program would demonstrate that the New Shepard RLV could operate in the suborbital environment for which it was designed, that the vehicle functions as designed, and that the operational support it receives between flights is sufficient to maintain system integrity and reliability.

2.1.4.4 Launch, Flight, Landing and Recovery Operations

The New Shepard RLV launch, flight, and landing activities would require less than a 10 minute period to complete. Recovery operations would include safing the vehicle propulsion system following the landing event, extracting the crew, off-loading residual HTP oxidizer and RP fuel, and transporting the RLV back to the VPF for processing.

Prior to each launch, Blue Origin may launch weather balloons filled with hydrogen or helium for assessing wind speed and other weather conditions. Nominally Blue Origin would launch one balloon per RLV launch, but in shifting meteorological conditions may launch up to 10 balloons per RLV launch. Each balloon would carry a radiosonde, an expendable instrument package suspended from the balloon. Upon launch each balloon would measure approximately 2 meters (6 feet) wide and expand in diameter as it rises in the atmosphere. As the radiosonde rises (at about 300 meters [1,000 feet] per minute), sensors on it measure atmospheric profiles such as pressure, temperature, and relative humidity. These sensors are linked to a battery powered radio transmitter that sends the sensor measurements to a ground receiver. Wind speed is measured by tracking the balloon with radar or optical trackers.

The New Shepard RLV would rise to approximately 38,100 meters (125,000 feet) under thrust from its main engines. The duration of this propulsive flight phase would be approximately 110 seconds. The RLV would then coast up to an apogee greater than 99,060 meters (325,000 feet). The RLV would then return to the landing pad under gravity free-fall conditions until the main engines are restarted to enable a powered landing. The RLV ground track would remain within the boundary of private land controlled by Blue Origin during the entire flight. As noted earlier in section 2.1.1.1, the propulsion module and CC may either return attached or land separately, depending on the mission scenario.

2.1.4.5 Communications and Tracking

Blue Origin plans to downlink navigation and critical system health data from the New Shepard RLV in real time, and display it on consoles for ground operators as the primary means of tracking the vehicle's position. In the case of a separating CC, Blue Origin would downlink navigation data from both the propulsion module and CC simultaneously. The consoles would display the current position as well as the predicted IIP[2]. Blue Origin also plans to use long-range optical cameras during flight. Blue Origin is evaluating whether to also use radar to track the vehicle.

During commercial operations, Blue Origin would also maintain constant voice communications with space flight participants in the CC.

Proposed radio communications devices at the proposed launch site include:

- S-band uplink and downlink radios to and from launch vehicles of 1 to 10 watts;
- A Mode S transponder or other transponder for transmitting vehicle identification;
- Commercial off-the-shelf private use ultra-high frequency radios for ground-to-ground communications (often referred to as base and 'walkie-talkie');
- Commercial off-the-shelf radios receiving data from weather monitoring equipment;
- Commercial off-the-shelf radio frequency remote control of various equipment, such as lifting cranes and fire protection equipment;
- Commercial off-the-shelf radios for communications between personal computers and other mobile devices (often referred to as 'WiFi') and for video transmissions;
- Radiosondes attached to weather balloons.

Blue Origin anticipates that the Federal Communications Commission (FCC) has already granted licenses or exemptions for operation of some of the commercial, off-the-shelf equipment noted above, and Blue Origin plans to seek permits and licenses from the FCC for all other radios.

[2] The point at which an object would impact if thrusting were stopped at a given time.

2.1.4.6 Night Operations

Blue Origin would design the New Shepard vehicle and ground facilities with the capability to perform night launches, if authorized by the FAA permit or license. Even if the launch occurs during the day, it is likely that pre-launch activity would occur on the site in the pre-dawn hours, and vehicle maintenance would occur during the evening.

Although the launch schedule has not yet been established, night launches would likely occur only infrequently and would comprise only a small fraction of the total number of New Shepard launches. Blue Origin does not anticipate conducting a night launch more frequently than once per month.

2.1.4.7 Decommissioning Activities

Decommissioning would occur if launch activities were approved and conducted at the site and Blue Origin eventually decided to stop conducting launches at the site. In this situation, the site would remain private property, and appropriate actions would be taken to ensure the proper disposal of hazardous materials and hazardous waste used or generated at the facility.

2.1.5 Proposed Activities

This EA addresses the overall impacts to the environment of the proposed operations anticipated for the five-year period under consideration. Therefore, the activities analyzed in the proposed action are those associated with the construction of the site and the launching and landing of the New Shepard and New Shepard prototype test vehicles at the proposed site, as follows:

- Clearing and grading the land where construction activities are proposed to occur;
- Constructing the following features as described in Section 2.1.1.4
  - Cement batch plant
  - Guard security post
  - Perimeter fence
  - Access road
  - Parking area
  - Water distribution and wastewater management
  - Vehicle processing facility
  - Administrative support center
  - Space flight participant training facility
  - Power generation facility
  - Sewage treatment plant
  - Vehicle garage
  - Explosive storage area
  - Test pad
  - Propellant storage area
  - Landing pad

- Transporting the vehicle, vehicle components, and propellants to the proposed site via road;
- Assembling the various vehicle components;
- Conducting ground-based tests and checkout activities;
- Moving the launch vehicle to the test pad;
- Loading the space flight participants, and/or other payload;
- Fueling the launch vehicle;
- Igniting the rocket motors;
- Collecting any debris from the test pad; and
- Landing, recovering and transporting the propulsion module and CC from the landing pad.

The New Shepard vehicle and the New Shepard prototype test vehicles would launch and land vertically. The flight profile would be such that the vehicle would remain within the confines of the private property surrounding the launch facility. Prior to test and launch activities from the proposed facility, Blue Origin would be responsible for complying with all applicable FAA licensing or permitting requirements, including any required calculations regarding expected casualties. The FAA would consider safety concerns as part of the mission and safety analysis prior to making a decision about issuing a license or permit to Blue Origin.

2.1.6 Permits, Licenses and Approvals

In addition to necessary licenses or permits from the FAA, to support the activities described above, Blue Origin would obtain a variety of Federal, state and local permits, licenses and approvals. These include, among others:

- FCC authorization related to radio and possibly radar at the proposed launch site.
- State registrations relating to wastewater and/or solid waste streams; local permits for wells and for driveway connections to state highways; and if Blue Origin were to operate a fixed, permanent power generation facility, permits for associated emissions and above-ground fuel tanks.
- State permits related to open burning of any planned fragments of solid rocket motors.

2.2 No Action Alternative

Under the no action alternative, the FAA would not issue a permit or license for Blue Origin to conduct launch operations in Culberson County, Texas. Under the no action alternative, Blue Origin would not conduct RLV testing or launch operations and, the goals set forth by the CSLA would not be advanced. As part of the no action alternative, the proposed site in Culberson County would remain private property.

Under the no action alternative, Blue Origin would be forced to identify other private property options or to reconsider association with state-sponsored spaceport facilities. For Blue Origin,

these decisions could result in higher RLV development and operational costs, decreased operational capabilities, and delays to Blue Origin's proposed development schedules.

2.3 Launch Site Alternatives

2.3.1 Alternative Locations Considered and Dismissed

In 2004, Blue Origin began evaluating possible locations for its proposed commercial launch site. Candidate sites included two privately-owned parcels in Culberson County, Texas, the proposed state-sponsored Southwest Regional Spaceport in Upham, New Mexico, and the Pecos County Aerospace Development Corporation-sponsored Pecos County West Texas Spaceport at Fort Stockton, Texas.

Blue Origin subsequently elected to conduct a more detailed analysis of the Culberson County sites. Blue Origin determined that launching from a remote, privately-owned, launch site would offer significant cost, schedule, and operational benefits for its proposed activities. These include:

- The size of the Culberson County sites, their location within larger, privately-owned ranches, and Blue Origin's ability to exclude third parties from the sites would provide a safety buffer surrounding Blue Origin's area of activity.

- The facilities could be designed specifically to meet Blue Origin's technical and programmatic requirements, as opposed to satisfying the general needs of a variety of launch operators.

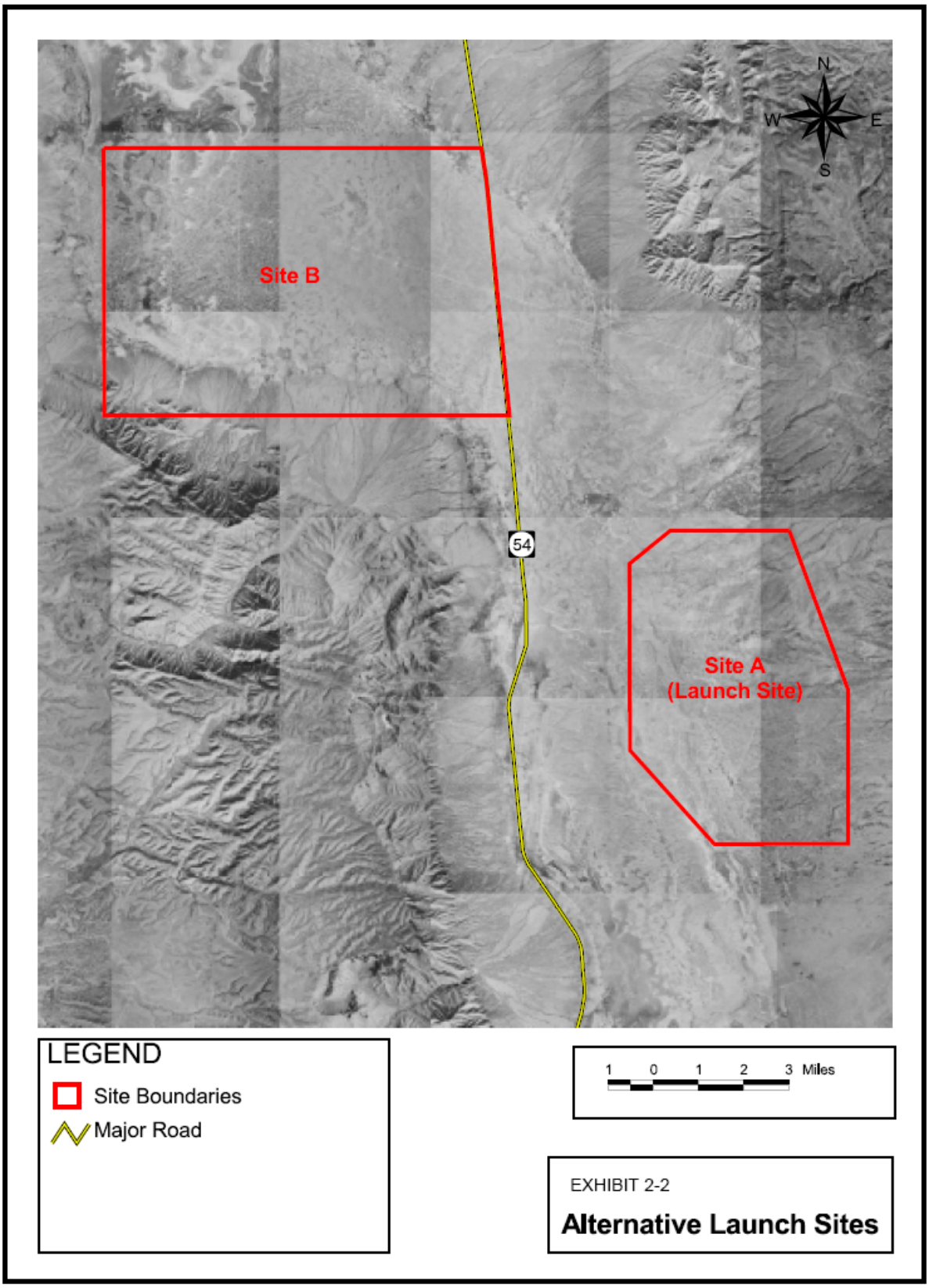
- A private, exclusive-use site would eliminate the need to coordinate Blue Origin's activities with other launch operators or the agencies that would operate the proposed spaceports.

For these reasons, Blue Origin determined that the Culberson County alternatives would best permit the company to conduct innovative, flexible RLV operations consistent with its programmatic, schedule and cost requirements.

2.3.2 Alternative Sites Considered in Culberson County

Two alternative sites were considered in Culberson County (Site A and Site B) as candidate basing sites for the proposed facilities (Exhibit 2-2). Both sites are on privately-owned land parcels. Both sites are located on large tracts of ranchland in the general vicinity of the city of Van Horn. Both sites would involve substantially similar impact on the environment. Site A is located to the East of Highway 54 and has the following features: it is open flat desert in a valley between the slopes of Sierra Diablo and Delaware mountain ranges at an elevation of about 1,132 meters (3,714 feet). Site B is located to the West of Highway 54 to the North and West of Site A and has the following features: it is open flat desert North and East of the slopes of the Sierra Diablo mountain range at an elevation of about 1,100 meters (3,610 feet). Site A has been

Exhibit 2-2. Alternative Launch Sites



identified as the preferred location for the proposed Blue Origin launch, landing, and recovery activities and as such is analyzed in detail in this EA.

Site B was considered but dismissed for several reasons:

- Site B is bisected by a natural gas pipeline and utility easement, which could impact the safety of landing operations.

- Site B is closer to mountains, which made Site B less desirable for vehicle-recovery operations.

2.3.3 Alternative Facility Configurations and Locations for Proposed Blue Origin Facilities in Culberson County, Texas

Within Site A, alternative configurations for buildings and the test pad were considered. A triangular configuration was considered which would have the Home Base area, the Launch Complex and the Landing Pad as three points of a triangle roughly equidistant from each other. A straight line configuration also was considered with the Home Base at one end of the line, the Launch Complex in the middle, and the Landing Pad at the other end. Alternative locations for placing the straight line configuration also were considered.

The triangular configuration was determined not to meet the purpose of and need for the proposed action, and therefore is not considered further in this EA. The triangular configuration would not allow for the development of a launch site for Blue Origin to pursue its objective of developing "safe, inexpensive and reliable human access to space" as stated in the purpose and need. Specifically, the triangular configuration was dismissed for the following reasons.

- The triangular configuration involved launch-control personnel looking into the sun at certain times of day when trying to view launch operations, which could create unsafe conditions that make the alternative technically infeasible.

- The triangular configuration would require transporting spacecraft up an elevated grade, making pre-launch operations difficult to execute, and therefore it was determined to be technically infeasible.

The straight-line configuration has been identified as the preferred configuration for the proposed Blue Origin launch, landing, and recovery activities and as such is analyzed in detail in this EA. Under the preferred configuration the Home Base would be located in the southern portion of the site, the Launch Complex would be located in the middle and the Landing Pad would be located further to the north. The preferred location would have the straight line configuration approximately centered between the east and west boundaries of Site A. The preferred site would be located more towards the southern portion of Site A and would make use of existing roads in this area. Other locations for the straight-line alternative were considered and dismissed.

Alternative locations that would orient the straight line configuration further to the West were dismissed for the following reasons.

- This location would put the launch facilities closer to the publicly accessible Highway 54 and could result in additional hazards to public safety.

- There is a ridge that runs much of the length of Site A, to the west of the preferred location that could seriously impact the safe transport of the launch vehicle by requiring the vehicle and transporter to traverse an area with a substantial grade.

- If the launch activities were located on the ridge or to the west of the ridge (i.e., closer to Highway 54), they would be more visible to the public traveling along Highway 54 and could become a distraction to traveling motorists or cause members of the public to attempt to stop and observe the launch activities.

- These potential safety concerns associated with this location would not allow for the development of a launch site for Blue Origin to pursue its objective of developing "safe, inexpensive and reliable human access to space" as stated in the purpose and need.

Alternative locations that would orient the straight line configuration further to the East were dismissed for the following reasons.

- The location of the Delaware Mountains to the east of Site A pose a vertical hazard to launch and landing operations.

- This potential safety concern associated with this location would not allow for the development of a launch site for Blue Origin to pursue its objective of developing "safe, inexpensive and reliable human access to space" as stated in the purpose and need.

Alternative locations that would orient the straight line configuration further to the North were dismissed for the following reasons.

- The existing roads on the property are focused in the southern portion of Site A. Moving the straight line configuration to the north would result in the need to cause additional ground disturbance due to the construction of additional access roads.

- Additional ground disturbance would increase the likelihood that cultural resources within Site A would be disturbed and could increase the amount of fugitive dust created by the construction activities.

- These potential issues would increase the development costs of the needed infrastructure and would not allow for the development of a launch site for Blue Origin to pursue its objective of developing "safe, inexpensive and reliable human access to space" as stated in the purpose and need.

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3 AFFECTED ENVIRONMENT

This section describes the existing environmental and socioeconomic characteristics of the area that could be affected by the proposed action and alternatives described in Section 2 of this EA. The information provided serves as a baseline from which to identify and evaluate environmental changes resulting from the proposed action and alternatives. To provide this baseline the affected environment is briefly described and those resource areas with a potential for concern are described in greater detail.

The affected environment is discussed in terms of the following resource areas: air resources, ecological resources, cultural/Native American resources, hazardous materials/waste management, land use, visual and aesthetic resources, noise, geology and soils, socioeconomics, traffic and transportation, water resources, health and safety, airspace, and environmental justice, Department of Transportation Section 4(f) lands and farmland are addressed as part of land use; floodplains are addressed as part of geology and soils; wetlands, and wild and scenic rivers are addressed as part of water resources; and natural resources and energy supply are addressed as part of socioeconomics.

3.1 Air Resources

3.1.1 Definition of Resource

The Earth's atmosphere consists of four main layers (i.e., troposphere, stratosphere, mesosphere, and ionosphere) that are separated by narrow transition zones. Each layer is characterized by altitude, temperature, structure, density, composition, and degree of ionization (i.e., the positive or negative electric charge associated with each layer). For the purpose of this EA, "lower atmosphere" refers to the troposphere, which extends from ocean level to an altitude of approximately 10 kilometers (32,800 feet). "Upper atmosphere" refers to the stratosphere, which extends from 10 kilometers (32,800 feet) to approximately 50 kilometers (164,000 feet), and higher altitudes.

Ambient air quality in the lower atmosphere is usually measured in terms of the concentration of various air pollutants in the atmosphere. The impact of exposure to ambient contaminants is a function of the pollutant involved, the duration of the exposure, and the concentrations reached during the exposure. The significance of a pollutant concentration is determined by comparing the concentration with appropriate Federal or State ambient air quality standards. These standards represent the allowable pollutant concentrations at which public health and welfare are protected and include a reasonable margin of safety.

The stratospheric ozone (O_3) layer protects the earth from harmful ultraviolet radiation. O_3 is continually created and destroyed by naturally occurring photochemical processes and its concentration fluctuates seasonally (25 percent) and annually (1-2 percent). O_3 is made up of three oxygen atoms, and is generated by the action of sunlight to combine an oxygen molecule with an atom of oxygen. Atomic oxygen is produced by photolysis, or the use of radiant energy to produce chemical changes, of molecules of oxygen, nitrogen dioxide (NO_2), or O_3. O_3 can be depleted by compounds that contain various elements, most notably chlorine, fluorine, hydrogen, and nitrogen. Aluminum oxide (particulates) and soot may also provide a reaction surface for

the destruction of O_3. NO_2 is also important; it functions as a major catalyst for O_3 destruction in the stratosphere. (FAA 2001) As the O_3 layer is depleted, more ultraviolet radiation can penetrate, resulting in potential health and environmental harm, including higher rates of certain skin cancers and cataracts, suppression of the immune system, damage to crops and aquatic organisms, and increased formation of ground-level O_3.

3.1.2 Regulatory Setting

The primary Federal legislation that addresses air quality is the Clean Air Act (CAA). Under the authority of the CAA and its amendments, the U.S. EPA established a set of National Ambient Air Quality Standards (NAAQS) for criteria pollutants: carbon monoxide (CO), NO_2, O_3, Particulate Matter (PM) with diameter 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). The NAAQS established "primary" standards to protect public health and "secondary" standards designed to protect the public welfare by addressing the effects of air pollution on vegetation, soil, materials, visibility, and other aspects of the general welfare. In addition to the NAAQS, the CAA also authorizes EPA to regulate emissions of hazardous air pollutants (HAPs), also known as toxic air pollutants or air toxics. HAPs are pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects.

3.1.2.1 Criteria Pollutants

As discussed previously, EPA has NAAQS for seven criteria air pollutants: SO_2, CO, NO_2, O_3 (including volatile organic compounds [VOCs], and nitrogen oxides [NO_X] as precursors), PM_{10}, $PM_{2.5}$, and Pb. For both primary and secondary standards, threshold levels were determined based on years of research on the health effects of various concentrations of pollutants on biological organisms, as well as other potential impacts on the environment. The State of Texas implements and enforces the NAAQS.

To further define local and regional air quality, the EPA divided the country into areas that achieve the NAAQS, called attainment areas, and those that do not achieve the NAAQS, called non-attainment areas. The non-attainment and attainment classifications are generally based on air quality monitoring data collected at certain sites in the state. The criteria for non-attainment designation vary by pollutant. For example, an area is in nonattainment for O_3 if its NAAQS has been exceeded more than three discontinuous times in three years at a single monitoring station, whereas an area is in non-attainment for CO if its NAAQS has been exceeded more than once per year. Areas where insufficient data are available to make an attainment status designation are listed as unclassifiable. Unclassifiable areas are treated as attainment areas for regulatory purposes. Areas that were previously designated nonattainment and subsequently redesignated to attainment due to meeting the NAAQS are classified as maintenance areas.

3.1.2.2 Toxic Air Pollutants

The 1990 CAA amendments require EPA to establish technology-based standards for HAPs called Maximum Achievable Control Technology (MACT). These MACT standards are source-category specific and must be achieved by sources with the potential to emit 9.08 metric tons (10 tons) per year of any single HAP, or more than 22.7 metric tons (25 tons) per year of any

combination of HAPs. The 1990 CAA amendments also require EPA to establish "residual risk" standards after the MACT standards have been implemented. These standards are designed to ensure that the public health is protected from exposure to HAPs with an "ample margin of safety" and that any adverse environmental effects are prevented. Like MACT standards, the residual risk standards are source-category specific; however, unlike the MACT standards, they are based on risks as opposed to technology. There are not currently any residual risk standards that would apply to the proposed action.

3.1.2.3 Prevention of Significant Deterioration

For locations that are in an attainment area for criteria air pollutants, Prevention of Significant Deterioration (PSD) regulations limit pollutant emissions from new or modified sources and establish allowable increments of pollutant concentrations. Three PSD classifications are specified, with the criteria established, in the CAA. Class I areas are those of special national concern where any appreciable deterioration in air quality is considered significant. Consequently, the most restrictive increments apply in Class I areas. Class I areas include all national parks, wilderness areas, and memorial parks that exceed certain sizes. Less restrictive increments apply in areas designated as Class II or Class III. Class II areas are all PSD areas that are designated as attainment or unclassifiable with respect to the NAAQS and are not classified in the CAA as Class I areas. Individual states have the authority to redesignate Class II areas to Class III areas to allow for higher levels of industrial development and emissions growth. There are as yet no designated Class III areas.

PSD requirements apply to major stationary sources. The CAA specifies 26 categories of stationary sources which are considered major sources if they emit or have potential to emit 90.7 metric tons (100 tons) per year or more of any pollutant subject to CAA regulation. Any other stationary source which emits or has the potential to emit 226.8 metric tons (250 tons) per year or more of any air pollutant subject to regulation under CAA is considered a major source and is subject to PSD requirements.

3.1.2.4 Regional Haze

Section 169 of the CAA sets forth a national goal for visibility, defined as the "prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas…from manmade air pollution." Regional haze is visibility impairment caused by cumulative air pollution sources over a wide geographic area. Under the regional haze rule (64 FR 35714, dated July 1, 1999), States are required to develop State Implementation Plans to address visibility at designated mandatory Class I areas, including designated national parks, wilderness areas, and wildlife refuges. A visibility analysis is required for each Class I area located within 100 kilometers (62 miles) of any new or modified major stationary sources whose emissions exceed PSD modeling thresholds.

3.1.2.5 Climate Change

The possibility of global climate change due to the increased introduction of "greenhouse gases" [e.g., carbon dioxide (CO_2), chlorofluorocarbons (CFCs), methane (CH_4), and nitrous oxide] into the atmosphere through human activity is a widely publicized, global issue with potential major

long-term implications to global climate and ecosystems. No specific regulatory standards for climate change exist. Various international treaties and agreements have been developed but the U.S. is not party to such agreements.

3.1.3 Region of Influence

The region of influence for air quality encompasses an area surrounding a candidate site that is potentially affected by air pollutant emissions caused by the alternatives. The air quality impact area normally evaluated is the area in which concentrations of criteria pollutants would increase more than a significant amount in a Class II area. Generally, this covers a few kilometers downwind from the source. Further, for sources within 100 kilometers (62 miles) of a Class I area, the air quality impact area evaluated would include the Class I area if the increase in concentration were greater than one microgram per cubic meter (24-hour average). The area of the region of influence depends on emission source characteristics, pollutant types, emission rates, and meteorological and topographical conditions.

The proposed launch site is located in a Class II area. The nearest Class I areas to the proposed launch site are the Guadalupe Mountains National Park (Texas) and Carlsbad Caverns National Park (New Mexico), located approximately 35 and 60 kilometers (22 and 37 miles), respectively, north of the proposed launch site.

Two region of influence boundaries were established for this project. For NAAQS and air quality increment analyses, impacts were evaluated at the site boundary, plus any additional area in which contributions to pollutant concentrations are expected to exceed significance levels. For visibility and related impacts in Class I areas, the region of influence is set at 100 kilometers (62 miles).

3.1.4 Existing Conditions

3.1.4.1 Climate and Meteorology

The proposed Blue Origin launch site would be located in Culberson County, Texas approximately 40 kilometers (25 miles) north of Van Horn. Culberson County is located in the Trans-Pecos region of West Texas. The general climate of the Trans-Pecos region is characterized as arid to semi-arid. The region is cool and dry during the winter and hot and dry during the summer. The average annual precipitation in the region is about 33 centimeters (13 inches), with most of the rainfall coming in the form of thundershowers between the months of June and October. (TWDB 2001) Annual precipitation generally decreases from east to west and increases with elevation. The average annual temperature in the region is approximately 18°C (65°F). Average high temperatures range from about 25 to 27°C (77 to 80°F). Average low temperatures are between 7 and 12°C (45 and 54°F). (TWDB 2001) The prevailing winds are from the southeast, but significant terrain-induced winds exist across the mountainous areas. (NWS 2005a)

In Van Horn, the average winter temperature is approximately 7°C (44°F) with an average daily minimum temperature of approximately -0.6°C (31°F). (NWS 2005b) The lowest temperature on record was -22°C (-7°F). In summer, the average temperature in Van Horn is approximately

26°C (79°F). Average daily maximum temperature in summer is approximately 34°C (94°F). The highest temperature on record was 44°C (112° F). The average annual precipitation in Van Horn is about 28 centimeters (11.2 inches) and the average annual snowfall is about 6 centimeters (2.4 inches). (NWS 2005b) The average annual wind speed is 14 kilometers per hour (8.9 miles per hour). The highest average wind speed, around 18 kilometers per hour (11 miles per hour), occurs in March and April (City Data, undated).

3.1.4.2 Occurrence of Hazardous Weather Conditions

During the spring and summer months, thunderstorms accompanied by heavy rainfall and hail are occasionally observed. Local flooding often occurs during these storms, but is of short duration (NWS 2005a). Tornadoes and winds with peak gusts as high as 151 kilometers per hour (94 miles per hour) have been observed in the Van Horn area. (NCDC 2005)

Blowing dust may occur in the region due to the combination of strong winds, sparse vegetation and the arid to semi-arid climate. High winds associated with thunderstorms are frequently a source of localized blowing dust. The sky is occasionally obscured by dust, but in most storms visibilities range from 2 to 5 kilometers (1 to 3 miles) (NWS 2005a). Dust storms covering an extensive area are rare, and those that reduce visibility to less than 2 kilometers (1 mile) occur only with the strongest pressure gradients such as those associated with intense extratropical cyclones which occasionally form in the region during winter and early spring. (Heidorn 2002) An average of five dust storms per year is observed in the region. (NWS 2005c)

3.1.4.3 Site Air Quality

The air quality in Culberson County can be generally considered as unimpaired. Ranching, farming, vehicular traffic, and three small industrial facilities are the only human activities within Culberson County that would affect background air quality. The Texas Commission on Environmental Quality (TCEQ) currently does not have any air quality monitoring stations in the county. (TCEQ 2005) Because there are no air monitoring stations in Culberson County, the county is deemed unclassifiable/attainment for all NAAQS. (40 CFR 81.344)

Exhibit 3-1 compares monitored air concentrations around the region with NAAQS. Because there are no air monitoring stations in Culberson County, data from the air monitoring station nearest to the launch site for each criteria pollutant are provided. For CO and PM_{10}, the nearest monitoring stations are located in the El Paso urban area, a nonattainment area for CO and PM_{10}. Data from these monitoring stations would not be representative of conditions in the project vicinity. Therefore, data from monitoring stations located in Webb County, Texas and Lea County, New Mexico are provided for CO and PM_{10}, respectively. As noted previously, Culberson County is considered to be unclassifiable/attainment for all of the NAAQS.

The only EPA-listed HAP of interest for this document is hydrogen chloride (HCl). HCl would be released from solid rocket motors during an emergency separation. Exhibit 3-2 provides estimated baseline emissions for criteria pollutants and HCl in Culberson County.

Exhibit 3-1. Comparison of Air Concentrations in Nearby Counties with NAAQS

Pollutant	Averaging Time	NAAQS	2004	2003	2002
CO (ppm)	1-hr	35	6.2[a]	7.5[a]	7.2[a]
	8-hr	9	3.5[a]	3.5[a]	4.3[a]
NO_2 (ppm)	Annual	0.053	0.005[b]	0.006[b]	0.007[b]
Ozone (ppm)	1-hr	0.12	0.076[b]	0.073[b]	0.087[b]
	8-hr	0.08	0.065	0.065[b]	0.076[b]
SO_2 (ppm)	24-hr	0.14	0.004[b]	0.004[b]	0.009[b]
	Annual	0.030	0.001[b]	0.001[b]	0.001[b]
$PM_{2.5}$ ($\mu g/m^3$)	24-hr	65	8[c]	12[c]	10[c]
	Annual	15.0	3.7[c]	4.1[c]	3.9[c]
PM_{10} ($\mu g/m^3$)	24-hr	150	48[c]	88[c]	54[c]
	Annual	50	15[d]	26[d]	17[d]
Pb ($\mu g/m^3$)	Quarter	1.5	0.02[e]	0.01[e]	0.01[e]

Source: EPA 2005

[a] Webb County, Texas (nearest representative monitoring station to the proposed launch site for CO)
[b] Eddy County, New Mexico (nearest monitoring station to the proposed launch site for NO_2, O_3, and SO_2)
[c] Jeff Davis County, Texas (nearest monitoring station to the proposed launch site for $PM_{2.5}$)
[d] Lea County, New Mexico (nearest monitoring station to the proposed launch site for PM_{10})
[e] Webb County, Texas (nearest monitoring station to the launch site for Pb)

Exhibit 3-2. Estimated Annual Emissions for Culberson County, Texas

Pollutant	Mobile (tons per year)	Industrial (tons per year)	Area (tons per year)	Total (tons per year)
CO	5,063	48.14	9	5,120.14
NO_2	1,682	589.40	4	2,275.4
SO_2	55	0.48	2	57.48
$PM_{2.5}$	120	0	98	218
PM_{10}	438	0	552	990
VOC	567	4.67	145	716.67
HCl	---	---	0.03	0.03

Source: EPA 2005

There are two Class I areas within 100 kilometers (62 miles) of the proposed launch site; the Guadalupe Mountains National Park and Carlsbad Caverns National Park. A variety of air pollution sources affect air quality and contribute to visibility degradation in these parks, including power generating plants, natural gas compressor stations, local gas well flaring, and mobile and area sources in El Paso, Hudspeth, Culberson, Loving, and Reeves counties in Texas, and Otero, Lee, and Eddy counties in New Mexico, in addition to other areas of the Southwest. Limited visibility measurements were made in Carlsbad Caverns National Park in the 1970s and 1980s, but measurements at Guadalupe Mountains National Park are now used to characterize visibility in both parks. An analysis of 1990-1999 data indicates that visibility in the area is improving slightly on the clearest days, but degrading significantly on the haziest days. Clearest days are associated with high pressure winds from the northwest; planned oil and gas development on the Otero Mesa could contribute to visibility degradation in the park on those clearest days. (NPS 2005)

3.2 Ecological Resources

3.2.1 Definition of Resource

Ecological resources include vegetation, wildlife, threatened and endangered species, and environmentally sensitive habitats. In this document, “special-status” species are those that are federally-listed as endangered or threatened, proposed for listing as endangered or threatened, candidates for federal listing; and species that are state-listed as endangered or threatened.

3.2.2 Regulatory Setting

The U.S. Fish and Wildlife Service (USFWS) and Texas Parks and Wildlife Department (TPWD) are the agencies with responsibility and/or authority for special-status species.

Species that are federally listed as threatened or endangered are protected under the Endangered Species Act of 1973, as amended. Under this legislation, a species is considered endangered if it is “...in danger of extinction throughout all or a significant portion of its range...,” and threatened if it is “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” This legislation designates candidate species as species for which “...the Service has enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.”

Texas laws and regulations pertaining to endangered or threatened animal species are contained in Chapters 67 and 68 of the TPWD Code and Sections 65.171 - 65.184 of Title 31 of the Texas Administrative Code (TAC). Endangered or threatened plant species are protected under regulations contained in Chapter 88 of the TPWD Code and Sections 69.01 - 69.14 of the TAC. Endangered species are those that the Executive Director of the TPWD has named as being "threatened with statewide extinction," and threatened species are those that the TPWD has determined are likely to become endangered in the future.

3.2.3 Region of Influence

The region of influence for ecological resources includes the proposed launch site and nearby off site plants, animals, and habitats that could be affected by construction and operations.

3.2.4 Existing Conditions

Ecological resources at the proposed launch site are described below, and are based largely on biological surveys conducted at the proposed launch site in January and April 2005. Details regarding the biological surveys and a more detailed description of ecological resources at the proposed launch site are provided in Appendix C.

3.2.4.1 Vegetation

The 7,527-hectare (18,600-acre) launch site is located within the Chihuahuan Desert, which is the largest of the four North American deserts. Most of the Chihuahuan Desert is in Mexico, but northward fingers extend along the Rio Grande and Pecos rivers into portions of Texas and New Mexico. The general vegetation community known as Chihuahuan Desert Scrub encompasses the proposed launch site. Overgrazing, climate change, and fire suppression have extended this vegetation community type northward over the last 100 to 250 years into areas previously characterized as grasslands. (Dick-Peddie 1993) Creosote (*Larrea tridentata*) and tarbush (*Flourensia cernua*) are co- dominant indicator species of Chihuahuan Desert Scrub. The proposed launch site is situated within a basin formed by the Sierra Diablo Mountains on the west and the Delaware Mountains on the east. Gently sloping alluvial fans dominate the eastern portion of the site, draining to the west. A northwest-to-southeast trending gypsum ridge ranging from approximately two to eight meters (5 to 25 feet) in height is located in the west-central portion of the site and overlooks a large similarly aligned depression to the west.

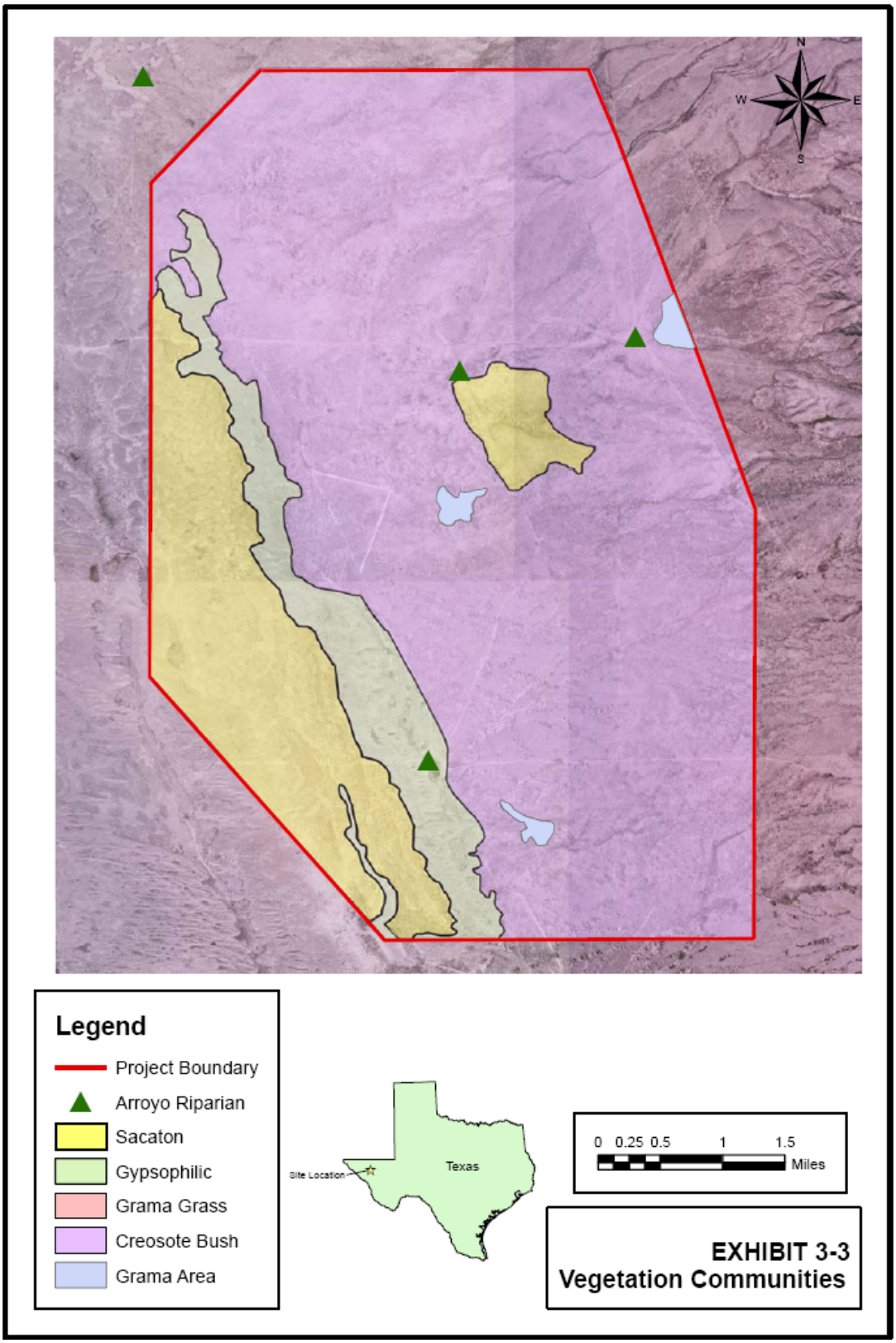
Five subsets of Chihuahuan Desert Scrub vegetation community occur within the proposed launch site.

- Creosote bush 5,609 hectares (13,860 acres)
- Sacaton 1,257 hectares (3,105 acres)
- Grama grass 59 hectares (145 acres)
- Gypsophilic 619 hectares(1,529 acres)
- Arroyo Riparian less than 0.8 hectares (less than 2 acres)

Brief descriptions of each community type are provided below.

The creosote bush community comprises the majority of vegetation within the proposed launch site (Exhibit 3-3), and encompasses nearly three quarters of the site. Topographically the creosote bush community coincides with gently sloped alluvial fans and level expanses. The community is dominated by creosote, and the presence of soaptree yucca (*Yucca elata*) and fluff grass (*Erioneuron pulchellum*) with minimal tarbush occurrence indicates recent (within the past 150 years) grassland succession. (Dick-Peddie 1993)

Exhibit 3-3. Vegetation Communities



The sacaton community occurs in poorly drained saline, calcareous clay loam soils that are prevalent along the western-southwestern edge of the site, and in one relatively large area in the central portion of the site. These flat areas are interspersed with swales and are characterized by alkali sacaton (*Sporobolus airoides*) and four-winged saltbush (*Atriplex canescens*) intermixed with patches of burro grass (*Scleropogon brevifolius*), fluff grass, tobosa (*Hilaria mutica*), and threeawn (*Aristida sp.*).

The grama grass community is dominated by black grama (*Bouteloua eripoda*). Other species include alkali sacaton, tobosa, burro grass, creosote, honey mesquite (*Prosopis glandulosa*), and tarbush.

The linear gypsum ridge in the west-central portion of the site supports the Gypsophilic community type. The ridge surface layer is composed of rocky consolidated limestone with presumably high levels of calcium carbonate and calcium sulfate in surface soils. The Gypsophilic community is the least diverse in the proposed launch site. Hairy coldenia (*Tiquilia hispidissima*), alkali sacaton, althorn (*Koeberlinia spinosa*), soaptree yucca, evening primrose (*Oenothera missouriensis*), bush muhly (*Muhlenbergia porteri*), and stickleaf (*Mentzilia albicaulis*) are the primary plant species.

Arroyo riparian vegetation within the proposed launch site is uncommon and occurs only near man-made arroyos (dry gullies) and impoundments. There are no naturally occurring surface waters within the site, nor any true riparian vegetation communities. Thus, the arroyo vegetation communities at the site have been termed “pseudo-riparian.” These communities encompass small circular areas around former livestock ponds and tanks or thin linear swales along ephemeral drainages. Although water is no longer pumped to these ponds and tanks, they apparently hold water after rains and tend to be more lushly vegetated than surrounding areas. This community type is dominated by large honey mesquite typically exceeding 5 meters (15 feet) in height and 20 centimeters (8 inches) diameter at breast height, sumac (*Rhus microphyllum*), desert willow (*Chilopsis linearis*) and thick, tall, bunch stands of alkali sacaton.

3.2.4.2 Wildlife

The Trans-Pecos region of the Chihuahuan Desert in West Texas is home to numerous species of invertebrates, reptiles, amphibians, mammals, and migrant and local birds. Habitats at the site are typical of those in the region, and thus, wildlife species present are typical of those in the surrounding region. Common birds at the site include the turkey vulture (*Cathartes aura*), common raven (*Corvus corax*), greater roadrunner (*Geococcyx californianus*), Northern mockingbird (*Mimus polyglottos*), and scaled quail (*Callipepla squamata*). Mammals at the site include the coyote (*Canis latrans*), badger (*Taxidea taxus*), pronghorn “antelope” (Antilocapra americana), chipmunk (*Eutamias sp.*), black-tailed jackrabbit (*Lepus californicus*), and desert cottontail (*Sylvilagus aududoni*). Reptiles at the site include the little striped whiptail lizard (*Cnemidophorus inornatus*), bull snake (*Pituophis melanoleuca sayi*), and prairie rattlesnake (*Crotalus viridis viridis*). Fish are not present due to the absence of surface water at the site. Appendix C contains a detailed description of species recorded at the site during biological surveys.

A small cave located along the eastern side of the limestone ridge in the west-central portion of the surveyed site contained a small colony of bats during the April 2005 survey. The bats appeared to be cave myotis (*Myotis velifer*), a common bat species in the Trans-Pecos region of Texas. A positive identification was not completed.

Two black-tailed prairie dog colonies occur in the vicinity of the launch site. The larger of the two colonies is located slightly outside the northwest boundary of the launch site. The colony covers approximately 0.08 to 0.1 square kilometers (20 to 25 acres), and the eastern edge of the colony is approximately 183 meters (600 feet) west of the launch site's western boundary. The other prairie dog colony is located in the southeastern portion of the launch site within the sacaton vegetation community, and covers approximately 0.03 to 0.04 square kilometers (8 to 10 acres).

3.2.4.3 Special-Status Species

This section addresses plant and animal special status species that potentially occur around the proposed launch site.

No federally- or state-listed special-status species were noted in the proposed launch site during the January and April 2005 field surveys. Exhibit 3-4 lists the special-status plant and animal species found (or formerly found) in Culberson County, and describes the habitat associated with each species. The table includes all special-status species for Culberson County based on records from USFWS (2005a) and TPWD (2005a). The USFWS (2005a) list for Culberson County consisted of five special-status species: Guadalupe fescue, gypsum wild buckwheat, Mexican spotted owl, Southwestern willow flycatcher, and yellow-billed cuckoo. The TPWD (2005a) list for Culberson County included all species in Table 3-3 except gypsum wild buckwheat.

The proposed launch site does not contain suitable habitat for the following 11 species listed in Exhibit 3-4: common black hawk, gray hawk, Mexican spotted owl, Southwestern willow flycatcher, yellow-billed cuckoo, zone-tailed hawk, Pecos pupfish, Chihuahuan mud turtle, mountain short-horned lizard, Guadalupe Mountains fescue, and gypsum wild buckwheat. Two species in Exhibit 3-4 (the black-footed ferret and gray wolf) have been extirpated from Texas (TPWD 2005a), and thus, are not present in the vicinity.

The black bear is occasionally found in desert lowlands in west Texas, but prefers mountainous forests (Schmidly 2004), and bears have not been observed by Blue Origin personnel or contractors in the vicinity of the proposed launch site. The American peregrine falcon and Arctic peregrine falcon might pass through the vicinity of the proposed launch site during migration, but would not nest there. The Arctic peregrine falcon nests only in Arctic regions and the American peregrine falcon usually nests in close proximity to water, so no suitable nest habitat occurs at the site. The remaining four species that could potentially occur in vicinity of the proposed launch site are discussed in detail below.

Exhibit 3-4. Special Status Species in Culberson County, Texas

Species	Federal Status[a]	State Status[a]	Habitat Requirements and Notes
Birds			
American peregrine falcon (*Falco peregrinus anatum*)	-	E	Nests in on high cliffs, usually in close proximity to water; not known to nest in very arid desert regions; potential migrant in Culberson County[b,c,d]
Arctic peregrine falcon (*Falco peregrinus tundrius*)	-	T	Nests in artic arctic regions, potential migrant in Culberson County[b,c]
Common black-hawk (*Buteogallus anthracinus*)	-	T	Cottonwood-lined rivers and streams; willow thickets on the lower Rio Grande floodplain[b,c]
Gray hawk (*Asturina nitida*)	-	T	Riparian forests, open woodlands, pastures with scattered trees and hedgerows; in Texas, typically restricted to Rio Grand valley[b,c]
Mexican spotted owl (*Strix occidentalis lucida*)	T	T	Nests in mixed conifer forests with high canopy closure, high stand density, a multi-layered canopy, uneven-aged stands, numerous snags, and downed woody matter[b,c]
Northern aplamado falcon (*Falco femoralis septentrionalis*)	E	E	Open country, especially savannah and open woodland, and sometimes in barren areas, grassy plains and valleys with scattered mesquite, yucca, and cactus[b,c]
Southwestern willow flycatcher (*Empidonax traillii extimus*)	E	E	Riparian thickets, especially willow and cottonwood; also known to use dense thickets dominated by tamarix and mesquite in close proximity to surface water[b, c]
Yellow-billed cuckoo (*Coccyzus americanus*)	C	-	Lowland deciduous woodlands of cottonwood and willow in riparian and mesic areas; nests in dense understory foliage[b,c]
Zone-tailed hawk (*Buteo albonotatus*)	-	T	Open deciduous or pine-oak woodlands in mountainous areas near water, wooded canyons, tree-lined rivers along middle slopes of desert mountains[b,c]
Fish			
Pecos pupfish (*Cyprinodon pecosensis*)	-	T	Springs, sinkholes, and pools of streams in Pecos River drainage[b]
Mammals			
Black bear (*Ursus americanus*)	-	T	Mostly mountainous forested areas; occasionally desert lowlands[b,e]
Black-footed ferret (*Mustela nigripes*)	E	E	Considered extirpated in Texas, the last Texas records were from Dallam (1953) and Bailey (1963) counties in the panhandle; this species is associated with large prairie dog colonies[b,e,f]

Species	Federal Status[a]	State Status[a]	Habitat Requirements and Notes
Gray wolf (*Canis lupus*)	E	E	Formerly known throughout the western two-thirds of the state in forests, brush lands; extirpated[b,e]
Reptiles			
Chihuahuan Desert lyre snake (*Trimorphodon vilkinsonii*)	-	T	Crevices in predominantly limestone-surfaced desert, especially in areas with jumbled boulders and rock fissures[b]
Chihuahuan mud turtle (*Kinosternon hirtipes murrayi*)	-	T	A semi-aquatic species that prefers bodies of fresh water with abundant aquatic vegetation; preferred habitats absent from proposed launch site[b]
Mountain short-horned lizard (*Phrynosoma hernandesi*)	-	T	Forested areas and semiarid plains at high elevations in open, shrubby, or wooded areas with sparse vegetation at ground level[b,g]
Texas horned lizard (*Phrynosoma cornutum*)	-	T	Open, arid and semi-arid regions with sparse vegetation; grass, cactus, scattered brush or scrubby trees[b]
Trans-Pecos black-headed snake (*Tantilla cucullata*)	-	T	Mesquite-creosote and pinon-juniper-oak[b]
Plants			
Guadalupe Mountains fescue (*Festuca ligulata*)	C	-	Gravelly and sandy loams in woodlands and grasslands on mesic slopes and in creek bottoms above 1,800 meters (6,000 feet) in the Guadalupe and Chisos Mountains; habitat types not found within the proposed launch site[b]
Gypsum wild buckwheat (*Eriogonum gypsophilum*)	T	-	Restricted to almost pure gypsum that is sparsely vegetated with other gypsophilous plants[b,h]

[a] E = Endangered, T = Threatened, C = Candidate, - = Not listed
[b] TPWD, 2005a
[c] Rappole and Blacklock, 1994
[d] TPWD, 2005c
[e] Schmidly, 2004
[f] USFWS, 1988
[g] BISON, 2005c
[h] NMRTPC, 2005

Northern aplomado falcon (Falco femoralis septentrionalis)

The Northern aplomado falcon is federally- and state-listed as endangered. This species was once found throughout the southwestern United States, but had nearly disappeared by 1930. Causes for their decline are uncertain, but habitat conversion and degradation, and stream

channelization that reduced riparian foraging habitat are probably major factors. (TPWD 2005b) After no confirmed sightings since the 1950s, a nesting attempt was recorded in Luna County, New Mexico in 2001. In 2002, this pair successfully fledged three chicks. Since then this site has not supported a successful breeding pair. (BISON 2005a)

In 1983, recovery efforts were initiated with captive nestling falcons from Mexico and transferred to the Peregrine Fund's facility in Boise, Idaho. Reintroduction efforts began in 1985 in southern Texas. These releases have resulted in the establishment of at least 39 pairs in south Texas and adjacent Mexico, and these birds have successfully fledged more than 179 young. (USFWS 2005b) In 2002, falcons were released at four sites on private ranches in west Texas under the Safe Harbor Agreement with the Peregrine Fund. These sites included a location approximately 80 kilometers (50 miles) south of the proposed launch facility. (USFWS 2005b)

The Northern aplomado falcon requires open grassland terrain with scattered trees or yuccas, an abundant prey base, and suitable nesting platforms. In the Mexican State of Chihuahua, Northern aplomado falcon territories were located in desert grassland/savanna where blue grama and tobosa grass were the most abundant grasses at nesting sites. (BISON 2005a) Northern aplomado falcons do not build their own nests, but instead appropriate abandoned stick nests of other bird species, particularly ravens and other raptor species. Most Northern aplomado falcon nests are in multi-branched soaptree yuccas and mesquite. Falcons often hunt cooperatively feeding on small to medium sized birds, insects, rodents, bats and reptiles. As with most raptors, the Northern aplomado falcon requires a large home range. The home range of post-released Northern aplomado falcons in Texas varied from 36 to 280 square kilometers (14 to 108 square miles). (BISON 2005a)

There is no record of nesting Northern aplomado falcons within Culberson County (USFWS 2005a), and none were observed during biological surveys of the proposed launch site in April 2005, which is the typical time period for nesting of this species in Texas. (TWPD 2005b) The proposed launch site is located within the historic range of Northern aplomado falcon and given the close proximity of reintroduction efforts, the species might occasionally forage at the proposed launch site. However, this species is typically associated with large Chihuahuan grassland expanses, and grasslands in the proposed launch site are not extensive. Only about 58 hectares (144 acres) of the 7,527 hectares (18,600 acres) proposed launch site are classified as grassland, and as shown in Exhibit 3-3, the 58 hectares (144 acres) of grama grass habitat are not contiguous, and instead are divided into three sub-areas within the creosote bush habitat type. In summary, the site does not represent prime habitat for the Northern aplomado falcon, but the possibility of occasional foraging cannot be ruled out.

Chihuahuan desert lyre snake (Trimorphodon vilkinsonii)

State listed as threatened, this species is a secretive crevice-dwelling reptile found in the predominantly limestone-surfaced desert northwest of the Rio Grande River from Big Bend to the Franklin Mountains. A burrowing (fossorial) species, it inhabits rocky areas with jumbled boulders, and rock faults and fissures. Its diet consists primarily of lizards. Potential habitat for this species within the proposed launch site is very limited, and occurs mainly along the limestone ridge bisecting the western portion of the site. No desert lyre snakes were observed in the proposed launch site during the January or April 2005 biological surveys.

Texas horned lizard (Phrynosoma cornutum)

Sometimes referred to as the horned toad, this reptile species is state-listed as threatened. Historical distribution ranged from Colorado, Kansas, and southwestern Missouri south through southeastern Arizona, New Mexico, Oklahoma, Arkansas, and Texas into northern Mexico. It is found in all regions of Texas except for the piney woods and marine environments. (BISON 2005b) This lizard inhabits flat, open generally arid regions with loose soils supporting bunchgrass, juniper, mesquite, acacia and succulents. Diet consists primarily of harvester ants, but other small arthropods may be eaten. Since this generalist species is found in a variety of habitats, it could occur within the proposed launch site. No Texas horned lizards were observed during biological surveys in April 2005.

Trans-Pecos black-headed snake (Tantilla cucullata)

Listed as threatened in Texas, this mainly nocturnal, secretive species is difficult to detect. It is a nocturnal and fossorial species that burrows into soft soils. It occurs in mesquite-creosote scrub and piñon-juniper-oak woodland habitats. Its diet consists of insects, spiders, and other invertebrates. The creosote bush portion of the proposed launch site provides suitable habitat for this species. No Trans-Pecos black-headed snakes were observed within the proposed launch site during biological surveys in April 2005.

On March 25, 2006 the FAA sent a letter to the USFWS regarding potential impact on threatened or endangered species from the proposed action. In the letter the FAA determined that formal consultation under Section 7 of the Endangered Species Act is not warranted. The FAA requested USFWS comments and/or concurrence with this determination. On May 23, 2006, the FAA received a response from the USFWS that concurred with the FAA's determination that it is unlikely that any federally listed threatened or endangered species would occur in the project area. The USFWS requested that the FAA review the potential for ground water development directly or indirectly associated with the project to impact springs in Jeff Davis and Reeves counties which host the federally endangered Comanche Springs pupfish and Pecos gambusia. A discussion of possible ground water impacts from the proposed action is included in Section 4 of this EA.

3.3 Cultural/Native American Resources

3.3.1 Definition of Resource

Cultural resources are those aspects of the physical environment relating to human culture, society, and cultural institutions that hold communities together and link them to their surroundings. Cultural resources include past and present expressions of human culture and history in the physical environment, such as prehistoric and historic sites, buildings, structures, objects, districts, natural features, and biota, which are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional life ways and practices, and are associated with community values and institutions.

Cultural resources include prehistoric and historic resources and ethnographic resources. Prehistoric and historic resources are the tangible remains of past activities that show use or modification by people. They are distinct geographic areas that can include artifacts, features such as hearths, rock alignments, trails, rock art, roads, landscape alterations, or architecture. In general, prehistoric and historic resources are the loci of purposeful human activity that has resulted in the deposition of cultural materials beyond the level of a few accidentally lost artifacts. Deposits that do not meet this criterion are still cultural in nature, but are described as isolated occurrences. Prehistoric resources show use or modification by people before the establishment of a European presence in west Texas in the mid 17th century. Historic resources show use or modification after the arrival of Europeans in the region.

The National Register of Historic Places (National Register) is a listing of buildings, structures, sites, districts, and objects that are considered significant at a national, state, or local level. Cultural resources that are listed on the National Register or have been determined eligible for listing have been documented and evaluated according to uniform standards, and have been found to meet criteria of significance and other requirements for listing. Cultural resources that meet the criteria and requirements for listing on the National Register are called historic properties.

Cultural resources that have a direct association with a living culture may be considered ethnographic resources. Ethnographic resources are associated with the cultural practices, beliefs, and traditional history of a community. They are used within social, spiritual, political, and economic contexts, and are important to the preservation and viability of a culture. Examples of ethnographic resources include places that play an important role in oral histories, such as a particular rock formation, the confluence of two rivers, or a rock cairn; large areas, such as landscapes and viewscapes; sacred sites and places important for religious practices; natural resources traditionally used by people such as plant communities or clay deposits; and places such as trails or camping locations. The components of an ethnographic resource can be man-made or natural. If an ethnographic resource is found to meet the criteria and requirements for listing on the National Register, it is called a traditional cultural property (TCP). A TCP is generally defined as a property "that is eligible for inclusion in the National Register 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." (Parker and King 1990)

3.3.2 Regulatory Setting

A number of Federal statutes address cultural resources and Federal responsibilities regarding them. The long history of legal jurisdiction over cultural resources, dating back to 1906 with the passage of the *Antiquities Act* (16 U.S.C. 431-433), demonstrates a continuing concern on the part of Americans for their cultural resources. Foremost among these statutes is the *National Historic Preservation Act* (NHPA) of 1966, as amended (16 U.S.C. 470). Section 106 of this statute requires Federal agencies to take into account the effect of Federal undertakings on any property that is included on or eligible for inclusion on the National Register. The regulations that implement Section 106 (36 CFR Part 800) describe the process for identification and evaluation of cultural resources, assessment of effects of Federal actions on historic properties or TCPs, and consultation to avoid, minimize, or mitigate adverse effects. The NHPA does not

require preservation of cultural resources, but does ensure that Federal agency decisions concerning the treatment of these resources result from meaningful consideration of cultural and historic values, and identification of options available to protect the resources.

The Federal government recognizes its unique relationship with Native American tribal governments and respects tribal sovereignty and self-government. Various Federal statutes have been enacted that establish and define a trust relationship with tribes. Specific statutes, regulations, and executive orders guide consultation with Native Americans to identify cultural resources important to tribes and to address tribal concerns about potential impacts to these resources. Those relevant to the proposed project are the NHPA and its implementing regulations (36 CFR Part 800.2), *American Indian Religious Freedom Act* of 1978 (42 U.S.C. 1996), and Executive Order 13175 *Consultation and Coordination with Indian Tribal Governments* (65 Federal Register [FR] 67249). This legislation calls on agencies to consult with Native American tribal leaders and others knowledgeable about cultural resources important to them. Consultation is conducted for Federal actions with the potential to affect locations of traditional concern, religious practices and areas where they are carried out, areas of traditional cultural uses, archaeological sites, and other modern and ancestral tribal resources.

3.3.3 Region of Influence

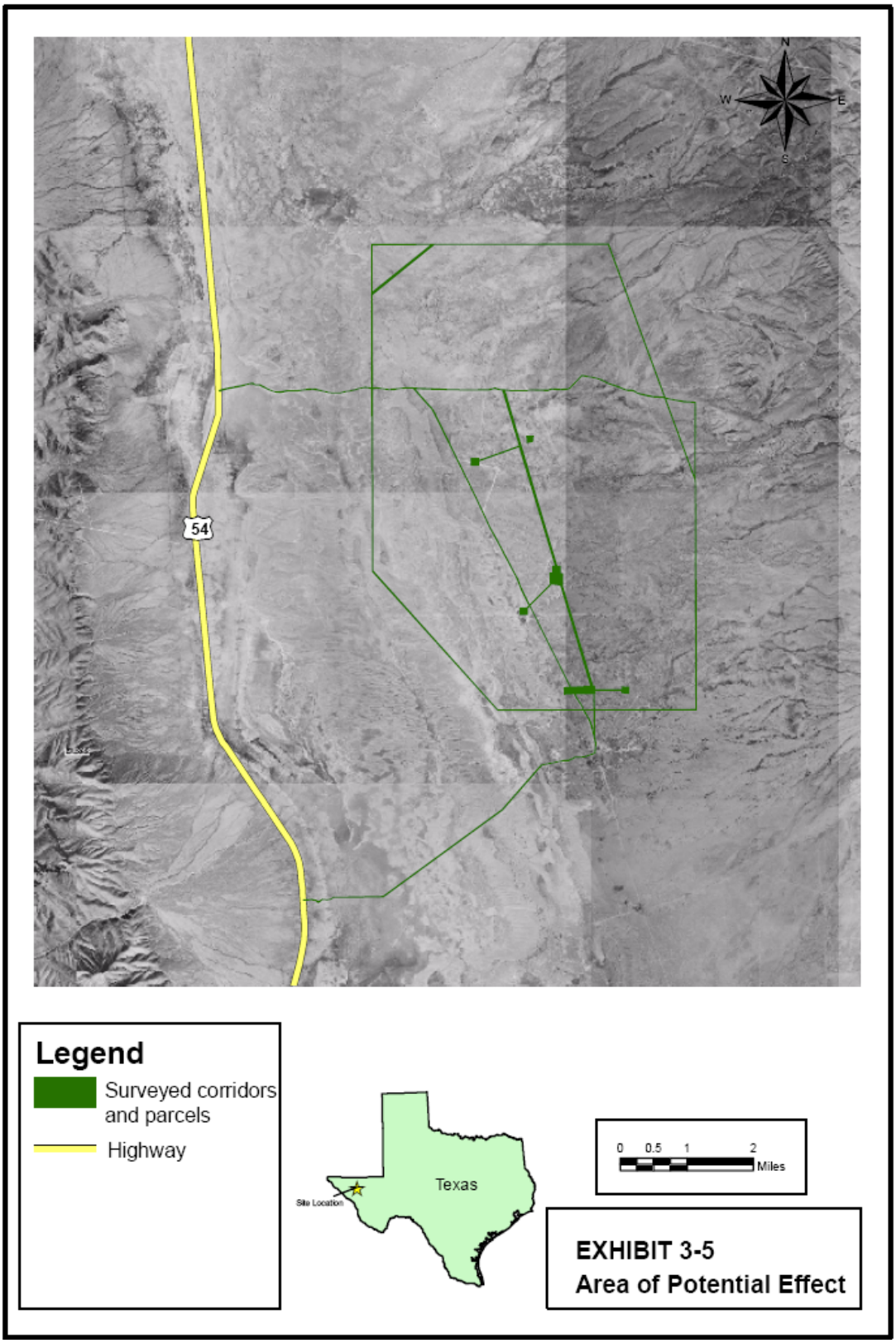
Information on prehistoric and historic resources that could be impacted by the proposed alternatives was collected through a systematic cultural resource inventory of the Area of Potential Effect (APE), shown on Exhibit 3-5. This systematic inventory included a site records search and an intensive pedestrian field survey. For discussions in this EA, the Region of Influence (ROI) for prehistoric and historic resources is equivalent to the APE. Information on ethnographic resources and potential impacts to them is being collected through consultation with Tribes. The ROI for ethnographic resources includes the APE for consideration of physical impacts and the region surrounding the proposed launch site for visual and auditory impacts. The results of the site records search and pedestrian field survey are described in an inventory report prepared by Geo-Marine, Inc. (Geo-Marine, Inc., 2005)

3.3.4 Existing Conditions

3.3.4.1 Cultural Background of the Proposed Launch Site

The proposed launch site is located in the Trans-Pecos culture region, but at the boundary with the Jornada region. This area has not received much attention by archaeologists due to the predominance of privately-owned land and the remoteness of the area. Thus, the information available from which to develop a cultural background of prehistory and history is limited. The information presented here is directly from the cultural context provided in the cultural resource inventory report prepared for the proposed project. (Geo-Marine, Inc. 2005)

Exhibit 3-5. Area of Potential Effect



The Paleo-Indian period in the project region, dating from approximately 10,000 to 6000 B.C., is characterized by small, mobile bands who subsisted on hunting large mammals such as mammoth and bison. Toward the end of this period, it is believed that these people were beginning to include smaller game such as big horn sheep and deer in the higher elevations. Information on the earlier portion of this period must come from evidence found in the nearby Southern Plains and further to the west, as no sites have been found in the project region. However, later Paleo-Indian sites have been found in the Trans-Pecos, though they are not numerous.

The Archaic period is generally characterized by broad-spectrum hunting and gathering by small groups that traveled seasonally throughout the year within large territories. In the project region, the emphasis seems to be on hunting small mammals, along with a broad-based reliance on a diverse range of plants. During this period, from 6000 B.C. to A.D. 200, populations started to increase dramatically, and later in the period, habitation sites are more numerous and larger. Archaic sites are found in a wide variety of environmental zones, illustrating the dependence on a wide variety of plants and animals. As in other neighboring culture regions, especially to the north and west, ceramics appeared during the Archaic period in the Trans-Pecos. However, unlike other neighboring regions, no evidence has been found to indicate the presence of horticulture.

During the Formative period, dating from A.D. 400 to 1450, use of the landscape, technologies, and subsistence all changed. Toward the end of the period the use of cacti and succulents seems to decrease, and there is little evidence of the use of horticulture until the very end of the period. Hunting of small to medium sized mammals continued throughout the period. Sedentism increased slightly, and throughout the period there was a gradual shift to the use of more substantial house structures. Preferences for settlement of various landforms fluctuated throughout the period.

The Historic era begins with the establishment of a European presence in the region in the mid 17th century. By 1659, the first outpost and mission had been established in the El Paso area. Military forts were constructed and they provided protection to the Chihuahua Trail, a commerce and information artery that connected Mexico with the Southwest. It was not until after 1848, with the annexation of Mexican lands by the United States, that Anglo-Americans substantially settled the Trans-Pecos region. To deal with marauding Native Americans, primarily Apaches and Comanches, forts were built and troops deployed to protect settlers. In the 1860s, attention was paid to exploiting the region for silver mining. The relocation of troops away from the forts to the southeastern United States during the Civil War resulted in many settlers being forced out of the area due to raiding activities of the Native Americans. The 1880s saw the end of Indian hostilities and the arrival of the railroads, resulting in significant increases in settlement of the region. Along with the railroads came cattle ranching, which became a leading industry for the region. Silver and tin mining remained important enterprises in the late 19th and early 20th centuries. In recent times, tourism has replaced agriculture as the leading industry.

3.3.4.2 Prehistoric and Historic Resources Identified in the Proposed Launch Site Area

A cultural resource inventory was conducted for the proposed project to identify prehistoric and historic resources. (Geo-Marine, Inc. 2005) The inventory included an intensive pedestrian field survey of the APE. A total of three square kilometers (765 acres) were surveyed. A total of 36 prehistoric and historic resources were identified, which include seven sites and 29 isolated occurrences. Exhibit 3-6 lists each identified site, its eligibility for the National Register, and the portion of the area around the proposed launch site where it is located. The 29 isolated occurrences were found in all areas of the APE. They include ground stone artifacts, projectile points, other chipped stone artifacts, chipped stone flakes, and fire-cracked rock. None of the isolated occurrences are eligible for listing on the National Register.

Exhibit 3-6. Prehistoric and Historic Sites Identified in the APE

Resource Number	Description	National Register Eligibility	Location around Proposed Launch Site
41CU692	Scatter of ground stone and chipped stone artifacts	Not eligible	Southern perimeter fence
41CU693	Scatter of fire-cracked rock and chipped stone artifacts	Not eligible	Western perimeter fence
41CU694	Scatter of chipped stone artifacts	Not eligible	Northwestern perimeter fence
41CU695	Scatter of thermal features and chipped stone, ground stone, and ceramic artifact shards	Eligible	Northwestern perimeter fence
41CU696	Scatter of thermal features and chipped stone, ground stone, and ceramic artifact shards	Eligible	South entrance road
41CU697	Scatter of fire-cracked rock and chipped stone, ground stone, and ceramic artifact shards	Not eligible	South entrance road
41CU698	Scatter of fire-cracked rock and chipped stone and ground stone artifacts	Not eligible	Northwestern perimeter fence re-route

National Register = National Register of Historic Places

All of the identified resources were recorded and evaluated to determine if they are eligible for listing on the National Register. The Texas SHPO has reviewed and concurred with the eligibility determinations. Resources that are eligible are afforded protection under the NHPA. If a Federal action will affect an eligible resource, then measures must be considered to avoid, minimize, or mitigate the effect.

3.3.4.3 Ethnographic Resources Identified around the Proposed Launch Site

In accordance with Section 106 of the NHPA, 14 Native American tribes have been contacted as potentially interested parties that may have cultural ties to the region. They were selected based on ethnographic studies conducted in the region for Carlsbad Caverns National Park and the Guadalupe Mountains National Park. (Hendricks and Thomas 2004) The following tribes were contacted.

- Apache Tribe of Oklahoma
- Comanche Nation of Oklahoma
- Fort Sill Apache Tribe
- Hopi Tribe
- Jicarilla Apache Nation
- Kiowa Indian Tribe of Oklahoma
- Mescalero Apache Tribe
- Pawnee Nation of Oklahoma
- Pueblo of Isleta
- Pueblo of Zia
- San Carlos Apache Tribe
- White Mountain Apache Tribe
- Ysleta del Sur Pueblo
- Zuni Tribe

To date, none of the contacted tribes has indicated concerns for cultural resources that would be impacted by the proposed project.

3.4 Hazardous Materials/Waste Management

3.4.1 Definition of Resource

Hazardous materials and hazardous waste include substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to the public health, welfare, or the environment when released.

3.4.2 Regulatory Setting

EPA regulates hazardous chemicals, substances, and wastes under the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the Toxic Substances Control Act. EPA has delegated responsibility for the RCRA regulations in the state of Texas to the TCEQ. The state of Texas has also established regulations governing aboveground storage tanks storing petroleum products (Texas Administrative Code, Title 30 - Environmental Quality, Chapter 334, Subchapter F) and other hazardous materials.

Tanks and other facilities for the storage of hazardous materials must be designed to comply with Spill Prevention, Control, and Countermeasure rules as outlined in 40 CFR Part 112. Any accidental releases of hazardous materials must be reported to the National Response Center if the quantity of the material released exceeds its reportable quantity. (Reportable quantities for hazardous substances are listed in 40 CFR §302.4 and 40 CFR Part 355.) Section 304(a) of the Emergency Planning and Community Right to Know Act, see 40 CFR §355.40, requires that accidental releases of hazardous materials be reported to the appropriate State Emergency Response Commission and Local Emergency Planning Committees if the release is greater than the reportable quantity.

The U.S. DOT has established requirements for the safe transport of hazardous materials. The Hazardous Materials Transportation Act of 1975 (49 U.S.C. 1801) gives the DOT authority to regulate shipments of hazardous materials by air, highway, or rail. The DOT regulations govern safety aspects of transporting hazardous materials, including packing, repacking, handling, labeling, marking, placarding, and routing.

3.4.3 Region of Influence

There are no municipal solid waste disposal facilities currently operating in Culberson County. Waste generated within the county is transported to one of eight disposal facilities under the jurisdiction of the Rio Grande Council of Governments, which is the regional municipal solid waste planning authority for Culberson and five adjoining counties in southwest Texas. [The Rio Grande Council of Governments includes Brewster, Culberson, El Paso, Hudspeth, Jeff Davis, Presidio counties in Texas and portions of Dona Ana County in New Mexico.] Total remaining landfill capacity in the state of Texas as of the end of 2003 was 1.15 billion cubic meters (1.51 billion cubic yards), of which 12 million metric tons (12 million tons) of capacity is within the Rio Grande Council of Governments area. (TCEQ 2004)

TCEQ periodically assesses the need for commercial hazardous waste management capacity for Texas-generated waste. A recent TCEQ needs assessment indicates the availability of hazardous waste treatment and disposal capacity is expected to exceed demand based on projected generation rates within the state of Texas. The estimated in-state demand for incineration of hazardous waste represents less than 40 percent of the available capacity at permitted commercial facilities located in the state of Texas. The in-state demand for hazardous waste landfill space represents less than one percent of the available permitted capacity in Texas. (TCEQ 2002) The projected demand for commercial hazardous waste management in Texas is concentrated along the upper Gulf coast and metropolitan areas such as Dallas-Ft. Worth. There is minimal demand or capacity for hazardous waste management in the immediate vicinity of the proposed site.

3.4.4 Existing Conditions

The only facilities currently on the proposed site are a trailer (with a portable generator) and several groundwater wells powered by windmills. Current activities at the proposed launch site require very limited use of hazardous materials (fuel for portable generator) or waste management. There is currently no hazardous waste or wastewater generation at the site. The small amount of solid waste generated (household garbage) is transported off site for disposal at existing facilities in the region.

3.5 Land Use (including Farmland and Section 4(f) Resources)

3.5.1 Definition of Resource

EPA defines land use as… ”the way land is developed and used in terms of the kinds of anthropogenic activities that occur (e.g., agriculture, residential areas, industrial areas).” (EPA 2003) Humans develop land for a variety of purposes that can include economic production, natural resource protection, or institutional uses. Land use in the U.S. is typically regulated in

some manner by land use plans, policies, or ordinances that stipulate the permissible uses within an area. Such land classification types can include agricultural, forestry, urban, inland water bodies, and other categories. Land use classifications are then often sub-classified for more specific purposes such as low-density residential or light industrial uses. (FAA 2001)

Regulations regarding land use can occur on a local, state, or Federal level to manage military installations, or to protect sensitive areas such as historic properties, prime or unique farmlands, national parks, wildlife refuges, or other areas that are afforded special status. However land use planning and regulations that designate acreages or parcels for residential, commercial, or industrial uses generally occur at the local and municipal levels. (FAA 2001)

3.5.2 Regulatory Setting

Land use management practices are subject to mandates of the controlling agency, while non-Federal lands are often subject to the collective guidance and regulations of local, county, and state entities. Land use management and planning approaches are intricate processes that seek to provide protection of resource values that may be present on site as well as off-site in the surrounding community. (FAA 2001)

The Farmland Protection Policy Act (FPPA) (7 U.S.C. 4201-4209) requires the cooperation of Federal agencies to minimize their contribution to the unnecessary and irreversible conversion of private programs and policies to protect farmland. For Blue Origin proposed launch operations, the launch site is located on private land and is privately funded; therefore, the FPPA does not apply.

FAA Order 1050.1E outlines significant impacts thresholds for Section 4(f) properties. As described in FAA Order 1050.1E, significant impacts would occur when a proposed action either involves more than a minimal physical use of a section 4(f) property or is deemed a "constructive use" substantially impairing the 4(f) property, and mitigation measures do not eliminate or reduce the effects of the use below the threshold of significance (e.g., by replacement in kind of a neighborhood park). Substantial impairment would occur when impacts to section 4(f) lands are sufficiently serious that the value of the site in terms of its prior significance and enjoyment are substantially reduced or lost. If there is a physical or constructive use, the FAA is responsible for complying with section 4(f) even if the impact is less than significant for NEPA purposes.

3.5.3 Region of Influence

Land use includes the land on and adjacent to the site, the physical features that influence current or proposed uses, pertinent land use plans and regulations, and land ownership and availability. The ROI for this EA includes the Corn Ranch and private land immediately surrounding the site located within the valley between the Delaware Mountains, and the Sierra Diablos.

3.5.4 Existing Conditions

The proposed launch facility lies within a large, privately owned property known as the "Corn Ranch." The Corn Ranch consists of desert scrubland and grassland that was settled in the late

19th century and used as ranch land until 2004. The Corn Ranch is now maintained by the property owner as a wildlife management area and for personal use.

The nearest towns to the Corn Ranch are Dell City, Texas (113 kilometers [70 miles]), Salt Flat (80 kilometers [50 miles]), Pine Springs (72 kilometers [45 miles]) and Nickel Creek (80 kilometers [50 miles]) to the north and Van Horn, Texas to the south (32 kilometers [20 miles]). State Highway 54 intersects Interstate I-10 in Van Horn. The only public access to the Corn Ranch is via State Highway 54.

Most of the land within a 40-kilometer (25-mile) radius of the proposed launch facility is privately owned. This land includes working farms and cattle ranches and former ranch properties that are now leased to groups of hunters and managed for game species, primarily mule deer. None of the ranches in the area raises significant number of cattle. The only industrial facilities in the general vicinity of the proposed launch facility are the Texas Architectural Aggregates Mine, approximately eight kilometers (five miles) to the west of the site, and the Delaware Mountain Wind Farm, approximately 16 kilometers (10 miles) to the northeast. The Texas Architectural Aggregates Mine is owned and operated by Texas Aggregates Incorporated; the Delaware Wind Farm is owned and operated by FPL Energy. A permanent easement for a natural gas pipeline owned by Kinder Morgan crosses the ranch approximately 24 kilometers (15 miles) north of the proposed launch site.

No state or county parks or recreation areas lie within 80 kilometers (50 miles) of the proposed launch site (Texas 2005). Guadalupe Mountains National Park (Texas) and Carlsbad Caverns National Park (New Mexico) are 35 and 60 kilometers (22 and 37 miles), respectively, north of the proposed launch site. Guadalupe Mountains National Park is a 348-square kilometer (86,000-acre) park that receives approximately 180,000 visitors annually. Carlsbad Caverns National Park, a 190-square kilometer (47,000-acre) park, receives more than 400,000 visitors annually. The Guadalupe Ranger District of the Lincoln National Forest lies immediately northwest of Carlsbad Caverns National Park. The Lincoln National Forest's three Ranger Districts cover more than a million acres in southeastern New Mexico.

3.6 Visual Resources

3.6.1 Definition of Resource

Visual resources are defined as natural and man-made features that constitute the aesthetic qualities of an area. Landforms, surface waters, vegetation and man-made features are the fundamental characteristics of an area that define the visual environment and form the overall impression that an observer receives of an area. (FAA 2004)

The importance of visual resources and any changes in the visual character of an area is influenced by social considerations, including the public value placed on the area, public awareness of the area, and community concern for the visual resources in the area. (FAA 2004)

The visual resources of an area and any proposed changes to these resources could be evaluated in terms of "visual dominance" and "visual sensitivity." Visual dominance describes the level of

noticeability that occurs as the result of a visual change in an area. Visual sensitivity depends on the setting of an area.

Visual Dominance. Proposed changes in the character of an area can be defined in terms of visual dominance. For example, if the users of the area would overlook the changes to the area's setting, then the changes would be "not noticeable." If the changes would be noticeable, but would be dominated by other features in the area's setting, then the changes would be "visually subordinate." A change that would compete with the visual character of an area is "visually co-dominant." Finally, a change that would detract from the character of the setting and would demand attention is "visually dominant." (FAA 2004)

Visual Sensitivity. Visual sensitivity depends on the particular setting in which the proposed action is to occur. Areas such as coastlines, national parks, recreation areas, and wilderness areas are areas of high visual sensitivity. In these areas, viewers tend to be aware of even very small changes in the visual environment. On the other hand, in the area of low sensitivity such as industrial areas, major changes can occur without undue notice to observers. (FAA 2004)

3.6.2 Regulatory Setting

Though dependent on physical location, many environments within the U.S. include regions of rich aesthetic and visual resources as well as designated and undesignated areas of great natural beauty and scenic diversity. Visual and aesthetic resources commonly fall under several different formal designations including national forest; national monument; national, state, or county parks; national wildlife refuges; wilderness areas; wild and scenic rivers; national trails; privately-owned land; and historic places and districts. Various roads also may be designated as scenic byways due to their scenic, historic, and cultural qualities. (FAA 2001)

3.6.3 Region of Influence

The ROI for visual resources includes the geographic area from which the launch site facilities and access roads may be seen. This would generally involve nearby higher elevations and public roadways (State Highway 54).

3.6.4 Existing Conditions

The Corn Ranch property encompasses a broad valley at elevation 1,097-1,189 meters (3,600-3,900 feet) above mean sea level with a northwest-southeast orientation. The Delaware Mountains rise to the east of the valley floor, and reach heights of approximately 1,737 meters (5,700 feet) (see Exhibit 3-7). The rugged and more picturesque Sierra Diablos rise more steeply to the west, and reach heights of approximately 2,042 meters (6,700 feet) (see Exhibit 3-8). The valley, which is approximately 16 kilometers (10 miles) wide, consists of desert scrubland and arid grassland historically used for cattle ranching. The most significant man-made feature of the area from a visual-aesthetic perspective is State Highway 54, a two-lane blacktop that connects Interstate 10 to State Highways 62 and 180 (Exhibit 3-9).

Exhibit 3-7. View of Proposed Launch Site Looking Northeast toward the Delaware Mountains from State Highway 54

Exhibit 3-8. View from the Ridge on Proposed Site Looking to the West toward the Sierra Diablo Mountains

Exhibit 3-9. State Highway 54 at the Corn Ranch Facing Northeast

A small number of ranch houses and outbuildings lie along the approximately 64 kilometers (40 miles) of Highway 54 that extend from the Beach Mountains, south of Corn Ranch to the Guadalupe Mountains, north of Corn Ranch. The existing conditions at the Corn Ranch would be rated as moderate to high visual sensitivity.

The boundary of the proposed Blue Origin launch site lies approximately five kilometers (three miles) east of Highway 54. The proposed launch site, which is roughly 10 kilometers (six miles) long by eight kilometers (five miles) wide (approximately 75 square kilometers [18,600 acres]), appears to be flat but its western boundary is actually several hundred feet lower in elevation than its eastern boundary. A low limestone ridge, approximately eight meters (25 feet) higher than surrounding land, parallels Highway 54 for several miles, screening motorists from much of the area where facilities would be sited.

The view in the foreground from State Highway 54 is of desert land with light green or brown grasses and dark green shrubs dotting the tan colored soil with an occasional black and green mesquite or yucca protruding above the shrubs (see Exhibit 3-7). The roadside is dotted with barbed wire fencing, gates, cattle pens, telephone/power poles and occasional road signs. In the background, the desert landscape fades to black and white and the Delaware Mountain range frames the horizon. Faint white shapes can be seen from the road on the desert. Typically, these are unimproved roads or one of the three ridges of limestone rock outcrops on the horizon.

In the mountains approximately 24 kilometers (15 miles) to the north of the proposed site there is a moderate size wind farm (Delaware Mountain Wind Farm). Only 7 to 10 windmills are visible from within the valley and they do not protrude above the mountain range. The windmills are only visible to the naked eye when the sun is setting in the west and visibility is moderate to high.

Military aircraft perform overflights of the valley at low level (152 to 610 meters [500 to 2000 feet]) on a daily basis. The military jets are generally heard before they are seen; the shapes/outlines of the aircraft are difficult to pick out against the mountain landscape. When they bank and cross the valley floor, they are immediately visible, however.

Current light sources include a dozen homes in the valley, vehicle headlights on State Highway 54 and warning lights on the Delaware Mountain Wind Farm.

3.7 Noise

3.7.1 Definition of Resource

Sound results when air or other media vibrate. The vibrations may be a combination of many frequencies to produce a complex sound. Humans are sensitive to vibrations with frequencies ranging from 20 to 20,000 cycles per second (hertz), with greatest sensitivity between 2,000 and 4,000 hertz. The energy of the vibrations is a measure of the "loudness" of the sound. Sound levels are measured in decibels (dB), which are calculated in mathematical terms from a ratio of the sound level to a reference sound level, which is generally the threshold of hearing. To make the decibel unit more applicable to the human response to sound frequencies, a variation of the unit has been created known as the A-weighted decibel (dBA). Another sound level weighting is the C-weighted scale (dBC) which emphasizes low frequency sounds. A remote desert environment generally has sound levels in the range of 22 to 38 dBA, whereas, an interstate highway interchange might have sound levels in the 55 to 70 dBA range. A low-level jet flyover could have sound approximately 100 dBA, depending on altitude and power level. Very large rocket launches such as the Space Shuttle have sound levels around 175 dBA at 50 feet from the test pad. Humans begin to experience pain at levels above 100 dBA. The Programmatic EIS for Licensing Launches (FAA 2001) has more complete information about sound and its measurement.

3.7.2 Regulatory Setting

Noise is primarily regulated through local noise ordinances, which are designed to protect noise sensitive areas (e.g., residential population centers and schools). Federally regulated noise standards are designed to protect worker safety, and various commercial standards address commercial aircraft noise.

The Occupational Safety and Health Administration (OSHA) regulation 1910.95 establishes a maximum noise level of 90 dBA for a continuous eight-hour exposure during a working day and higher levels for shorter exposure time in the workplace. The EPA has recommended an average equivalent noise level of 70 dBA for continuous 24-hour exposure to noise to protect hearing (EPA 1974). Noise also may be impulsive in nature. Under OSHA regulation 1910.95, exposure to impulse noise should not exceed 140 dBA. The 140 dBA threshold should be considered advisory rather than mandatory. The FAA regulates the noise associated with commercial aircraft at 14 CFR Part 36.

3.7.3 Region of Influence

Noise from the proposed action would affect the area surrounding the launch site and along State Highway 54. This region is a typical, remote, desert environment as described more thoroughly in other sections of this chapter.

3.7.4 Existing Conditions

The baseline noise levels in the region of the proposed launch site are those typical of a remote desert – approximately 22 to 38 dBA. (FAA 2001) There is occasional road noise on State Highway 54 and aircraft noise, from commercial jetliners and military aircraft. Road noise is intermittent and of low intensity, associated with car and light-truck traffic on the state highway. Commercial airliners occasionally pass overhead at 7,620 to 20,668 meters (25,000 to 35,000 feet) and are relatively unobtrusive. Military aircraft from Holloman Air Force Base, New Mexico, and other installations occasionally conduct low-level navigation flights over the Sierra Diablo and Delaware Mountain ranges and, depending on altitude and lateral distance, can produce noise levels high enough to startle animals and annoy humans. The Air Force has prepared an Environmental Impact Statement on the Holloman low-level flights, indicating maximum noise levels for five aircraft types ranging from 88 to 115 dBA at 152 meters (500 feet) altitude. (United States Air Force [USAF] 1998) There are no noise sensitive receptors within the ROI. The nearest noise sensitive areas are Guadalupe Mountains National Park and Carlsbad Caverns National Park. The southern boundary of Guadalupe Mountains National Park is 42 kilometers (26 miles) from the Blue Origin landing pad and 45 kilometers (28 miles) from the launch complex. The southern boundary of Carlsbad Caverns National Park is 64 kilometers (40 miles) from the Blue Origin landing pad and 68 kilometers (42 miles) from the launch complex.

3.8 Geology and Soils (including Floodplains)

3.8.1 Definition of Resource

Geology and soils are those Earth resources that may be described in terms of landforms, geology, and soil conditions. The makeup of geology and soils within a given physiographic region influences the occurrence of vegetation types, the presence of mineral or energy resources, the presence of ground water resources, and the potential for seismicity and associated risks such as earthquakes and landslides.

Geology

Geology is the study of the composition and configuration of the Earth's surface and subsurface features. The general shape and arrangement of a land surface, including its height and the position of its natural and man-made features, is referred to as topography. The topography of the land surface affects the general direction of surface water and ground water flow. Groundwater is stored and transmitted underground in aquifers that supply lakes and rivers and is often used for human purposes, such as drinking water and irrigation for crops.

Soils

Soil is defined as the surface layer of the Earth, composed of minerals and fine rock material disintegrated by geological processes and humus, the organic remains of decomposed vegetation. Soils and sediments are typically described in terms of their composition, slope, and physical characteristics. Differences among soil types in terms of their structure, organic and chemical properties, elasticity, strength, shrink-swell potential, and erosion potentially affect their ability to support or sustain agricultural, structural, filtration, and natural detoxification purposes. The U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) has classified over 20,000 types of soils in the U.S., including areas classified as prime and unique farmlands. Information pertaining to a given area's soil types is typically available from county soil surveys.

The three principal types of soil are clay, sand, and loam. Factors determining the nature of soil are vegetation type, climate, parent rock material, elevation, and the geological age of the developing soil. Soil and sediment characteristics vary significantly depending upon their physical location and can be compounded by environmental factors. For example, some soils in the U.S. are naturally more acidic than others in the country.

Floodplains

Based on definitions in Executive Order 11988 ("Floodplain Management;" 42 Federal Register 26951), there are no floodplains on the proposed launch site, only gullies and arroyos that convey water after thundershowers.

3.8.2 Regulatory Setting

Geology

No specific regulatory standards pertain to geology other than best management practices (BMPs) and building codes that must be adhered to within seismic zones.

Soils

While the USDA has designated specific soils as prime and unique farmlands, no additional regulations govern soils. State-implemented BMPs are in place to control erosion and prevent runoff and stream sedimentation.

3.8.3 Region of Influence

The Region of Influence for impacts to geology and soils is considered to be defined by the boundaries of the Blue Origin property. Because all proposed launches are to be vertical in nature, various engineering controls would ensure that these assumptions remain valid during launch and recovery activities.

3.8.4 Existing Conditions

3.8.4.1 Geology

The launch site is located in West Texas within the Trans-Pecos region of the Basin and Range Physiographic Province in West Texas. The Trans-Pecos region of West Texas encompasses the area west of the Pecos River, bounded on the south and west by the Rio Grande River. Evidence suggests that most of this region is underlain by Precambrian rocks. Cambrian to Pennsylvanian rocks crop out in this region. The rocks in the region represent a marine sequence caught between the North American continent and an unidentified continent during the Pennsylvanian Period and thrust onto the North American continent. Local deformation occurred during the Laramide Orogeny from Late Cretaceous to Early Tertiary. Late Tertiary extensional (rift) tectonics resulted in high angle normal faults creating the Basin and Range structures and related north-south trending mountains. Large basins formed between the ranges and were subsequently filled with thick gravel and sand eroded from the adjacent mountains. (Angle 2001)

The proposed launch site is located in the northern portion of the Wildhorse Flat sub-basin of the greater Salt Basin, a closed basin with surface drainage resulting from ephemeral streams and flowing toward the center of the basin. Underlying strata at the location are primarily of Permian age and consist mainly of limestone, dolomite, sandstone, and some siltstone. Salt Basin sediments are generally Late Tertiary and Quaternary sands, silts, clays, gravels, caliche, and evaporites. Overlying these deposits is unconsolidated alluvium including sands, silts, clay, and gravel. (Barnes 1979)

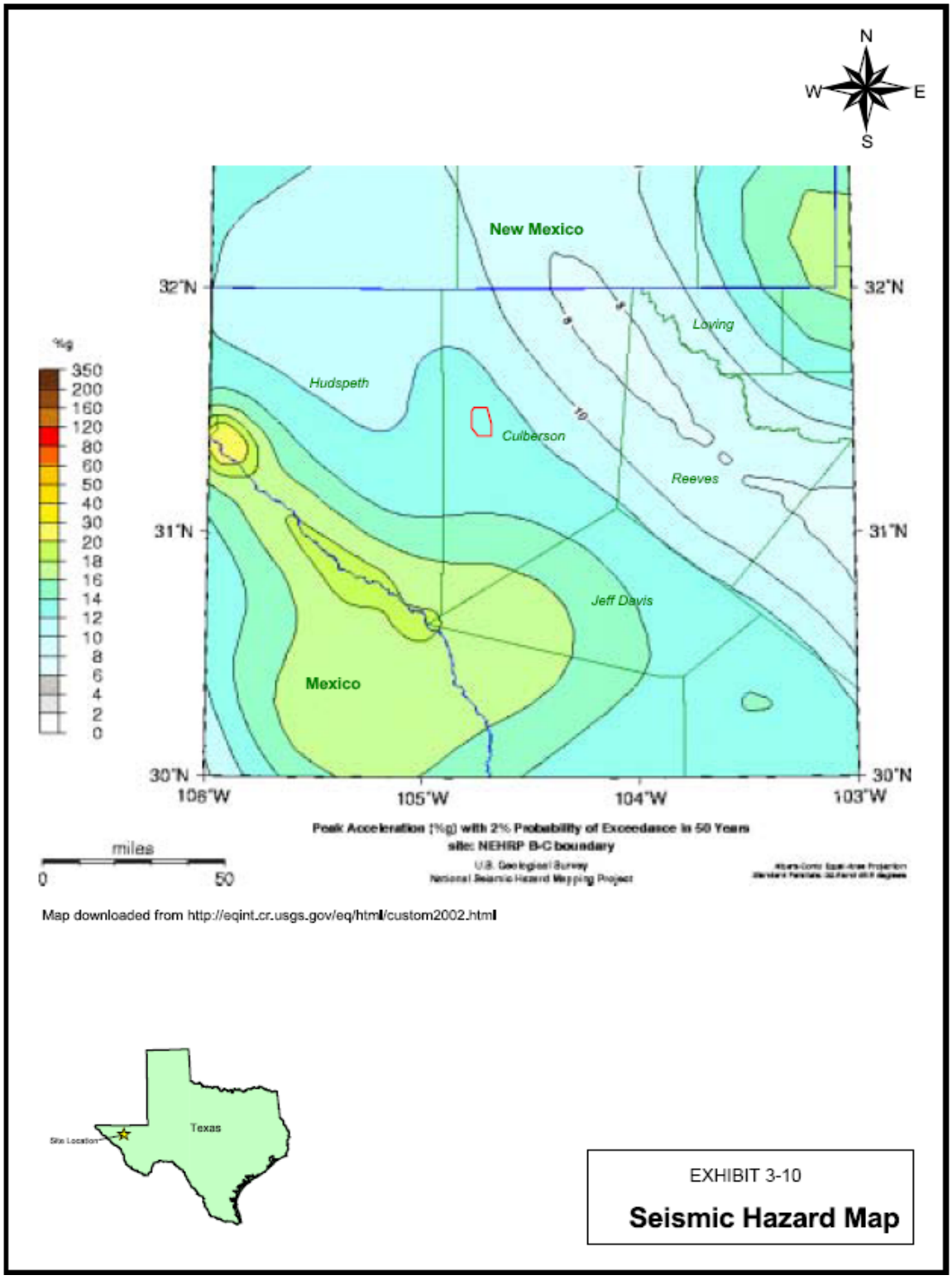
The extensional faulting that formed the Salt Basin is more extensive along the western margin of the basin and has resulted in subsidence, while the eastern margin acts as a hinge. Quaternary faults cutting the basin fill in the region are generally north or northwest trending, high angle normal faults and are mostly confined to the western margin of the bolson (a basin filled with sediments) and are more continuous in this area. These faults trend parallel to zones in Precambrian and Paleozoic rocks covered by the basin fill. There is no apparent evidence of faults cutting the basin fill within the site boundary.

3.8.4.2 Potential Natural Geologic Hazards

Occurrences of potential natural geologic hazards are listed below.

Seismicity – Seismic activity in this area is mostly associated with the Rio Grande Rift region west of the site. The strongest recorded earthquake in west Texas (magnitude 6 on the Richter scale) occurred in Valentine, Texas, about 97 kilometers (60 miles) southeast of the site, in 1931. The United States Geological Survey (USGS) National Seismic Hazard Mapping Project (NSHMP) map of Texas (USGS NSHMP 2002) shows that the peak acceleration expected at the site is 14-16%g with a 2% probability of exceedance in 50 years (Exhibit 3-10). This represents a relatively low risk from seismic activity. By contrast, the peak acceleration expected in the Albuquerque, New Mexico area is approximately 20%g with a 2% probability of exceedance in 50 years and the peak acceleration expected in the Salt Lake City, UT area is approximately 60%g with a 2% probability of exceedance in 50 years. Additionally, the facilities would be sited, designed, and built to prevent damage from a possible earthquake.

Exhibit 3-10. Seismic Hazard Map



Flooding – Although average annual rainfall is low (28 centimeters [11 inches] per year) (Larkin and Bomar 1983) at the launch site, and it would not be located in the 100-year floodplain (Federal Emergency Management Agency Flood Insurance Rate Map), localized flooding is possible. This is of most concern when associated with ephemeral streams. The terrain on which the facilities would be located slopes downward gently from east to west and there are well-defined drainage features that convey water from high to low areas. The potential for flooding in the proposed facility areas is low.

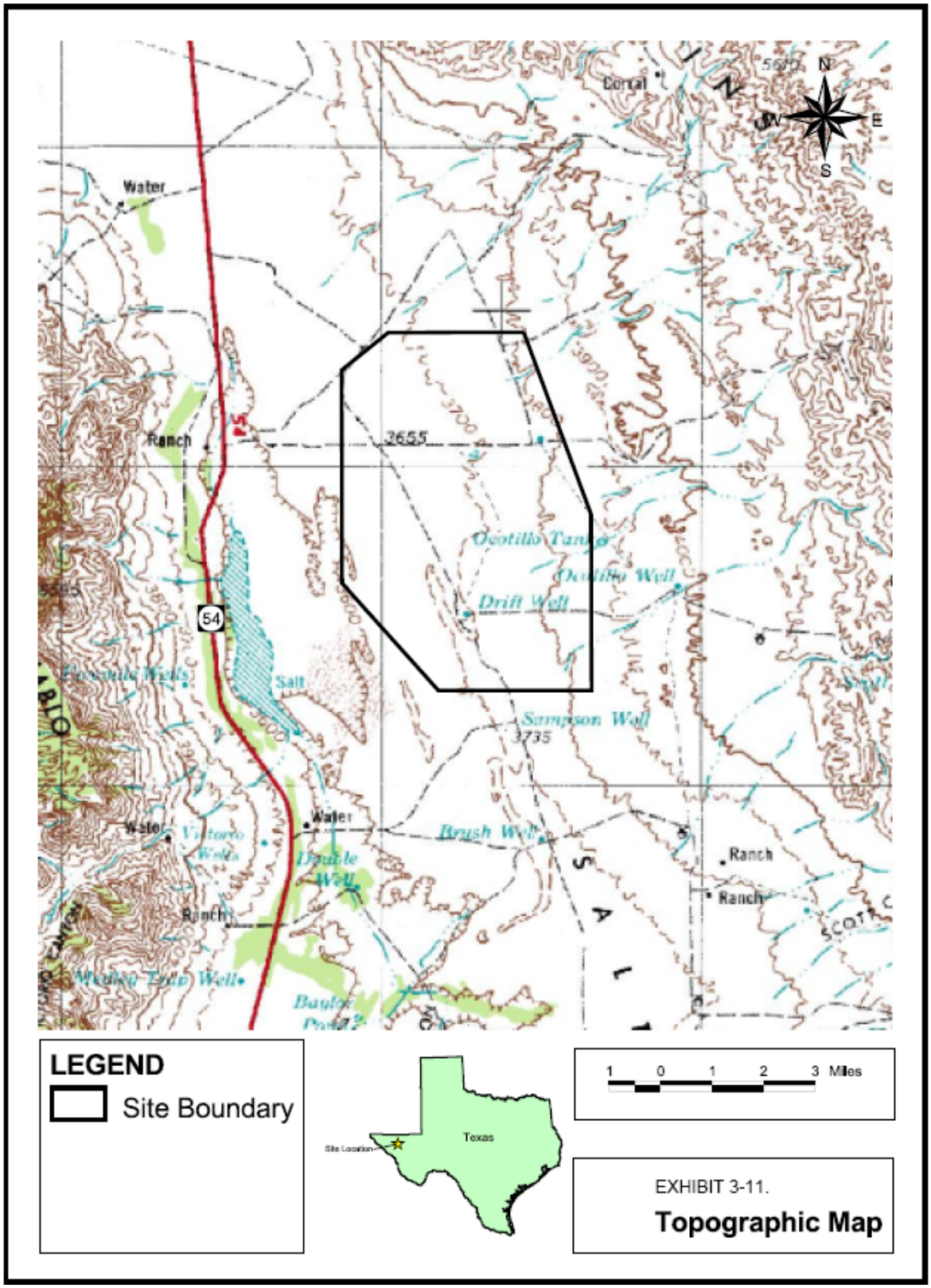
3.8.4.3 Soils

Soils at the proposed site fall into two broad classifications. Generally the Reakor-Verhalen association is found in the eastern portion of the site and the Holloman-Reeves association is found in the western portion. These soil associations are well to moderately well drained. About 50 percent of the Reakor-Verhalen association is Reakor soils composed of pink calcareous loam at the surface, underlain by light brown calcareous sandy loam, which is underlain by pink calcareous clay loam. Verhalen soils make up about 30 percent of this association and are comprised of grayish brown calcareous clay, underlain by brown calcareous clay, which is underlain by pink calcareous clay. Roughly 20 percent of this area is comprised of shallow soils, gravelly soils, and soils in the drainage ways. Holloman soils make up 60 percent of the Holloman-Reeves association and are comprised of pale brown calcareous clay loam, underlain by very pale brown calcareous strongly alkaline silt loam (approximately 70 percent of the volume of this layer is gypsum and calcium carbonate), underlain by brown calcareous strongly alkaline sandy clay loam. The Reeves soils make up about 25 percent of the association and are comprised of pale brown calcareous moderately saline sandy clay loam, underlain by light yellowish brown calcareous moderately saline silty clay loam, underlain by very pale brown calcareous moderately saline silty clay loam. The remaining soil is clayey overlying gypsum. (USDA-SCS 1991)

3.8.4.4 Topography

Topographic relief at the launch site is generally moderate (Exhibit 3-11) with an average slope of about 9.5 meters per kilometer (50 feet per mile). There is a fairly prominent ridge located in the southwestern portion of the site that separates the proposed facility locations from State Highway 54. Surface water generally flows from east to west in the area of the proposed launch site. On the infrequent occasions that it rains, water in the vicinity of the launch site would tend to flow to the west into the salt basin(s) between the site and State Highway 54. Runoff water from the Sierra Diablo Mountains would flow eastward into the same basin(s) and would not affect the launch site.

Exhibit 3-11. Topographic Map



3.9 Socioeconomics (including Natural Resources and Energy Supply)

3.9.1 Definition of Resource

Socioeconomics include the social and economic indicators that are specific to the human environment. For the purposes of this document, social indicators include statistical data related to population distributions, ethnicity, home ownership, medical facilities, educational facilities, and other public amenities. Economic indicators are used to assess the economic health of a community, as well as to make forecasts concerning future economic conditions. For the purposes of this document, key economic indicators include employment trends, unemployment rates, income levels, and housing characteristics.

Collectively, social and economic indicators are often referred to as socioeconomics. Much of the information that assists in evaluating the socioeconomic status of a given population is available from the U.S. Census Bureau on a national, state, or regional level. Site-specific socioeconomic data are available from the U.S. Census Bureau on a county, census block, and census tract level as well. More detailed information regarding a community's educational institutions, medical services, and local employment information is typically available from the state or county governmental offices such as local Chambers of Commerce and the Bureau of Economics.

FAA Order 1050.1E states that Executive Order 13123, Greening the Government Through Efficient Energy Management (64 FR 30851, June 8, 1999), encourages each Federal agency to expand the use of renewable energy within its facilities and in its activities. E.O. 13123 also requires each Federal agency to reduce petroleum use, total energy use and associated air emissions, and water consumption in its facilities. It is also the policy of the FAA, consistent with NEPA and the CEQ regulations, 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 environment, and sensitivity to the concerns of the traveling public. This is in keeping with section 102(2)(A) of NEPA, which requires all agencies to "...utilize a systematic interdisciplinary approach, which will ensure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking...."

3.9.2 Regulatory Setting

Socioeconomic conditions are regulated through a host of Federal programs that provide for equal opportunity, anti-discrimination, and accessibility, as well as state and local ordinances. There are no special purpose laws for natural resources and energy supply.

3.9.3 Region of Influence

For socioeconomic analysis purposes, the ROI is defined as the area in which the principal direct and secondary socioeconomic effects of site actions are likely to occur and are expected to be of the most consequence for local jurisdictions. Socioeconomic characteristics addressed at the Blue Origin West Texas Commercial launch site include employment, income, population,

housing, and community services. These characteristics are analyzed for a two-county ROI, Culberson and Hudspeth Counties in Texas, where it is expected that the majority of the temporary and permanent launch site employees would reside.

3.9.4 Existing Conditions

3.9.4.1 Employment and Income

The government sector employs the greatest number of workers in the ROI, providing 27.8 percent of employment. Other important sectors of employment include farming (18.5 percent); retail trade (13.5 percent); and services (10.7 percent). (BEA 2005) Exhibit 3-12 details the largest employment sectors in the ROI.

Exhibit 3-12. Largest Employment Sectors by Industry – 2003

Total Employment	Culberson	Hudspeth	ROI Total	
	1,480	1,399	2,879	**% of ROI**
Farm	176	357	533	18.5%
Retail	311	78	389	13.5%
Accommodation and food services	204	44	248	8.6%
Other services, except public administration	not available	59	59	2.0%
Government	370	430	800	27.8%
Total % of largest employment sectors			2,029	70.5%
Services			307	10.7%

Source: BEA 2005; TTNUS 2005

The labor force in the ROI decreased at an average annual rate of -0.9 percent between 1995 and 2004. The labor force in the State of Texas increased at an average annual rate of 1.7 percent over the same time period (BLS 2005). Exhibit 3-13 details employment trends in the ROI.

In 2004, employment in the ROI was 2,375, which constituted less than one percent of state employment (BLS 2005). Employment in the ROI decreased at an average annual rate of -1.2 percent between 1995 and 2004. At this rate, total employment in the ROI decreased at a slightly faster pace than the labor force. Employment in the State of Texas increased at an average annual rate of 1.7 percent over the same time period (BLS 2005).

Culberson County unemployment increased from 5.9 percent in 1995 to 7.9 percent in 2004. Hudspeth County unemployment increased from 2.0 percent in 1995 to 6.0 percent in 2004. The state-wide average unemployment remained unchanged at 6.1 percent in 1995 and in 2004 (BLS 2005).

Exhibit 3-13. Employment Trends

1995	Culberson	Hudspeth	ROI Total	Texas
Labor Force	1,280	1,485	2,765	9,572,436
Employment	1,205	1,456	2,661	8,985,635
Unemployment	75	29	104	586,801
Unemployment Rate	5.9%	2.0%	3.8%	6.1%
2004	**Culberson**	**Hudspeth**	**ROI Total**	**Texas**
Labor Force	1,108	1,440	2,548	11,035,379
Employment	1,021	1,354	2,375	10,362,982
Unemployment	87	86	173	672,397
Unemployment Rate	7.9%	6.0%	6.8%	6.1%
Labor Force % Change (average annual)	-1.5%	-0.3%	-0.9%	1.7%
Employment % Change (average annual)	-1.7%	-0.8%	-1.2%	1.7%

Source: BLS 2005; TTNUS 2005

Per capita income in 2003 was $15,522 in Culberson County and $16,482 in Hudspeth County. The average per capita income in the two-county ROI was $16,040, compared to the state of Texas average of $29,074. (BEA 2005)

3.9.4.2 Population

Between 1990 and 2004, the ROI population decreased from 6,322 to 6,027, an average annual decrease of -0.3 percent. Hudspeth County's population increased at an average annual growth rate of 0.9 percent, while Culberson County's population decreased at an average annual growth rate of -1.4 percent. (USCB 1990 and 2005) For the same period, the state of Texas grew at an average annual rate of 2.3 percent.

Culberson and Hudspeth counties are both among the 25 least densely populated counties in the continental U.S. Based on an estimated population of 6,027 in the two counties in 2004 and a two-county area of 21,714 square kilometers (8,384 square miles) (USCB 2005), the population density in the ROI is less than one person (0.7) per square mile. Roughly half of the ROI's estimated 6,027 residents live in the two county seats, Van Horn (Culberson County) and Sierra Blanca (Hudspeth County).

3.9.4.3 Housing

The number of housing units in the ROI was 2,792 in 2000, with 2,144 units occupied. (USCB 2000a; TTNUS 2005) There were a total of 648 vacant housing units in the ROI in 2000.

(USCB 2000a; TTNUS 2005) Of the 269 vacant units in Culberson County, 4.8 percent were for sale, 10.4 percent were for rent, and 32.3 percent were for seasonal, recreation, or occasional use. (USCB 2000a) Of the 379 vacant units in Hudspeth County, 8.2 percent were for sale, 12.7 percent were for rent, and 24.8 percent were for seasonal, recreation, or occasional use. (USCB 2000a) In 2000, the homeowner vacancy rate in the ROI ranged from 1.7 percent in Culberson County to 3.4 percent in Hudspeth County, while the rental vacancy rate ranged from 8.4 percent in Culberson County to 18.8 percent in Hudspeth County. (USCB 2000a) Culberson County's vacancy rates were comparable to the State of Texas rates of 1.8 percent homeowner vacancy and 8.5 percent rental vacancy. (USCB 2000a) Hudspeth County's rates were significantly higher.

3.9.4.4 Community Services

Schools

There are three school districts in the ROI serving 890 students. The Culberson County-Allamoore Independent School District has three schools to serve 620 students. The Dell City Independent School District has one school to serve 133 students. The Sierra Blanca Independent School District has one school to serve 137 students. (TEA 2004)

Medical Facilities

The ROI is served by the Culberson County Hospital District in Van Horn. The hospital has 14 beds, one full-time physician, one full-time physician's assistant, five to six registered nurses, and seven to ten licensed practical nurses. (Bates 2005) The hospital does not have surgical or obstetrics capabilities. Most residents travel to hospitals outside of the ROI for these services, usually to hospitals in El Paso, Texas. Other hospitals just outside of the ROI include (City-Data.Com Undated).

- Reeves County Hospital (Pecos, Texas)
- Carlsbad Medical Center (Carlsbad, New Mexico)
- Big Bend Regional Medical Center Home Health (Alpine, Texas)

Natural Resources and Energy Supply

The existing energy demands at the proposed site are met by the intermittent use of a diesel power generator. The current activities at the site do not require the use of water supplies.

3.10 Traffic and Transportation

3.10.1 Definition of Resource

Transportation as a resource relates to the manner in which goods, equipment, and people move to and from an area of interest.

3.10.2 Regulatory Setting

The Department of Transportation regulates transport of hazardous materials in 49 CFR Parts 171-179; however, there are no regulations affecting traffic other than local and state ordinances restricting speed and other vehicle operation parameters.

3.10.3 Region of Influence

The ROI for transportation includes Corn Ranch, the proposed launch site, and Texas Highway 54, the two-lane paved road that services both areas. Most goods, equipment, and people move to and from the area of the proposed launch site by road.

3.10.4 Existing Conditions

The proposed launch site is approximately 40 air kilometers (25 air miles) and 48 road kilometers (30 road miles) north of Van Horn. Access to the proposed launch site is from Texas Highway 54, which is approximately eight kilometers (five miles) west of the proposed project's center of operations. As depicted in Exhibit 1-1, Highway 54 runs north and south between Interstate Highway 10 to the south and U.S. Highways 62/180 to the north. Highway 54 is a two-lane, paved road with occasional driveway entrances to ranches, but no crossroads in the vicinity of the project.

Union Pacific operates a major rail line from El Paso to Dallas, approximately 40 kilometers (25 miles) to the south of the proposed site, running approximately parallel to I-10 and passing through Van Horn. El Paso, which is 193 kilometers (120 miles) west of Van Horn, is a hub for Union Pacific. There is a rail yard at Sierra Blanca, 105 kilometers (65 miles) west of Van Horn. Sierra Blanca is the location of the joining of the second intercontinental railroad in 1881. Sierra Blanca also has a junction with another Union Pacific line that runs to San Antonio, roughly paralleling Interstate 20. The nearest major air service is at El Paso International Airport, which serves several national and international passenger airlines and cargo carriers. There is a small county airport in Van Horn.

Traffic on Highway 54 is extremely light. In a recent (2004) traffic survey conducted by the Texas Department of Transportation, 180 vehicles per day passed a counting location on Highway 54 approximately 48 kilometers (30 miles) north of Van Horn. (Czerniak 2005) This equates to 7.5 vehicles per hour or one vehicle every eight minutes. Although a Level-of-Service analysis has not been performed, clearly traffic on Highway 54 can be characterized as free flow or Class A as defined by the National Research Council. (NRC 1985) No traffic noise measurements have been performed; however, the noise is typical of a remote setting with infrequent traffic (see Section 3.7). There is no traffic accident data for this highway, but given the infrequent traffic, the rate would be very small.

3.11 Water Resources (including Wetlands and Wild and Scenic Rivers)

3.11.1 Definition of Resource

The Texas Water Development Board (TWDB) defines major aquifers as those supplying large quantities of water in large areas of the state; minor aquifers typically supply large quantities of water in small areas or relatively small quantities in large areas.

3.11.2 Regulatory Setting

Drinking water quality, in this case ground water is regulated by the Texas Commission on Environmental Quality. The standards promulgated by this commission are written to comply with the Federal Safe Drinking Water Act and U.S. EPA's Primary Drinking Water Regulations. Property owners in Texas have the right to capture or use the ground water beneath their property (rule of capture), regardless of the effects on neighboring wells.

3.11.3 Region of Influence

The boundary of the underlying ground water body, the Wild Horse Flat of the West Texas Bolsons, defines the region of influence. The boundaries of this flat, shown in Exhibit 3-14, lie within Culberson County, Texas.

3.11.4 Existing Condition

3.11.4.1 Wetlands

There are no permanent, naturally occurring surface waters or open freshwater systems, or federally protected wetlands, as defined by section 404 of the Clean Water Act, on the proposed site. As a result, jurisdictional wetlands would not be affected by the proposed activities.

3.11.4.2 Wild and Scenic Rivers

The only river in Texas designated by the National Park Service as a wild and scenic river is a 307-kilometer (191-mile) stretch of the United States side of the Rio Grande River along the Mexican border beginning in Big Bend National Park. This wild and scenic river is not in the ROI for this project; therefore, impacts to the river are not considered in this EA.

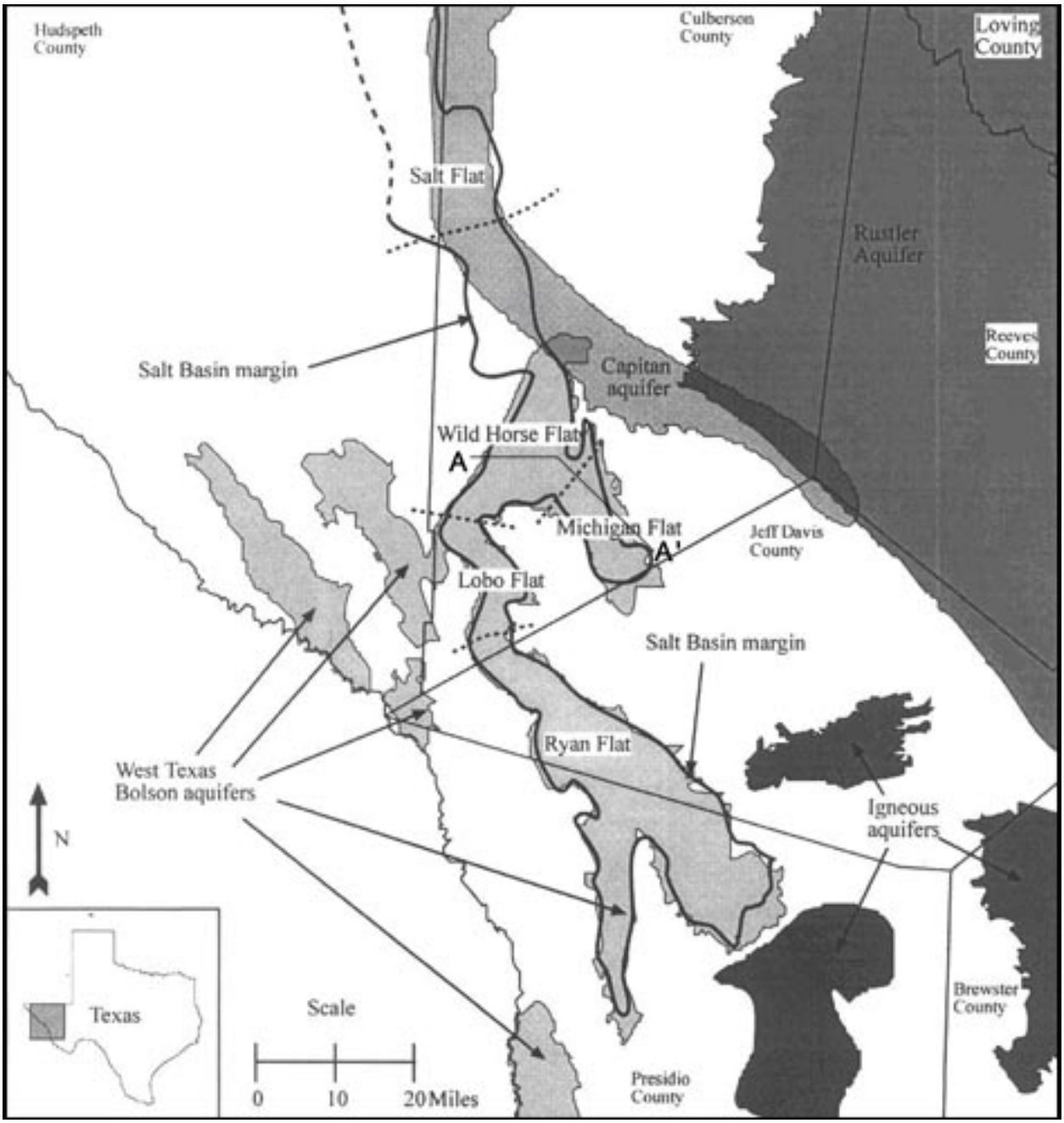
3.11.4.3 Aquifers

There are no major aquifers within approximately 80 kilometers (50 miles) of the proposed Blue Origin site. The site does lie over a minor aquifer, referred to as the West Texas Bolsons. (Ashworth and Hopkins 1995)

The West Texas Bolsons include several deep basins filled with erosional sediments of Quaternary and Tertiary age that contain variable quantities of ground water. These filled basins, or bolsons, include Red Light Draw, Eagle Flat, Green River Valley, Presidio-Redford, and Salt Basin. The easternmost basin, which is approximately 225 kilometers (140 miles) long and 40 kilometers (25 miles) across at its widest point, is the Salt Basin, which can be further subdivided

into four aquifer sub-basins; Wild Horse, Michigan, Lobo, and Ryan Flats (Exhibit 3-14). (Ashworth and Hopkins 1995) Ground water from the Salt Basin Bolson aquifer is the primary source of water supply where the aquifer exists. It provides the water supply for the communities of Van Horn, Sierra Blanca (purchased from Van Horn), and Valentine. The

Exhibit 3-14. Ground Water Hydrology

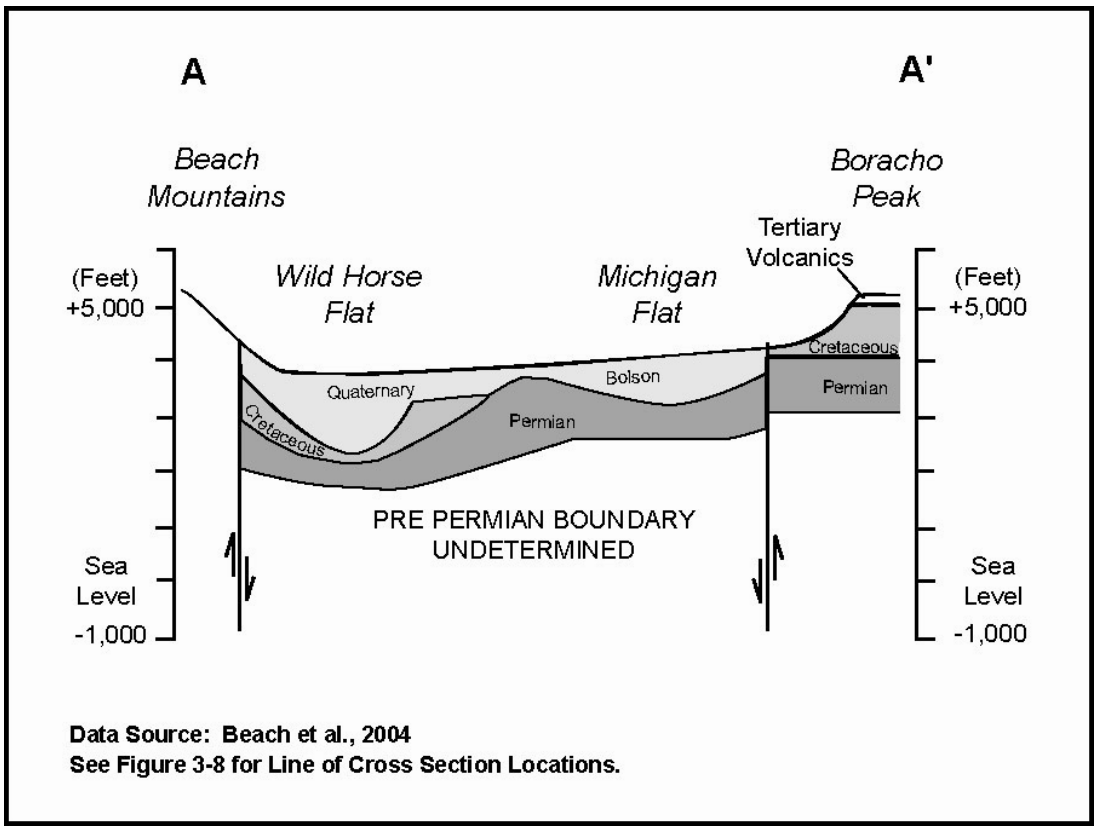


northern portion of the Salt Basin (north of Wild Horse Flats) is referred to as the Salt Flats and contains significantly more brackish to saline ground water than the portions to the south (Beach et al. 2004).

The proposed site is located in the northern portion of Wild Horse Flat, in Culberson County. With a gross lake evaporation rate, 213 centimeters (84 inches) per year, greatly exceeding the annual rainfall at the site, 28 centimeters (11 inches) per year, (Larkin and Bomar 1983) no perennial surface water is found in the Salt Basin (Angle 2001) nor in Culberson County. (CCGCD 2000) Ephemeral overland flow, which can result from locally intense rainfall activity or rainfall in the surrounding mountains, drains toward the center of the basin. (Angle 2001)

The Bolson sediments are on the order of 152 meters (500 feet) thick in the area of the site. Much of the Salt Basin Bolson to the south of Wild Horse Flat is underlain by tertiary igneous rocks, sometimes referred to as the Igneous Aquifer, which are in turn underlain by Cretaceous and Permian limestones. (Beach et al. 2004) However, the tertiary formation is absent in Wild Horse Flat and the Quaternary Bolson deposits are instead directly underlain by the Cretaceous and Permian hydrogeologic units. Exhibit 3-15 shows a geohydrologic east-west cross-section through Wild Horse Flat. (Beach et al. 2004) The location of the cross-section is indicated in Exhibit 3-15. The saturated portions of the Permian and Cretaceous limestones are sometimes included with the hydrologically connected basin fill under the designation of the Salt Basin Bolson aquifer.

Exhibit 3-15. Geohydrologic Cross-Section



Because of the high evaporation rates and relatively low vertical hydraulic conductivity, direct precipitation does not result in recharge of the West Texas Bolson aquifer in areas like the proposed Blue Origin site, where precipitation is less than 30 centimeters (12 inches) per year. (Beach et al. 2004) Recharge to Wild Horse Flat occurs around the margins of the basin and along channels of ephemeral streams. The net aquifer recharge rate is in the range of 1 percent (Gates et al. 1980) to 1.2 percent (Beach et al. 2004) of total precipitation. Ground water flows into Wild Horse Flat from the south, i.e., from Lobo Flat. (Angle 2001) Discharge from the basin is through leakage to underlying formations, pumping and basin outflow to the east, i.e., to Michigan Flat. (Gates et al. 1980, Angle 2001) Although ground water pumping for irrigation accounts for the greatest withdrawals from Wild Horse Flat, it has been on the decline over the past 20 years. There has been an overall water level decline of approximately 9 meters (30 feet) in Wild Horse Flat since 1950, due to the agricultural water pumping. This decline has slowed in response to the decreased pumping since the mid 1980s. (Angle 2001) There are approximately 1,365,000 acre-feet of fresh water and an additional 1,050,000 acre-feet of slightly saline water in Wild Horse Flat storage. Based on expected future use of the aquifer, recharge and cross-formational flow rates, it is projected that the amount of water in storage will be unchanged in the year 2050. (CCGCD 2000) This forecast is likely to be conservative in light of recently completed detailed modeling of ground water availability of the Salt Basin Bolson aquifer, in which it is projected that Wild Horse Flat water levels will rebound by as much as 6 meters (20 feet) by the year 2030, and then level out until the year 2050. (Beach et al. 2004)

The average hydraulic conductivity of Bolson sediments in Wild Horse Flat is approximately 15 feet/day, with values ranging from 5 to 33 feet/day. (Beach et al. 2004) Similar hydraulic properties have been found in the underlying cretaceous rocks. The recently completed ground water availability modeling included calibration of the model to determine hydraulic conductivity values in each model layer. It was found that appropriate values of horizontal and vertical hydraulic conductivity for Wild Horse Flat were 50 and 0.05 feet/day, respectively. The corresponding Cretaceous-Permian unit conductivities were 1 and 0.1 feet/day, respectively. (Beach et al. 2004) For 500 feet of Bolson thickness, the resulting transmissivity is 2,500 $feet^2$/day. This is within the range of transmissivity estimates of up to 9,900 $feet^2$/day. (Angle 2001)

Specific yield is the ratio of the volume of water sediment or rock will yield to its volume and is equivalent to effective porosity for an unconfined aquifer such as the Salt Basin Bolson Aquifer at Wild Horse Flat. A specific yield of 0.13 was estimated for the upper part of the basin fill, but 0.10 was estimated for the entire basin depth because deeper sediments have lower porosity. (Gates et al. 1980)

The Texas Water Commission has defined aquifer water quality in terms of dissolved-solids concentrations: fresh (less than 1,000 milligrams per liter); slightly saline (1,000 - 3,000 milligrams per liter); moderately saline (3,000 - 10,000 milligrams per liter); and very saline (10,000 - 35,000 milligrams per liter). (TWC 1989) Most Salt Basin Bolson Aquifer water is fresh. The exception to this is in Wild Horse and Michigan Flats, where slightly to moderately saline waters are more common. Of 189 data sampling points in the Salt Basin Bolson Aquifer, more than 25 percent of the water analyses had reported nitrate concentrations above the primary drinking water standard of 10 milligrams per liter as nitrate-nitrogen.

Wells in the Wild Horse Flat and Michigan Flat area tend to have higher transmissivity values (i.e., produce more water) when they are completed in the underlying Cretaceous formations rather than solely in the basin fill. (Angle 2001) Regardless of aquifer hydraulic characteristics, yields in existing wells are often a factor of well construction. Wells with the highest yields are typically those with the longest screen interval in the area where aquifer saturated thickness is greatest. (Beach et al. 2004)

Water from eight existing wells on and in the immediate vicinity of the proposed Blue Origin site was analyzed to characterize site specific ground water quantity and quality. An additional four wells (numbers 1, 2, 3, and 5 of Exhibit 3-16) were investigated but were dry and were not assessed further. All of the wells with water were finished in the Quaternary deposits of the Salt Basin Bolson aquifer. Installed well depths ranged from 40 to 92 meters (130 to 302 feet). Depths to the water table were mostly in the range of 25 to 40 meters (82 to 130 feet), with the water table reported at 73 meters (238 feet) at one well (number 4 of Exhibit 3-16) and 183 meters (600 feet) at another (number 7 of Exhibit 3-16). Depths to the water table in 1950 were available at wells number 6 and number 9. The elevation of the water table had decreased 4 and 5 meters (14 and 17 feet), respectively, in these two wells from 1950 to 2005. Measured flow rates in the eight assessed wells ranged from less than 4 to 227 liters per minute (1 to 60 gallons per minute).

Water from each of the eight capable wells was sampled in January 2005 for a suite of water quality parameters. It should be noted that only two of the wells (number 8 and number 10 of Exhibit 3-16) were maintained and in use. Total dissolved solids concentrations indicated water that was slightly saline at five of the wells, moderately saline at two of the wells (number 4 and number 6), and very saline at well number 16. Exhibit 3-17 reports the range of sampled parameters and comparisons with Texas Water Quality standards for public water systems. (TCEQ 2004) Water from well number 10 was slightly saline (1,370 milligrams per liter) but otherwise was within all water quality standards. Wells number 7, number 8, and number 9 were also slightly saline and exceeded only “three, two, and one, respectively,” additional secondary and/or action levels.

Exhibit 3-16. Well Locations Map

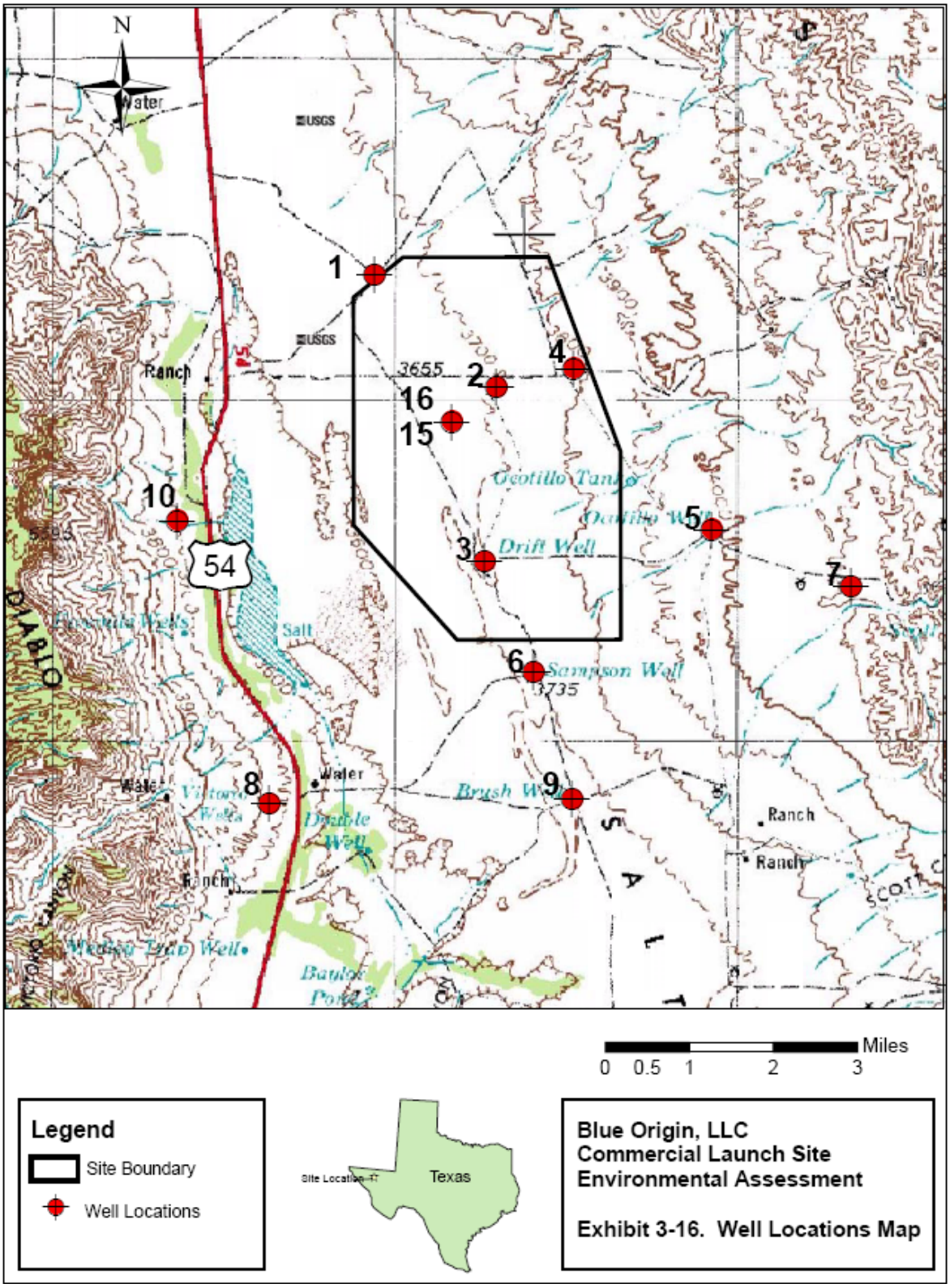


Exhibit 3-17. Ground Water Quality at Site Water Wells

Parameter	Measurement Range (milligrams/liter)	Texas Water Quality Standard (TCEQ 2004) (milligrams/liter)	Number of wells within standard (of 8 tested)
Total Coliform	All Detected	(a)	(a)
Fecal Coliform	ND-Detected	ND	7
Total Dissolved Solids	1340-16300	1000[b]	0
Gross Alpha Particles	5.31-50.4	15[c]	5
Gross Beta Particles	9.07-159	50[c]	7
Nitrates	ND-26.5	10	7
Aluminum	ND-6.02	0.2[b]	7
Arsenic	ND-0.007	0.05	8
Barium	ND-0.02	2	8
Calcium	42.1-592	NE	NE
Chromium	All ND	0.1	8
Copper	ND-0.23	1.3[d]	8
Iron	0.14-59.1	0.3[b]	2
Lead	ND-0.27	0.015[d]	5
Magnesium	34.1-828	NE	NE
Manganese	ND-2.57	0.05b	4
Nickel	All ND	0.1	8
Silver	All ND	0.1[b]	8
Sodium	4.7-3910	NE	NE
Beryllium	All ND	0.004	8
Zinc	0.04-22.5	5[b]	7
Total Hardness	618-4890	NE	NE

[a] No more than one positive sample per month if fewer than 40 samples per month are taken; only one sample taken in 6 of the 8 wells
[b] Secondary standard; water exceeding this standard can be used (with written approval from the Texas Commission on Environmental Quality) until such time as water can be supplied meeting this standard at a reasonable cost
[c] Units of picocuries per liter
[d] Action level; actions for small water systems could include further monitoring and public notification
ND = none detected
NE = no established standards

3.12 Airspace

3.12.1 Definition of Resource

Airspace is the defined space above a nation that is under its legal control. Airspace is limited horizontally, vertically, and temporally. The FAA designs and manages the national airspace based on guidelines from the Federal Aviation Regulations. The FAA has developed specific classifications for airspace to establish limits on its use. These classifications include Controlled, Uncontrolled, and Special Use airspace; military training routes; en route airways and jet routes; airports and airfields; and air traffic control. The types of airspace are dictated by the number and type of aircraft that are predicted to use the airspace, the nature of the operations conducted within the airspace, the required level of safety, and the level of national and public interest in the airspace. The FAA manages commercial and general aviation activity within the airspace and the military, with FAA oversight, manages military aviation activity within Special Use and Other airspace.

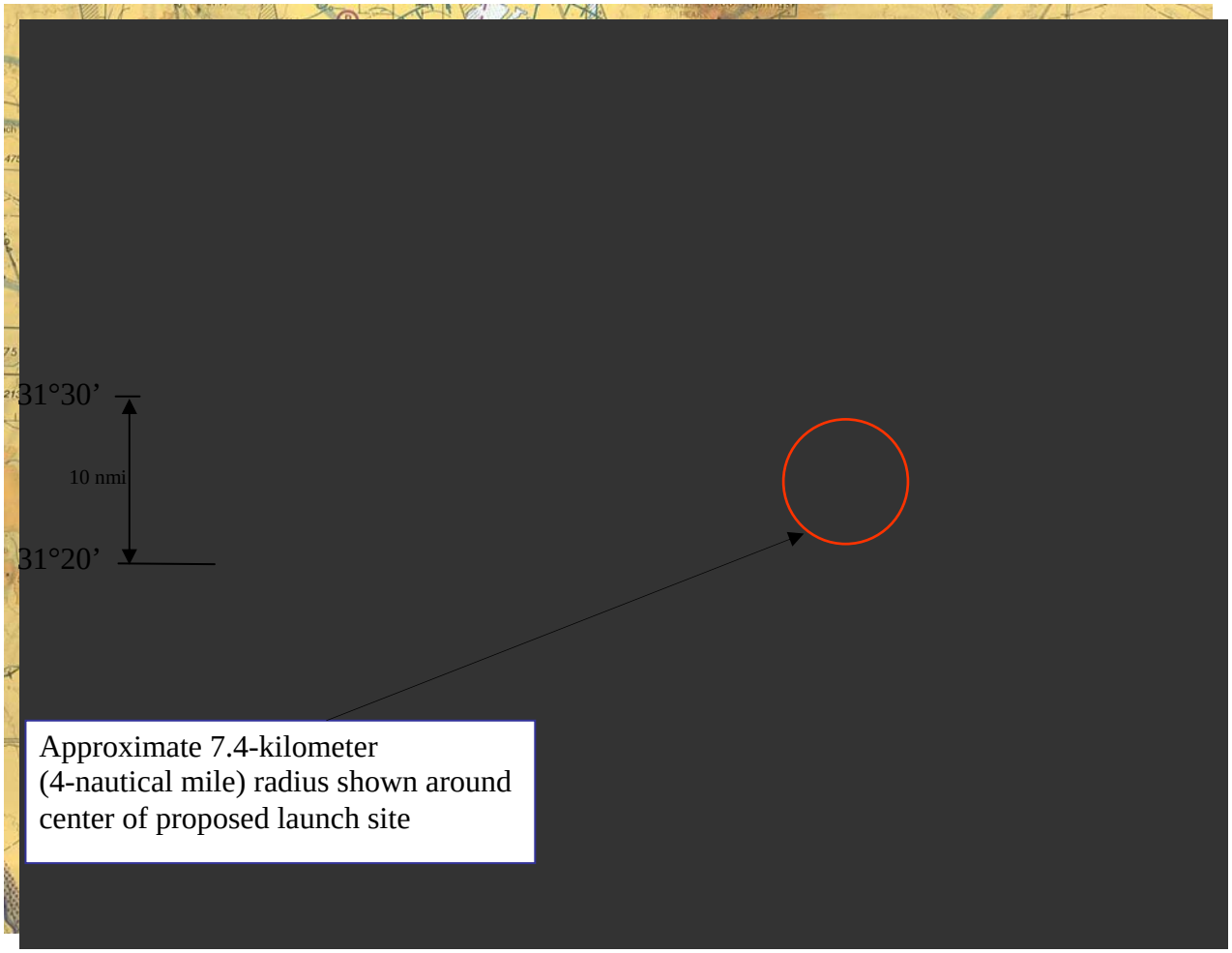
3.12.2 Regulatory Setting

Use of the airspace above the potential launch site is regulated by the Federal Aviation Administration pursuant to its regulations at 14 CFR§71.

3.12.3 Region of Influence

The ROI is defined as the airspace within a 7.4-kilometer (4-nautical mile) radius of the proposed launch site, which extends outside of Blue Origin's property in all directions (see Exhibit 3-18).

Exhibit 3-18. Airspace Usage



Adopted from El Paso Sectional Aeronautical Chart (75th Edition, 4 August 2005) (NACO 2005)

3.12.4 Existing Conditions

Air traffic within a 7.4-kilometer (4-nautical mile) radius of the test pad has been examined using data provided by FAA Air Traffic Control. During the period December 12, 2005 through December 16, 2005, aircraft tracks through this airspace ranged from 102 to 129 per day. The majority of these aircraft, 92 to 122 per day, were non-military. The Department of Defense currently notes two low-level training routes that pass within a 7.4-kilometer (4-nautical mile) distance of the proposed launch site, 1R 102 and 1R 194. Commercial air-route V-198 also passes within a 7.4-kilometer (4-nautical mile) radius of the proposed launch site.

3.13 Environmental Justice

3.13.1 Definition of Resource

Environmental justice has been defined as 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. (EPA 2002) Concern that minority and/or low-income populations might be bearing a disproportionate share of adverse health and environmental impacts led President Clinton to issue an Executive Order (EO) in 1994 to address these issues. That Order, EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," directs Federal agencies to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. The Presidential Memorandum that accompanied EO 12898 emphasized the importance of using existing laws, including NEPA, to identify and address environmental justice concerns, "including human health, economic, and social effects, of Federal actions." When conducting NEPA evaluations, FAA incorporated environmental justice considerations into both its technical analyses and its public involvement program in accordance with U.S. EPA and CEQ regulations.

3.13.2 Regulatory Setting

The CEQ, which oversees the Federal government's compliance with EO 12898 and NEPA, subsequently developed guidelines to assist Federal agencies in incorporating the goals of EO 12898 in the NEPA process. This guidance, published in 1997, was intended to "…assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed." The 1997 CEQ guidance does not provide a standard approach or formula for identifying and addressing environmental justice issues. Instead, it offers Federal agencies general principles for conducting an environmental analysis under NEPA.

- Federal agencies should consider the population structure in the ROI to determine whether minority populations, low-income populations, or Indian tribes are present, and if so, whether there may be disproportionately high and adverse human health or environmental effects on any of these groups.

- Federal agencies should consider relevant public health and industry data concerning the potential for multiple or cumulative exposure to human health or environmental hazards in the affected population and historical patterns of exposure to environmental hazards, to the extent such information is available.

- Federal agencies should recognize the interrelated cultural social, occupational, historical, or economic factors that may amplify the effects of the proposed agency action. These would include the physical sensitivity of the community or population to particular impacts.

- Federal agencies should develop effective public participation strategies that seek to overcome linguistic, cultural, institutional, and geographic barriers to meaningful participation, and should incorporate active outreach to affected groups.

- Federal agencies should assure meaningful community representation in the process, recognizing that diverse constituencies may be present.

- Federal agencies should seek tribal representation in the process in a manner that is consistent with the government-to-government relationship between the U.S. and tribal governments, the Federal government's trust responsibility to federally-recognized tribes, and any treaty rights.

3.13.3 Region of Influence

The ROI for environmental justice consists of the census tracts surrounding the launch site. These census tracts were targeted because they capture any potential impacts caused by the major resource areas/disciplines of the project including geology and soils, water, air quality, biological, cultural, land use and recreation, transportation, visual, noise, socioeconomics, health and safety, and waste management during both the construction and operations phases of the proposed action. The socioeconomic ROI is the largest and, therefore, bounding ROI. Additionally, because of the large concentration of Hispanic and Latino populations in the region, Culberson and Hudspeth Counties were chosen as the geographic areas of comparison for this analysis. Using the entire state of Texas would serve to artificially inflate the minority populations in the targeted census tracts.

3.13.4 Existing Conditions

3.13.4.1 Minority Populations

For the purpose of this evaluation, minority refers to people who classified themselves in the 2000 U.S. Census Bureau (USCB) as Black or African American, Asian or Pacific Islander, American Indian or Alaskan Native, Hispanic of any race or origin, or other non-White races. (CEQ 1997) The CEQ identifies these groups as minority populations when either (1) the minority population of the affected area exceeds 50 percent or (2) the minority population percentage in the affected area is meaningfully greater than the minority population percentage in the general population or appropriate unit of geographical analysis.

Demographic information from the USCB was used to identify minority populations in the region of influence. Information on locations and numbers of minority populations was obtained from the 2000 U.S. Census. Census data is reported on the level of census tracts, a geographical area that varies with size depending largely on population density (low-population density census tracts generally cover larger geographical areas).

As shown in Exhibit 3-19, for Culberson County, the aggregate of minority races is 31.1 percent. Persons of Hispanic or Latino origin (ethnicity) accounted for 72.2 percent of the total County population (see table footnote). White persons accounted for 68.9 percent of the total County population. None of the 2000 minority populations for the two census tracts are meaningfully greater than the corresponding minority population in Culberson County. Census Tract 9502's Hispanic ethnicity population does exceed 50 percent of the total Census Tract 9502 population. However, the concentration of the Hispanic population in Census Tract 9502 is similar to that of Culberson County.

Exhibit 3-19. Census 2000 Racial and Ethnic Characteristics

Race	Culberson County	Census Tract 9501	Census Tract 9502	Hudspeth County	Census Tract 9501	Census Tract 9502
Total Population, 2000	2,975	330	2,645	3,344	2,572	772
White – alone	68.9%	90.6%	66.2%	87.2%	87.1%	87.8%
Black or African American – alone	0.7%	0.9%	0.7%	0.3%	0.4%	0.0%
American Indian or Alaska Native – alone	0.5%	0.0%	0.5%	1.4%	0.9%	3.0%
Asian – alone	0.6%	0.9%	0.5%	0.2%	0.2%	0.1%
Native Hawaiian or Other Pacific Islander – alone	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Some other race alone	27.1%	5.2%	29.9%	8.8%	10.0%	4.7%
Two or more races	2.2%	2.4%	2.2%	2.1%	1.4%	4.4%
Aggregate minority population	31.1%	9.4%	33.8%	12.8%	12.9%	12.2%
Hispanic – of any race[a]	72.2%	30.9%	77.4%	75%	78.8%	62.3%

Source: USCB 2000b

[a] The USCB complies with the Office of Management and Budget (OMB) standards for maintaining, collecting, and presenting data on race, which were revised in October 1997. They generally reflect a social definition of race recognized in this country. They do not conform to any biological, anthropological or genetic criteria. In accordance with the OMB definition of ethnicity, the USCB provides data for the basic categories in the OMB standards: Hispanic or Latino and Not Hispanic or Latino. In general, the USCB defines ethnicity or origin as the heritage, nationality group, lineage, or country of birth of the person or the person's parents or ancestors before their arrival in the United States. People who identify their origin as Spanish, Hispanic, or Latino may be of any race. According to the revised OMB standards noted above, race is considered a separate concept from Hispanic origin (ethnicity).

As shown in Exhibit 3-19, for Hudspeth County, the aggregate of minority races is 12.8 percent. Persons of Hispanic or Latino origin (ethnicity) accounted for 75 percent of the total County population (see table footnote). White persons accounted for 87.2 percent of the total County population. None of the 2000 minority populations for the two census tracts in Hudspeth County are meaningfully greater than the corresponding minority population in Hudspeth County. The Hispanic ethnicity populations in Census Tracts 9501 and 9502 do exceed 50 percent of the total populations for those census tracts. However, the concentrations of the Hispanic populations in these census tracts are similar to the concentration of the Hispanic population in Hudspeth County.

3.13.4.2 Low-Income Populations

Environmental justice guidance defines low-income using statistical poverty thresholds used by the USCB. USCB low-income households in each census tract were divided by the total

households for that tract to obtain the percentage of low-income households per tract. Exhibit 3-20 identifies the low-income census tracts in the region of interest. As shown in Exhibit 3-20, 25.5 percent of households are below the poverty level in Culberson County and 32.9 percent of households in Hudspeth County are below the poverty level.

Exhibit 3-20. Percent of Households below Poverty Level

Race	Culberson County	Census Tract 9501	Census Tract 9502	Hudspeth County	Census Tract 9501	Census Tract 9502
Number of Households	1,060	142	142	1,100	810	290
Percent of households below the poverty level	25.5%	7.7%	7.7%	32.9%	38.3%	17.9%

Source: USCB 2000c

None of the census tracts in the study area meets the two CEQ criteria for identification. The percentages of low-income households in the two census tracts do not exceed 50 percent of their total household populations, and their percentages are not meaningfully greater than the corresponding percentages for low-income households in Culberson and Hudspeth Counties.

3.13.4.3 Migrant Workers and Transient Populations

Farming (18.5 percent); retail trade (13.5 percent); and services (10.7 percent) are the major employment sectors in the ROI, accounting for over 42 percent of all jobs. While actual numbers are difficult to obtain because of the nature of transient populations, it is assumed that the migrant farm and service worker population may also be large. Additionally, it is estimated that a large percentage of the farm and service worker population migrates in from Mexico.

3.14 Health and Safety

3.14.1 Definition of Resource

Health and safety includes consideration of any activities, occurrences, or operations that have the potential to affect the well being, safety, or health of workers or members of the general public. Overall public health and safety is controlled by a host of legislation that regulates transportation of hazardous cargo, provides for the protection of workers in the work place, protects the public from exposure to hazardous materials, and provides for emergency preparedness.

3.14.2 Regulatory Setting

OSHA regulations and NASA Safety Program requirements are applicable as well as the FAA regulations at 14 CFR Parts 400-450.

3.14.3 Region of Influence

The Health and Safety ROI includes all persons who could potentially be affected by activities at the launch site. This includes both site workers and members of the public traveling along State Highway 54.

3.14.4 Existing Conditions

There is one employee currently assigned to the proposed Blue Origin site. Current activities at the proposed launch site require very limited use of hazardous materials (fuel for portable generator) or waste management. There is currently no hazardous waste or wastewater generation. Therefore, there are no safety and health risks to workers or members of the public associated with the proposed Blue Origin site.

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4 ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental consequences of the proposed action and the no action alternative, as described in Chapter 2. The analyses are based on information from Chapter 2, descriptions of the existing environment in Chapter 3, and other information described or referenced in this chapter. Both direct and indirect impacts are considered in the EA. Direct impacts are those caused by the proposed action that occur at the same time and place (or immediately thereafter). Direct impacts of a large development project could include construction-related impacts such as soil erosion and disturbance of wildlife or operations-related impacts such as emissions of air or water pollutants. Indirect impacts are those that occur later in time, but are still reasonably foreseeable. Indirect impacts could include strains on infrastructure or public services resulting from population growth associated with a large development project.

The safety and health of the general public could be affected by the proposed action; however, due to the remote location of the Culberson County, Texas launch site, the potential to affect the public would be limited to in-flight emergencies. The closest public area to the launch site activities would be more than eight kilometers (five miles) from the test pad and recovery areas. The FAA will consider credible accident scenarios during a RLV Systems Safety Review conducted by AST, as part of a licensing determination.

4.1 Air Resources

4.1.1 Proposed Action

Impacts to ambient air quality would occur from the construction and operation of the proposed launch site. As discussed in more detail in the following paragraphs, launch site impacts on air resources would be *de minimis*. Because the proposed launch site is located in an air quality control region that has always been in attainment with Federal and state ambient air quality standards, an analysis of conformity under the CAA Section 176(c) is not required.

4.1.1.1 Construction

Construction activities potentially affecting air quality include the clearing of land, operation of heavy-duty construction equipment, the temporary operation of a cement batch plant, and on site vehicle travel on unsurfaced roads. Exhaust emissions from these sources would result in releases of the following criteria pollutants: nitrogen oxides (NO_X), sulfur oxides (SOx), CO, particulate matter less than or equal to 10 microns in diameter (PM_{10}), and volatile organic compounds (VOCs). The calculation of emissions from construction equipment was based on emission factors provided in the U.S. EPA document AP-42, “Compilation of Air Pollutant Emission Factors” (EPA 1992). For highway vehicles (i.e., worker commuting vehicles and delivery vehicles) emission factors were obtained from the EPA Mobile Source Emission Factor Model, MOBILE6.2. (EPA 2002)

Air quality analyses were also based on engineering estimates that approximately 28,428 square meters (306,000 square feet) of floor space would be constructed and 3 square kilometers (760 acres) of land would be disturbed during construction. Material requirements include approximately 7,646 cubic meters (10,000 cubic yards) of concrete and 9,175 cubic meters

(12,000 cubic yards) of aggregate. The construction project would be completed in approximately 12 months based on the assumption that construction would occur with two shifts per day, six days per week and would involve conventional construction and earth-moving equipment (e.g., bulldozers, graders, excavators, dump trucks). Most land clearing and soil transfer operations would take place during the first six months of the construction project (see Exhibit 4-1).

Exhibit 4-1. Construction Equipment On site by Type and Number per Month

Equipment	Rated HP	Construction Month											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Bulldozers	155	2	2	2	2	1	0	0	0	0	0	0	0
Excavators/Trench Machines	145	2	2	2	2	1	0	0	0	0	0	0	0
Road Graders	147	3	3	3	3	3	1	1	1	0	0	0	0
Front-end loaders/backhoes	115	3	3	3	3	3	3	2	2	1	1	1	1
Dump Trucks	250	5	10	10	10	5	5	2	2	2	2	1	1
Rollers	130	0	2	2	2	2	2	2	2	0	0	0	0
Water Trucks	250	0	2	2	2	2	2	2	2	0	0	0	0
Compactors	145	0	1	1	1	1	1	0	0	0	0	0	0
Concrete Trucks	250	0	5	5	5	5	5	0	0	0	0	0	0
Utility Trucks-1/2 Ton	200	5	10	10	10	10	5	5	5	11	11	11	11
Utility Trucks-1 Ton	225	5	5	10	10	10	5	5	5	2	2	0	0
Utility Crane-5 Ton	194	0	1	1	1	1	1	1	1	1	1	1	0
Forklifts	130	0	0	1	1	1	1	1	1	1	1	1	1
Man-lifts	80	0	0	0	0	0	2	2	2	2	1	0	0

Note: Assumed fork lifts and man lifts operated 6 hours per day. Assumed all other equipment operated 10 hours per day. To calculate total number of hours each equipment type would operate, per month multiply table value by 144 (forklifts/manlifts) or 240 (all other equipment).

Fugitive dust generated during land clearing and soil transfer operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. A common procedure to estimate emissions from an entire construction project is to use the EPA emission factor of 1.2 tons per acre per month of activity. (EPA 1992) This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM_{10}. (EPA 1992) It

was also assumed that water would be applied to disturbed areas. This would reduce emissions by about 50 percent. Facility construction could include a concrete batch plant at the project site. Particulate matter consisting primarily of cement dust would be the only regulated pollutant emitted in the concrete mixing process. The cement batch plant would incorporate particulate control techniques such as the enclosure of conveyors and elevators, filters on storage bin vents, and the use of water sprays. Emission factors for the concrete batch plant were obtained from AP-42. (EPA 1992)

The estimated maximum annual pollutant emissions resulting from construction activities are presented in Exhibit 4-2. Actual construction emissions are expected to be less, because conservative emission factors and other conservative assumptions were used in the modeling of construction activities and tend to overestimate impacts. To estimate the impact to the local air quality, Exhibit 4-3 provides a comparison of anticipated emissions from construction activities to baseline emissions from Culberson County.

The maximum concentrations of pollutants at the launch site property line that would be associated with construction activities were estimated using EPA's SCREEN3 model. (EPA 1995) As shown in Exhibit 4-4, the estimated increases in ambient background concentrations due to proposed construction activities would be less than NAAQS. Impacts are expected to be localized and short-term.

Exhibit 4-2. Estimated Maximum Annual Emissions of Criteria Pollutants from Construction at the Launch Site

Source	PM_{10} (tons)	SO_2 (tons)	CO (tons)	NO_2 (tons)	VOC[a] (tons)
Site Preparation	342	---	---	---	---
Concrete Batch Plant	0.09	---	---	---	---
Equipment Engines	6.35	2.44	29.04	130.06	7.63
Aggregate Transfer	0.04	---	---	---	---
Personal Vehicles	0.02	0.004	7.56	0.88	0.54
Total	348.50	2.44	36.60	130.94	8.18

[a] VOCs contribute to the formation of ground level O_3

Exhibit 4-3. Comparison of Maximum Annual Emissions from Construction to Culberson County Baseline Conditions

Source	PM_{10} (tons)	SO_2 (tons)	CO (tons)	NO_2 (tons)	VOC[a] (tons)
Site construction	348.50	2.44	36.60	130.94	8.18
Culberson County Baseline	990	57.48	5120.14	2275.4	716.67
Net Increase Over Baseline (%)	35.2%	4.2%	0.7%	5.8%	1.10%

[a] VOCs contribute to the formation of ground level O_3

Exhibit 4-4. Comparison of Predicted Maximum Downwind Concentrations Due to Construction Activities to NAAQS

Pollutant	Averaging Time	NAAQS[a] ($\mu g/m^3$)	Maximum Incremental Concentration Increase[b] ($\mu g/m^3$)	Incremental Concentration Increase as Percent of NAAQS (percent)
CO	8-hour	10,000	0.04	0.00040
	1-hour	40,000	0.05	0.00013
NO_X	Annual	100	0.01	0.01
SOx	Annual	80	0.05	0.06
	24-hour	365	0.25	0.07
	3-hour	1,300	0.56	0.04
PM_{10}	Annual	50	0.07	0.14
	24-hour	150	0.35	0.23

[a] The more stringent of the Federal and state standards is presented if both exist for the averaging period.
[b] Increase in ambient air concentrations estimated using EPA's SCREEN3 model

4.1.1.2 Operation

Lower Atmosphere

Operational emissions would result from use of personal vehicles to access the site and diesel generators that provide electric power for the launch site, as well as from the launch vehicle during liftoff. In the first five months of operation, the diesel generators might be used to provide 750 kilowatts of sustained electric power during day-to-day operations and 1.2 megawatts of electric power during launch operations (5 launches-10 hours per day). During

non-working hours the generators might provide 100 kilowatts of electric power. At some point during and after the first five months of operation the generators would be used for emergency power during launches. Performance verification testing would be conducted once per month for a period not to exceed 10-hours. The estimated maximum annual pollutant emissions resulting from normal launch activities are presented in Exhibit 4-5. The maximum concentrations of pollutants at the launch site property line that would be associated with these launch activities were estimated using EPA's SCREEN3 model. (EPA 1995) The estimated increases in ambient background concentrations due to launch site operations would be negligible. Increases in ambient background concentrations in the Guadalupe Mountains National Park and Carlsbad Caverns National Park would be considerably smaller resulting in a negligible, less than significant impact on visibility.

Upper Atmosphere

The propellants that would be used for launches at the proposed launch site include hydrogen peroxide and kerosene. Using these propellants, the CO_2 emissions would be the most significant. (FAA 2001) For an assumed 52 launches per year in 2010, a total of 1,060 tons of CO_2 would be emitted by the launch activities. From 2006-2010, a maximum of 25 test launches per year would be conducted, producing less than half this amount of CO_2. By comparison, the total annual CO_2 emissions from all U.S. sources for 1999 were over 5.5 billion metric tons (6.1 billion tons). (FAA 2001) Although CO_2 emissions could affect global warming, the CO_2 emissions from the proposed action would be negligible compared to the rest of the CO_2 emissions sources in the U.S. These propellants do not produce O_3-depleting compounds. Therefore, impacts to the upper atmosphere would be negligible.

While launch vehicle emissions from operations at or above 914 meters (3,000 feet) do occur, these emissions would not result in appreciable ground-level concentrations. The mixing layer (sometimes referred to as the boundary layer) is the layer of air directly above the Earth's surface that is relatively well mixed. This layer extends up 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, creating an inversion. This inversion prevents a parcel of air from spontaneously rising past the mixing height because its temperature would have to increase, requiring energy input. Furthermore, substances in the free troposphere above the mixing height tend to remain in the free troposphere rather than sink through the inversion layer into the mixing layer due to these temperature and density trends. Therefore, a parcel of air above the mixing height will spontaneously rise rather than fall with a decrease in temperature and density, which would require energy. (Visconti 2001) Pollutants released into the atmosphere above the mixing height will, in large part, remain above the mixing height. Releases of pollutants above this altitude will not result in appreciable ground-level concentrations of the pollutant. Accordingly, when launch vehicles reach an altitude at or above the mixing height, their emissions generally will have negligible effect on ground-level concentrations.

Exhibit 4-5. Estimated Annual Emissions of Criteria Pollutants from Operation of the Launch Site[a], tons per year

Source	PM_{10}	SOx	CO	NO_X	VOC[b]
PSD Significant Emissions Rate[c]	15	40	100	40	40
Year 1					
Launches[d]	---	0.034	0.010	---	---
Diesel Generators	0.434	27.734	3.213	10.028	0.700
Personal Vehicles	0.001	0.0002	0.336	0.039	0.024
Total	**0.43**	**27.77**	**3.56**	**10.07**	**0.72**
Years 2-4					
Launches[e]	---	0.168	0.048	---	---
Diesel Generators	0.006	1.925	0.033	0.655	0.023
Personal Vehicles	0.025	0.0047	8.692	1.015	0.625
Total	**0.03**	**2.10**	**8.77**	**1.67**	**0.65**
Year 5 and Beyond					
Launches[e]	---	0.350	0.100	---	---
Diesel Generators	0.006	1.925	0.033	0.655	0.023
Personal Vehicles	0.025	0.005	8.692	1.015	0.625
Total	**0.03**	**2.28**	**8.83**	**1.67**	**0.65**

[a] The use of solid rocket motors during an emergency separation would release approximately 113 kilograms (248 pounds) of CO, 100 kilograms (221 pounds) of HCl, 170 kilograms (375 pounds) of Al_2O_3 , to the atmosphere. Proposed testing of the emergency separation system would create estimated total emissions of less than 1,134 kilograms (2,500 pounds) of CO; 1,043 kilograms (2,299 pounds) of HCl; and 1,700 kilograms (3,748 pounds) of Al_2O_3 over a one year period. Due to the infrequency of emergency separation or separation motor tests, the impacts of these emissions would be negligible.

[b] VOCs contribute to the formation of ground level O_3

[c] Source: 40CFR52.21

[d] Assumes 5 launches in first year

[e] Assumes 25 launches per year

As discussed in Section 2.1, solid rocket motors would be used during an emergency separation. The use of solid rocket motors in an emergency would result in a release of approximately 113 kilograms (248 pounds) of CO, 100 kilograms (221 pounds) of HCl, 170 kilograms (375 pounds) of Al_2O_3, to the atmosphere. Proposed testing of the emergency separation system would result in estimated total emissions of less than 1,134 kilograms (2,500 pounds) of CO, 1,043 kilograms (2,300 pounds) of HCl, and 1,701 kilograms (3,750 pounds) of Al_2O_3 over a one year period. Due to the infrequency of emergency separation or separation motor tests, the impacts of these emissions would be negligible.

As discussed in Section 3.1.2.5, climate change is a global issue with potential major long-term implications to global climate and ecosystems. The proposed launch site has the potential to contribute to global climate change effects as a result of emissions from the ground support operations, emissions and rocket exhaust emissions; however, the global effect would be negligible.

4.1.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued and no construction or launch operations would be conducted. There would be no air emissions from launch operations. Current fugitive dust emissions would continue to occur.

4.2 Ecological Resources

4.2.1 Proposed Action

The following sections provide an assessment of potential impacts to biological resources from the construction and operation of the proposed launch site. These potential impacts are discussed relative to their effects on terrestrial biota and special status species. Because there are no aquatic resources in the vicinity of the launch site, a discussion of impacts to aquatic biota is not relevant to this analysis.

4.2.1.1 Construction

Vegetation

Construction activities described in Section 2.4 would result in the clearing, grading, or disturbance of approximately 308 hectares (760 acres), which is approximately 4.1 percent of the 7,527 hectares (18,600 acres) contained within the launch site perimeter fence line.

Because the proposed site receives only about 28 centimeters (11 inches) of rainfall annually (Culberson County Conservation Management Plan 2000), erosion and sedimentation are less of a concern than in less arid regions. Nevertheless, flash flooding during infrequent storms occurs in the region, and soil erosion caused by water movement across the cleared area could potentially alter vegetation communities in down gradient ephemeral drainages. Construction activities would be carefully planned and conducted according to best management practices to minimize erosion and soil loss. For example, secured haybales and/or straw wattles would be

used to trap sediment from disturbed areas to prevent off site discharge of sediment, and runoff retention dams and diversion berms would be constructed where applicable.

Construction activities would impact the approximate acreages of the five vegetation communities at the proposed launch site as shown in Exhibit 4-6 (See Exhibit 3-3, Section 3.2.4.1).

Exhibit 4-6. Areas Impacted by Construction Activities

Vegetation community	Area Impacted
Creosote bush	201 hectares (497 acres)
Sacaton	32 hectares (79 acres)
Grama grass	9 hectares (22 acres)
Gypsophilic	7 hectares (17 acres)
Arroyo riparian	<0.4 hectares (<1 acre)

The above acreages consist of impacted areas within the proposed launch site plus a corridor of approximately 15 meters (50 feet) adjacent to but outside the perimeter fence. In addition to the acreages indicated above, approximately 58 more hectares (144 acres) would also be impacted due to construction of access roads and rights-of-way outside the 7,527 hectares (18,600-acre) proposed launch site. The additional 58 hectares (144 acres) would be in creosote bush and sacaton vegetation communities.

As shown above, most construction activity would be in vegetation characterized as creosote bush community. This community type comprises approximately 5,609 hectares (13,860 acres), or approximately three-fourths of the 7,527 hectares (18,600-acre) proposed launch site. The sacaton community encompasses approximately 1,256 hectares (3,103 acres) of the proposed launch site, only 32 hectares (79 acres) of which would be disturbed by construction. Likewise, approximately 7 of 619 hectares (17 of 1,529 acres) of gypsophilic community would be disturbed. Because these plant communities type are common on the launch site and throughout the Chihuahuan Desert in the Trans-Pecos region of Texas, the anticipated loss would represent only a small portion of this habitat type and would not adversely affect local or regional diversity of plants and plant communities. The grama grass community is somewhat less abundant on the site 59 hectares (145 acres), but the disturbance of 9 hectares (22 acres) of this community would not adversely affect local or regional diversity of this community. Similarly, the disturbance of less than one of two acres of pseudo arroyo riparian vegetation, which is not naturally occurring and is found only near former livestock ponds and tanks, would not adversely affect local or regional diversity of plants.

Wildlife

Potential construction-related impacts to wildlife could be produced by activities such as noise, human presence, clearing, and grading. As described in Section 3, on March 25, 2006 the FAA sent a letter to the USFWS regarding potential impact on threatened or endangered species from

the proposed action. In the letter the FAA determined that formal consultation under Section 7 of the Endangered Species Act is not warranted. The FAA requested the USFWS comments and/or concurrence with this determination. On May 23, 2006, the FAA received a response from the USFWS that concurred with the FAA's determination that it is unlikely that any federally listed threatened or endangered species would occur in the project area. The USFWS requested that the FAA review the potential for ground water development directly or indirectly associated with the project to impact springs in Jeff Davis and Reeves counties which host the federally endangered Comanche Springs pupfish and Pecos gambusia. A discussion of possible ground water impacts from the proposed action is included in Section 4.11 of this EA.

Impacts to wildlife from construction at the proposed Blue Origin site would consist of removal of vegetation, which could lead to permanent or temporary loss of habitat and degradation of value of adjacent habitat due to an increase in noise and human activity. Construction activities such as clearing, excavating, and grading would result in impacts to wildlife through elimination of vegetation communities (habitats) and their associated fauna. Small numbers of less-mobile, burrow-dwelling animals (e.g., pocket gophers, chipmunks) inhabiting the construction area could be displaced by construction activity or killed if burrows are filled, crushed, or paved. More mobile animals such as birds and larger mammal species (e.g., rabbits, pronghorn) would be expected to disperse to less-disturbed areas of the proposed launch site or off site. Lizards and snakes are mobile, and many of these would also be expected to disperse to less disturbed areas of the proposed launch site or off site.

The only construction activity proposed near either of the two prairie dog colonies (see Section 3.2.2.2) is the placement of a perimeter fence. The fence would be located approximately 183 meters (600 feet) east of the eastern edge of the northern colony, and approximately 518 meters (1,700 feet) west of the southern colony. The construction of the perimeter fence at these distances would not impact either of these colonies, nor other wildlife species (e.g., Western burrowing owls, badgers) that might inhabit prairie dog burrows.

The small cave in which roosting bats have been observed (Section 3.2.2.2) is located along the eastern side of the gypsum/limestone ridge in the west-central portion of the launch site. The only construction activity proposed in the vicinity of the cave would be the construction of a road approximately 183 meters (600 feet) east of the ridge, and thus, the cave and associated animal species would not be impacted.

As described in the previous vegetation subsection, most of the proposed construction activity would be in areas characterized as creosote bush community. This vegetation type is abundant on the proposed launch site and is not considered to be high-quality wildlife habitat. The loss of 308 hectares (760 acres) of habitat would result in a small, less than significant impact to the wildlife of the proposed launch site.

Development of the proposed launch site would result in the fencing and enclosure of 7,527 hectares (18,600 acres) of Chihuahuan Desert Scrub vegetation. Much of the enclosed area would continue to provide habitat for wildlife, particularly species that are more tolerant of noise and human presence. However, the fenced enclosure may preclude the entry into the area of large animals such as pronghorn. Because the proposed launch site provides no watering holes, important foraging areas, or other important habitat for large mammals, the fenced enclosure

would not adversely affect large mammals in the area. Birds, reptiles, and small mammals such as chipmunks and mice would not be hindered by the fence. Some animals would undoubtedly be able to dig underneath the fence if desired (e.g., coyote, badger). Although the enclosed area would extend approximately 11 hectares by 8 kilometers (7 miles by 5 miles) at its widest points, no migratory wildlife would be impacted, since the only migratory wildlife in the area are birds and bats.

Construction activities would include excavation, digging and pouring foundations, and construction of buildings, roads, and utilities. These activities would involve the movement of workers and construction equipment and would be associated with relatively high noise levels from earth moving equipment, portable generators, pile driving equipment, pneumatic tools, drills, hammers, and the like. Although noise levels in construction areas could be high (up to 100 dBA at 30 meters (100 feet) from sources of noise), these high local noise levels would not be expected to propagate far beyond the boundaries of the project site. Exhibit 4-7 illustrates the rapid attenuation of construction noise over relatively short distances. At 122 meters (400 feet) from the construction area, construction noises would range from approximately 60 to 80 dBA. These are below noise levels known to startle or frighten small mammals and waterfowl. (Golden et al. 1980) Although noise levels would be relatively low outside of the immediate area of construction, the combination of construction noise and human activity would be expected to displace small numbers of birds and small mammals that might forage, feed, nest, rest, or den in the area. Some animals would be driven from the area permanently, while others probably would become accustomed to the increased noise and activity levels and would return to the area. These disturbances are expected to create impacts on terrestrial mammals that would be small, short-term, and localized and not significant.

Special-Status Species

Based on habitats present at the site and on the results of biological surveys, the Northern aplomado falcon (federally-listed as endangered) is the only federally-listed special status species that may occur at the proposed launch site. The project area is located within the historic range of Northern aplomado falcon and is approximately 80 kilometers (50 miles) northwest of a site in Jeff Davis County where falcons were recently released; therefore, the species could use a portion of the grassland habitat at the proposed launch site. This species is typically associated with large Chihuahuan grassland expanses, and grasslands in the launch site are not extensive. Only about 59 hectares (145 acres) of the 7,527-hectare (18,600-acre) launch site are classified as grassland (See Exhibit 3-3, Section 3.2.4.1 and Appendix C). Because the launch site does not represent prime habitat for the Northern aplomado falcon, and none have been observed at the site, the construction of the proposed launch site would have no effect on the Northern aplomado falcon; a negligible impact.

Exhibit 4-7. Peak and Attenuated Noise (in dBA) Levels Expected from Operation of Construction Equipment[a]

Source	Noise Level (peak)	Distance from Source			
		50 feet	100 feet	200 feet	400 feet
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Fork lift	100	95	89	83	77

[a] Source: Golden et al. 1980

No federally listed special-status species were recorded within the proposed boundaries of the launch site during January and April 2005 field surveys (Section 3.2.3). Although several special-status animal and plant species have been recorded in Culberson County (Exhibit 3-4), the proposed launch site does not contain suitable habitat for most of these species; therefore, construction of the proposed action would have no effect on federally-listed species or designated critical habitat.

Twelve plant and animal species that are state-listed as threatened or endangered (but are not federally-listed special-status species) are found or were formerly found in Culberson County (see Exhibit 3-4). As discussed in Section 3.2.4.3, the proposed launch site does not contain suitable habitat for six of the 12 state-listed species (common black hawk, gray hawk, zone-tailed hawk, Pecos pupfish, Chihuahuan mud turtle, and mountain short-horned lizard), so construction of the proposed launch site would have no effect on these species. The black bear, state-listed as threatened, is occasionally found in desert lowlands in west Texas, but prefers mountainous forest, and bears have not been observed by Blue Origin personnel or contractors in the vicinity of the proposed launch site. The American peregrine falcon (state-endangered) and Arctic peregrine falcon (state-threatened) might pass through the vicinity of the proposed launch site during migration, but would not nest there (see Section 3.2.4.3). Thus, construction of the proposed launch site would have no impact on the black bear, the American peregrine falcon, or the Arctic peregrine falcon.

The remaining three state-listed special status species that could potentially occur in vicinity of the proposed launch site are the Chihuahuan Desert lyre snake, the Texas horned lizard, and the Trans-Pecos black-headed snake. All three are listed by the state of Texas as threatened. Potential habitat for the Chihuahuan Desert lyre snake within the proposed launch site is very limited, and occurs along the limestone ridge bisecting the western portion of the site. No construction is planned for this area, and thus, the proposed action would have no effect on this species. The Texas horned lizard is found in a variety of habitats and could occur within the proposed launch site. Potential habitat for the Trans-Pecos black-headed snake at the proposed launch site consists of mesquite-creosote scrub. Although neither the Texas horned lizard nor the Trans-Pecos black-headed snake was observed during biological surveys, their existence at the proposed launch site cannot be ruled out. Nevertheless, construction activities would impact only a relatively small portion of either species' habitat in Culberson County or the Trans-Pecos region, and population impacts on these two species would not be expected.

4.2.1.2 Operation

Vegetation

Approximately 90 hectares (223 acres) of land would be permanently disturbed (e.g., cleared for a firebreak or covered with surfaces such as concrete, asphalt or other pavement) as a result of the proposed action. These areas would be a subset of those that were cleared for construction, and therefore, no additional impacts would be associated with these areas. Similarly, operational activities such as grounds maintenance and the use of herbicides to maintain a firebreak around the site perimeter would occur only in areas that were cleared during the construction phase. Although operational activities would be long-term, they would occur in areas that do not provide locally or regionally important vegetation. Therefore, associated impacts would be negligible, and less than significant.

Launch and recovery operations would not affect vegetation, since launch and recovery operations would be conducted over concrete launch and landing pads. No high temperature exhaust gases would come within 80 feet of the surrounding vegetation during the nominal ascent or decent trajectory profile.

Although chemicals from vehicle launch emissions can impact vegetation, significant impacts are not expected from proposed launch operations. The New Shepard RLV would use concentrated hydrogen peroxide and rocket propulsion grade kerosene as the propellants. Using this propellant combination, the CO_2 emissions would be the most significant. (FAA 2001) While CO_2 emissions could affect global warming, the CO_2 emissions would be negligible (less than significant) compared to the rest of the CO_2 emissions sources in the U.S. and worldwide. CO_2 emissions would not negatively impact local vegetation.

Wildlife

Operational-related activities that could impact wildlife include launch noise, sonic booms, and vehicle launch emissions.

Day-to-day operations around the launch site would not extend beyond the developed areas and would be expected to cause only minor disturbance to animals inhabiting the area. The duration and frequency of proposed vehicle landing and recovery operations are noted in Section 2.1.1 above, and are not expected to disturb wildlife because the landing and recovery area would not provide suitable habitat to most species that inhabit the vicinity near the proposed launch site.

Modeling data for noise characteristics specific to the New Shepard launch vehicle are not available because the vehicle design has not been finalized. As detailed in Section 4.7.1.2, noise from the launch vehicle is anticipated to be less than the Taurus rocket because the expected thrust parameters are considerably less than the Taurus rocket. Noise from Taurus launches has been thoroughly studied. Information presented in Section 4.7.1.2 indicates that if a Taurus launch were to occur at the proposed Blue Origin site, predicted launch-related noise levels within 9.7 to 12.9 kilometers (6 to 8 miles) would be greater than the approximately 80-85 dBA levels that are known to startle birds and mammals. (Golden et al 1980) The duration of launch noise would be approximately one minute, with the peak noise lasting from 5 to 15 seconds after launch. (FAA 2001; SRS Technologies 1998) Birds would be disturbed, but would be expected to return to the area within minutes of the launch. Monitoring studies of birds during the breeding season at Cape Canaveral indicate that adult birds responded to noises from Space Shuttle launches by flying away from the nests, but they returned within 2 to 4 minutes. (FAA 1996) In addition, studies of birds, some within 250 meters (820 feet) of the Titan launch complexes at Cape Canaveral, have shown no mortality and no reductions in habitat use by species were related to noise from Titan launches. (FAA 1996) Similarly, launch-related noise for both the Space Shuttle and Titan IV launches has not had a substantial effect on wildlife on or near the launch complex. (FAA 1996) (Note: Titan rocket launches are associated with greater noise levels than Taurus rocket launches.) Based on the above information, and given the short duration of the launch noise, significant adverse impacts to wildlife from launch-related noise are not expected. As discussed in Section 4.7.1.2, landing noise is substantially less than liftoff noise and lasts less than 20 seconds. Thus, significant adverse impacts on wildlife from landing-related noise are not expected. Similarly, vehicle operations are not expected to disturb wildlife because the landing and recovery area would not provide suitable habitat for most species that inhabit the region.

Sonic booms are another potential source of launch-related noise impacts to wildlife. Section 4.7.1.2 describes a detailed simulation of sonic booms generated during launch activity. As discussed in this latter section, the proposed launch trajectory would be essentially vertical, i.e., no pitch-over as occurs with most other types of launches. Therefore, during the ascent phase of a launch, the sonic boom from the vehicle would propagate away from the Earth's surface and would likely not be heard, resulting in no impacts on wildlife. Nevertheless, sonic booms would impact the ground during landings. As further explained in Section 4.7.12, the magnitudes of sonic booms have been calculated using conservative assumptions. The calculations indicate that the loudest sonic boom would be equivalent to 90 dBA or 107 dBC and would occur along a circular contour approximately 1.3 kilometers (0.8 miles) from the landing pad. As mentioned in

the previous paragraph, noise levels of approximately 80-85 dBA are known to startle birds and mammals. (Golden, et al 1980) At approximately 4 miles from the landing pad, the sound level of the sonic boom would be approximately 85 dBA or 103 dBC. The sound level of the sonic boom would drop to 80 dBA or 100 dBC at 12.9 kilometers (8 miles) from the landing pad. Thus, during landing, a sonic boom could potentially startle birds and mammals up to a distance of 6.4 to 12.9 kilometers (4-8 miles) from the landing pad. Military aircraft from Holloman Air Force Base, New Mexico, and other military installations occasionally conduct low-level navigation flights in the vicinity of the proposed launch site. As discussed in Section 3.7.4, the Air Force has prepared an Environmental Impact Statement on the Holloman low-level flights, indicating maximum noise levels for five military aircraft types ranging from 88 to 115 dBA at 150 meters (500 feet) altitude. (USAF 1998) The noise levels from these low-level training flights are similar to the above conservatively-predicted noise levels from sonic booms generated during landing of the launch vehicle. As discussed in the previous paragraph on launch-related noise, short term noise of this magnitude does not appear to significantly adversely impact wildlife.

Vehicle launch emissions would probably have negligible impacts on birds, since birds would be frightened away by the noise of the launch, resulting in minimal contact with the exhaust plume. Potential impacts of the plume on mammals and reptiles are difficult to quantify, but because the launch facility would be a developed area that would not provide suitable habitat to most species that inhabit the region, few species would be in the vicinity of the launch facility.

Blue Origin would be expected to launch approximately one weather balloon per launch, but in some meteorological conditions may launch more balloons for a single launch. Each balloon would carry a radiosonde instrument package transmitting atmospheric data as it rises. A radiosonde flight can last in excess of two hours, and during this time the radiosonde can ascend to over 35 kilometers (about 115,000 feet) and drift more than 200 kilometers (about 125 miles) from the release point. When the balloon has expanded beyond its elastic limit and bursts (about 6 meters or 20 feet in diameter), a small parachute slows the descent of the radiosonde, minimizing the danger to lives and property.

The U.S. Government's National Weather Service releases approximately 75,000 weather balloons each year. Blue Origin is expected to launch 14 to 520 balloons per year (the latter figure based on highly conservative estimates of 10 balloons per launch for each of 52 flights per year).

As noted previously, most weather balloons burst when they reach an altitude of 8 to 32 kilometers (5 to 20 miles) and the limits of their elasticity are reached. A small percentage of weather balloons return to Earth undamaged or only partially shredded and have been implicated in rare deaths of marine mammals, who either become entangled in the balloons or ingest their pieces. Research has shown that at inland sites balloons are not an environmental concern. (Burchette, 1989) The small percentage of balloons that do not burst into tiny pieces come down at less than one balloon per thirty-nine square kilometers (fifteen square miles). (Burchette 1989) Latex rubber balloons are highly degradable under a broad range of exposure conditions, including exposure to sunlight, water, and soil. Balloons degrade at about the same rate as oak leaves and about three times faster than small pieces of oak and pine wood. (Burchette 1989)

Therefore, weather balloons released in association with launches at the proposed Blue Origin launch site would have no ecological impact.

Special-Status Species

As noted in Sections 3.2.3 and 4.2.1, no state or federally listed species was observed in surveys of the proposed Blue Origin site conducted in January and April 2005. Based on the habitats present, three state-listed species (Chihuahuan Desert lyre snake, Trans-Pecos black-headed snake, Texas horned lizard) and one federally listed species (Northern aplomado falcon) could occur in limited numbers in the vicinity of the site. It is conceivable that small numbers of these state listed reptiles or an individual Northern aplomado falcon could be disturbed by launch noise or sonic booms. Any disturbance would be brief (less than approximately one minute) and create impacts similar to those currently experienced as a result of military aircraft overflying the proposed launch site. Depending on the species and its sensitivity to noise, there would likely be some level of startle response, with normal activity ceasing for a minute or so, then resuming when the launch noise or sonic boom noise diminished.

4.2.2 No Action Alternative

Under the no action alternative, no experimental permit or license would be issued to Blue Origin for the proposed activities at the Culberson County, Texas location. Therefore, there would be no impacts to ecological resources from launch operations.

4.3 Cultural/Native American Resources

The following discussion explores possible sources of impact to determine if the potential for impacts on cultural resources exists under the various alternatives. Potential direct and indirect impacts on cultural resources are assessed by comparing the locations of known cultural resources identified in the ROI with the locations of activities under the alternatives. Potential impacts on cultural resources are assessed using the "criteria of adverse effect" (36 CFR Part 800.5[a][1]), as defined in the implementing regulations for the NHPA. An adverse effect occurs when an undertaking may alter the characteristics of an historic property or *traditional cultural property* (TCP) that make it eligible for the National Register. Therefore, the analysis of impacts using these criteria is limited to those resources determined as eligible or potentially eligible. There are five broad categories of effect: (1) physical destruction or alteration; (2) isolation and restriction of access; (3) introduction of visible, audible, or atmospheric elements out of character with the resource; (4) neglect leading to deterioration or vandalism; and (5) transfer, sale, or lease from Federal to non-Federal control without adequate restrictions to ensure preservation. For this EA, an impact is equivalent to an adverse effect.

Under the various alternatives, categories (1) and (3) could apply. Possible sources of direct impacts can include physical destruction resulting from groundbreaking activities; access to construction areas by large machinery; improvement of existing access and storm water control measures; use of staging areas for storage of equipment and supplies; and future maintenance activities. These physical impacts can occur to both known sites and subsurface sites that could be discovered during groundbreaking activities. Indirect impacts on cultural resources are often not quantifiable and can occur to cultural resources both within and outside the project area.

Possible sources of indirect impacts can include physical harm resulting from changes in erosion patterns that are caused by construction, compaction of the soil, or removal of vegetation; increased vandalism or illegal artifact collecting of resources due to the presence of construction and maintenance workers in the area; and an increased probability for inadvertent physical harm to resources both in the short and long term.

The potential for impacts on TCPs or to ethnographic resources that are not recommended as eligible for listing on the National Register but were identified as important to tribes is based on tribal concerns identified during tribal consultation. Potential impacts to religious and sacred sites are addressed in the context of the *American Indian Religious Freedom Act* (42 U.S.C. 1996) and EO 13007 *Indian Sacred Sites*, which provide for Federal protection and consideration of religious practices that might be impacted under the alternatives. Potential impacts could include physical impacts to religious or sacred sites, loss of access to sites, and burdens on the practice of religion by traditional practitioners. Potential indirect impacts can include the introduction of visual or auditory elements out of character with a TCP or ethnographic resource. These can result from introducing modern buildings and machinery into an otherwise rural or natural setting.

Currently, no potential impacts, direct or indirect, are known for TCPs or ethnographic resources under the proposed action or no action alternative.

The FAA consulted with the Texas SHPO to identify important historic properties, determine potential impacts to those properties, and to identify measures to avoid or mitigate adverse impacts. A Memorandum of Agreement (MOA) was developed by the FAA, the Texas SHPO, and Blue Origin, that describes what measures are to be taken regarding avoidance or mitigation of impacts on historic properties as a result of the proposed action.

4.3.1 Proposed Action

4.3.1.1 Construction

The proposed locations where construction activities would occur for the Blue Origin launch site contain one archaeological site determined eligible for the National Register. The site is designated 41CU696 and is a scatter of thermal features and chipped stone, ground stone, and ceramic artifact shards.

Site 41CU696 is located along the South entrance road at the entrance gate to the project area from Highway 54. Widening and improvements to this road and gate would result in physical damage to the site. Because of the size and orientation of 41CU696, a new location for the entrance road could not be identified. To reduce the amount of impact to the site under the proposed action, the width of the construction corridor through the site would be limited from 30.5 meters (100 feet) to 9.5 meters (31 feet). To ensure that construction activities would not extend outside the 9.5-meter (31-foot) corridor, the 9.5-meter (31-foot) boundary would be permanently fenced. Prior to construction activities occurring within 30.5 meters (100 feet) of Site 41CU696, data recovery excavations would occur within the 9.5-meter (31-foot) corridor to recover the archaeological data that would be damaged. The mitigation activities would be conducted in consultation with the Texas State Historic Preservation Officer (SHPO), and would

occur per a Memorandum of Agreement and mitigation plan signed by Blue Origin, AST, and the SHPO.

The survey identified an additional site, designated 41CU695, which is a scatter of thermal features and chipped stone, ground stone, and ceramic artifact shards. Site 41CU695 is located in the portion of the project area where the northwest corner of the launch site perimeter fence and adjacent firebreak was proposed to be constructed. Construction of the fence and firebreak would have resulted in physical damage to the site. In an effort to avoid 41CU695, a route for that portion of the fence and firebreak was identified. A survey of a corridor for the new route found no eligible resources. A temporary fence around 41CU695 would be installed during the construction of the fence and firebreak to ensure that site 41CU695 would not be inadvertently impacted during construction activities. By utilizing the new route for the fence and firebreak, and fencing 41CU695 temporarily during construction of the fence and firebreak, 41CU695 would not be directly impacted by the proposed action. These activities avoid impacts on 41CU695 as described in the MOA developed by the FAA, Texas SHPO, and Blue Origin.

Indirect impacts on cultural resources are not quantifiable and could occur to cultural resources both in and outside of the project area. Construction of facilities and associated compaction of soils and removal of vegetation would affect erosion patterns, which in turn could physically harm resources. To address this possible impact, construction activities would be carefully planned and conducted according to best management practices to minimize erosion. For example, secured hay bales would be used to trap sediment from disturbed areas to lessen erosion, and runoff retention dams and diversion berms would be constructed. 'V' trenches would be constructed along the road to address rain water run off from the road near the cultural site. The increase in activities and workers in the area during construction could result in vandalism or illegal artifact collecting at archaeological sites. Prior to beginning work, all employees and contractors conducting construction activities would be educated regarding cultural resources in the project area, appropriate avoidance measures, and associated restrictions regarding vandalism and illegal artifact collecting. The presence of construction activities would also increase the chance for inadvertent physical harm to cultural resources. All construction areas would be fenced or staked during all construction activities to prevent any activities from proceeding outside of the approved construction area. Also, construction management and staff would be educated on the requirement that all activities must take place within approved areas. These measures would help prevent impacts to cultural resources outside the approved work areas.

If during construction activities previously unknown cultural deposits are discovered, construction activities in the area would halt and a qualified archaeologist would evaluate the discovery in consultation with the Texas SHPO.

4.3.1.2 Operation

Direct impacts on cultural resources from maintenance or operation activities at the launch site would be unlikely because these activities would take place within areas already disturbed by construction. The South entrance road would be permanently fenced through site 41CU696 at the 31-foot boundary, preventing any expansion of the road width within the site as a result of maintenance activities.

Indirect impacts could occur to cultural resources both in and outside of the project area as a result of ground-disturbing maintenance activities. Maintenance activities and workers in the area could result in vandalism or illegal artifact collecting at archaeological sites. Prior to beginning work, all employees and contractors conducting maintenance activities would be educated regarding cultural resources in the project area, appropriate avoidance measures, and associated restrictions regarding vandalism and illegal artifact collecting. The presence of ground-disturbing maintenance activities would also increase the chance for inadvertent physical harm to cultural resources. All maintenance areas would be fenced or staked during all ground-disturbing activities to prevent any activities from proceeding outside of the approved maintenance area. Also, maintenance management and staff would be educated on the requirement that all ground-disturbing activities must take place within approved areas. These measures would help prevent impacts to cultural resources outside the approved work areas.

If during maintenance activities previously unknown cultural deposits are discovered, ground-disturbing activities in the area would halt and a qualified archaeologist would evaluate the discovery in consultation with the Texas SHPO.

4.3.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued to Blue Origin for the proposed activities at the Culberson County, Texas location. Therefore, there would be no impacts on cultural resources from launch operations.

4.4 Hazardous Materials/Waste Management

4.4.1 Proposed Action

4.4.1.1 Construction

As described in Section 2.4.2, under the proposed action, only the facilities required to support the New Shepard RLV system would be constructed. The construction activities would use small quantities of hazardous materials, which would result in generation of small volumes of hazardous wastes. The hazardous materials that are expected to be used are common to construction activities and include diesel fuel, gasoline, and liquefied natural gas to fuel the construction equipment, hydraulic fluids, oils and lubricants, welding gases, paints, solvents, adhesives, and batteries. Appropriate hazardous material management techniques would be followed to minimize their use and waste disposal. The use, management, and disposal of hazardous materials for both the construction and operations phases are described in Exhibit 4-8.

Nonhazardous and hazardous waste generated during construction of the launch site would include construction debris, empty containers, spent solvents, waste oil, spill cleanup materials (if used), and lead-acid batteries from construction equipment. Construction contractors would be responsible for safely removing these wastes from the site for recycling or disposal in accordance with applicable requirements.

Debris resulting from site preparation such as brush and stumps would be burned on site, and soil excavated during construction activities would be stockpiled for on site use. Given the

Exhibit 4-8. Hazardous Materials Use and Waste Management at the Proposed Blue Origin Launch Site

Hazardous Materials Use and Management		
Material	**Use**	**Management**
Hydraulic fluid and lubrication oils	Construction equipment	Stored on impervious surface with spill cleanup materials available. Used oils (< 189 liters [50 gallons] per year) would be collected for recycling
Welding gases	Construction of launch site structures and fabrication and maintenance of equipment in on site welding and machine shops.	Consumed in welding operations. Cylinders will be removed from launch site by vendors.
Diesel fuel, gasoline, liquefied petroleum gas	Fuel for construction equipment estimated at 378,541 liters (100,000 gallons) of diesel fuel and 227,125 liters (60,000 gallons) of gasoline. Up to 227,125 liters (60,000 gallons) of diesel fuel could be used in the first year of operation before the site connected to the regional grid. Thereafter, relatively small amounts of diesel fuel (<26,498 liters [7,000 gallons]) would be consumed.	Stored in above ground tanks with secondary containment and periodic inspections.
Paints, primers, thinners, cleaning fluids, degreasers, adhesives, sealants, isopropyl alcohol	Construction and maintenance of launch site facilities and equipment, cleaning of dust sensitive equipment, and laboratory use.	Limited quantities stored on site at any one time. Small amounts (<379 liters [100 gallons] per year) of spent solvents would be transported off site for disposal.
Kerosene and hydrogen peroxide (90 percent)	Propellants used in the propulsion module for the New Shepard RLV estimated at 46,720 kilograms (103,000 lbs) of HTP and 5,443 kilograms (12,000) lbs of kerosene per launch	Delivered to the launch site in DOT approved trucks and containers. Stored in tanks with containment. Consumed during launch or recovered from RLV after landing.
Explosives	Solid rocket motors and small pyrotechnic-actuated valve and cutter assemblies used in RLV	Stored in DOT approved shipping containers in a dedicated area away from the VPF and other operations and administrative buildings. Consumed in launch operations.

Hazardous Materials Use and Management		
Material	**Use**	**Management**
Compressed helium and nitrogen gases	Provides inert atmosphere during RLV assembly and testing (up to 50 12.2 meter (40-foot) tube trailer deliveries of compressed gases per year)	Cylinders will be removed from launch site by vendors.
Waste Management		
Construction debris	Scrap lumber, metal, cardboard, paper, etc.	Removed for off site recycling or disposal during construction phase.
Spent solvents, paper, waste oil, batteries, spill cleanup materials, antifreeze, and empty containers	From construction, grounds keeping, housekeeping, maintenance, and spill response (as required) activities	Removed for appropriate off site recycling or disposal during construction and launch operations.
Sewage	From portable toilets during construction and a combination of central sewage treatment and septic systems during launch operations	Contents of portable toilets would be removed by vendor. Contents of septic tank would be drained periodically and removed for off site disposal.

anticipated number of construction personnel, the volume of non-recyclable, nonhazardous waste is expected to be small. Transporters of solid waste would be required to contain waste during transport, promptly remove any waste spilled, and clean the affected areas. The amount of construction generated waste (approximately 1,270 metric tones [1,400 tons]) from the proposed site would be negligible, less than significant, in comparison to the quantity of municipal solid waste (approximately 381,018 metric tones [420,000 tons] per year) that is typically disposed of in this region.

The Texas state regulations (Texas Administrative Code, Title 30 - Environmental Quality, Chapter 335, Subchapter C) include requirements for identifying and characterizing hazardous wastes; obtaining a hazardous waste facility identification number; and hazardous waste storage, transportation, and recordkeeping requirements. The hazardous waste generator category for the proposed launch site during the construction phase is expected to be no more than a "small quantity generator" (i.e., generates more than 220 pounds [100 kilograms] but less than 2,200 pounds [1,000 kilograms] of hazardous waste in any calendar month). The hazardous waste generation rate for the launch site is expected to average less than 45.4 kilograms (100 pounds) per month. The facility would qualify as a "conditionally exempt small quantity generator" (i.e., less than 220 pounds [100 kilograms] of hazardous waste per calendar month). All hazardous waste would be shipped off site for appropriate treatment or disposal in accordance with the applicable generator classification. The types and quantities of hazardous waste associated with

launch site operations could easily be accommodated by existing commercial treatment and disposal capacity within the state.

The state of Texas regulations include an industrial waste classification system (see Texas Administrative Code Sections 335.1(15)-(17) for waste classes) and require that industrial facilities obtain a solid waste registration number and submit an annual waste summary report if they generate more than 220 pounds (99.8 kilograms) of Class 1 industrial waste per month. Class 1 wastes include both hazardous wastes and certain nonhazardous industrial wastes (e.g., a container that previously held a hazardous substance, petroleum substances or waste containing petroleum substances, water contaminated with ethylene glycol). Waste generated during the construction of the launch site would be managed in accordance with the State's industrial waste requirements.

Sewage generated during construction activities (e.g., from portable toilets) would be removed for off site disposal. Some sewage may be managed in on site septic systems. The contents of the septic systems would be periodically removed for off site disposal. The average and peak construction workforce is estimated at 45 and 70 individuals, respectively. Based on an engineering guide of 284 to 473 liters (75 to 125 gallons) of water usage per day per worker, the construction workforce would generate approximately 511,031 to 794,936 liters (135,000 to 210,000 gallons) of sanitary wastewater per month. The appropriate permits would be obtained through the TCEQ Culberson County office for installation of on site sewage facilities.

An on site concrete batch plant would operate for approximately five months during the peak construction period. Waste water associated with the batch plant would be disposed on site.

4.4.1.2 Operation

The hazardous material management practices described above for construction would also be followed during launch site operations. The majority of the hazardous materials used in launch operations are the propellants for the New Shepard RLV and compressed gases. Small solid rocket motors and explosive devices such as linear shaped charges and detonators would also be used for non-routine (emergency) flight operations and development flight tests. The use, management, and disposal of hazardous materials for both the construction and operations phases are described in Exhibit 4-8.

Other hazardous materials used in support of launch operations would include isopropyl alcohol and acetone used for cleaning. These other materials would be stored in National Fire Protection Association and International Fire Code approved flammable storage cabinets in quantities of 37.9 liters (10 gallons) or less for each material. Annual usage of isopropyl alcohol and acetone is expected to be less than 379 liters (100 gallons) each.

Propellants used for the New Shepard RLV include rocket propulsion grade kerosene (RP-1) and 90 percent concentration hydrogen peroxide. These propellants would be delivered to the proposed site in licensed, DOT approved tank trucks, on an as needed basis. The RP-1 fuel would be delivered in 26,498 liter (7,000 gallon) tank trucks, and the hydrogen peroxide would be delivered at 90 percent concentration in 15,142 liter (4,000 gallon) tank trucks. No manufacturing or concentration of hydrogen peroxide would occur at the launch site.

RP-1 would be stored on site in a 37,854 liter (10,000 gallon) National Fire Protection Association and International Fire Code approved, Underwriter's Laboratories listed aboveground storage tank. This tank would utilize integral secondary containment with double wall construction, and would be equipped with over-fill protection devices and hydrocarbon leak detectors monitoring the interstitial space between the tanks walls. Tank level and leak sensors would be continuously monitored by an automatic system with local and off-site alarm notifications. The fuel storage tank would have a code-required vent located 3.7 meters (12 feet) above the ground. Atmospheric emissions of fuel vapors by evaporation from the storage tank would be less than 0.9 kilograms (2 pounds) per day. The fuel storage tank would be protected by concrete-filled steel bollards to prevent accidental damage by delivery and service vehicles, and surrounded by a locked chain-link fence. Tank drain and fill valves would be secured with locks when not being operated for propellant transfer operations.

The 90 percent concentration hydrogen peroxide would be stored in three, 37,854 liter (10,000 gallon) aboveground storage tanks constructed of high-purity aluminum specially designed for long-term compatibility with concentrated hydrogen peroxide. The hydrogen peroxide storage tanks would be enclosed by concrete secondary containment dikes with 200 percent of total tank volume capacity. The hydrogen peroxide tanks would also be surrounded by a locked chain-link fence, and tank fill/drain valves would be secured with locks when not being used for propellant transfer operations. The hydrogen peroxide storage tanks would be equipped with tank level and temperature sensors which are continuously monitored by an automatic system with local and off-site alarm notifications. These tanks would also incorporate manually- or automatically-activated water deluge systems to cool and dilute the hydrogen peroxide in the tanks in the unlikely event of temperature increase due to decomposition of product. Hydrogen peroxide storage tanks would be protected from solar heat gain by a metal roof structure over the containment dikes. The tank secondary containment dikes would include a sump area with water dilution capability to collect small drips or spills. This sump area would be emptied after any spill using a water-driven jet eductor pump to dilute the spilled hydrogen peroxide and transfer it to a waste peroxide holding tank for further dilution and decomposition to water and oxygen.

Propellant transfer operations to New Shepard RLVs would be accomplished using automated pumping systems. Propellants would be transferred to the RLV via small pipelines contained in covered concrete trenches. The hydrogen peroxide transfer plumbing would be equipped with a double-wall jacket, and a leak detector monitoring the interstitial space between the transfer piping and the outer jacket. This leak detector would be continuously monitored during transfers by an automated system which terminates propellant delivery in the event of a leak. This system would also monitor propellant flow rates, pressures, temperatures, and propellant load delivered to the New Shepard RLV and would protect against overfill of the tanks onboard the vehicle. After hydrogen peroxide loading of the vehicle is completed, the transfer piping would be purged of residual hydrogen peroxide with gaseous nitrogen. Residual hydrogen peroxide would be diluted with water to less than 50 percent concentration and collected in the waste peroxide holding tank for further dilution and decomposition to water and oxygen.

RP-1 fuel transfer plumbing would likewise be contained in a covered concrete trench. The trench would be equipped with water sensors and hydrocarbon leak detectors which would automatically terminate transfer operations in the event of a leak. The propellant loading system

would also monitor propellant flow rates, pressures, temperatures, and propellant load delivered to the New Shepard RLV and would protect against overfill of the tanks onboard the vehicle.

Propellant transfer operations would be rigorously controlled with procedures and equipment to minimize the likelihood of a leak or accidental spill. The permanent launch site staff would include a trained HAZMAT/Emergency Response Team who are trained and certified in spill containment and cleanup procedures. This team would report and coordinate emergency responses as required to local, state, and Federal authorities. The Emergency Response team would maintain a vehicle stocked with spill-response kits and personal protective equipment to handle fuel or hydrogen peroxide spills. The emergency response vehicle would be equipped with appropriate fire extinguishers and a water supply for dilution of hydrogen peroxide. The Emergency Response Team would maintain demonstrated proficiency by conducting semi-annual drills in coordination with off-site emergency services.

Small amounts of hazardous and nonhazardous wastes are expected to be generated during launch operations. Nonhazardous waste would be managed as described in Section 4.4.1.1 for disposal at an off site landfill. Similarly, hazardous wastes generated during launch operations would be transported off site to an appropriate disposal facility in accordance with applicable Federal and state requirements. The hazardous waste generator category for the proposed launch site during the operations phase is expected to be "conditionally exempt small quantity generator" (i.e., generates less than 99.8 kilograms [220 pounds] per calendar month). The waste generation rate for the launch site is expected to average less than 45 kilograms (100 pounds) per month. Hazardous waste would be shipped off site for appropriate treatment or disposal in accordance with the applicable generator classification.

In accordance with EPA and TCEQ regulations, an explosives emergency response is exempt from RCRA permitting requirements if the situation involves an actual or potential imminent threat to human health or the environment. As described in Section 4.13, open burning would be used to dispose of any igniter or solid rocket motor fragments collected by emergency response personnel in the event of an off-nominal landing of the abort module. Any open burning that is not performed as part of an explosives emergency response (e.g., disposal of propellant from tests), would be conducted in accordance with applicable regulatory requirements.

Sewage generated during launch operations would be managed in the central sewage treatment plant and on site septic systems. The contents of the septic systems would be periodically removed for off site disposal. The operations workforce is estimated at eight fulltime security personnel and 15 personnel supporting flight preparations and launches for a total of 23 individuals. It is estimated that the operations workforce would generate approximately 102,206 liters (27,000 gallons) of sanitary wastewater per month, based on a conservative value of 60 people daily.

There would be no routine wastewater generation associated with launch operations. Any wastewater accumulation would be associated with an off-normal event such as a spill or activation of a fire suppression system. The wastewater would be disposed on site, if appropriate, or transported off site to a treatment facility. There would be no significant wastewater management impacts.

4.4.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued to Blue Origin for the proposed activities at the Culberson County, Texas location. Hazardous materials would not be required to support launch operations. There would be no hazardous or solid waste, sewage, or wastewater generation from launch operations.

4.5 Land Use (including Farmland and Section 4(f) Resources)

4.5.1 Proposed Action

The proposed launch facility complex lies within a large, privately-owned property known as "The Corn Ranch." The Corn Ranch consists of desert scrubland and grassland that was settled in the late 19th century and used as ranchland until 2004. The Corn Ranch is now maintained by the property owner as a wildlife management area and for personal use.

Section 4(f) properties would not be significantly impacted by the proposed action because it does not require the use of any section 4(f) properties, and it does not create a "constructive use" that substantially impairs the properties. Section 4(f) properties are not substantially impaired because the impacts of the proposed action are not sufficiently serious that the value of the site in terms of its prior significance and enjoyment are substantially reduced or lost.

No farmlands or agricultural use lands are located on the proposed site. No prime farmland, unique farmland, farmland of state importance, or general farmland would be converted to a non-agricultural use as a result of the proposed action. No conflicts with existing agricultural uses would occur as a result of the proposed action.

4.5.1.1 Construction

Construction of the launch site would result in converting about 90 hectares (223 acres) of desert scrubland and grassland into industrial areas. This relatively small area represents 1.2 percent of the approximately 7,527 hectares (18,600 acres) proposed site and less than a small fraction of the larger Corn Ranch property. As discussed in Section 3.2.1, the proposed launch site lies in the Great Chihuahuan Desert, which includes parts of Mexico, Arizona, New Mexico, and west Texas and covers approximately 453,250 square kilometers (175,000 square miles, 112,000,000 acres).

4.5.1.2 Operation

Operation of the launch site would necessitate the fencing and enclosure of approximately 7,527 hectares (18,600 acres) of desert scrubland and grassland that was rangeland until 2004 and is currently managed as a private wildlife management area. This acreage would continue to provide habitat for wildlife, particularly species that are more tolerant of noise and a human presence. Land use would be essentially unchanged; only the core facility areas would be converted to industrial use.

4.5.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued to Blue Origin for the proposed activities at the Culberson County, Texas location. Land would not be required to support launch operations. There would be no change in land use from these operations.

4.6 Visual Resources

4.6.1 Proposed Action

As described in Section 2.4.2, the land proposed for the launch site was formerly used for cattle ranching. Construction would be limited to the small number of facilities and limited infrastructure required to support the launch site. The existing visual and aesthetic conditions of the proposed launch site and surrounding lands are described in Sections 3.4 and 3.5.2. The existing conditions of the launch site and the adjacent landscape would be rated as moderate to high visual sensitivity due to the undisturbed desert setting of the valley and surrounding picturesque mountain ranges.

4.6.1.1 Construction

As described in Section 3.5.1, impacts to visual and aesthetic resources are often considered in terms of visual dominance and visual sensitivity. During the construction phase, the visual landscape would be impacted primarily by construction activities associated with the two launch site access road improvements that would intersect State Highway 54 and the associated vehicle traffic traveling to and from the launch site. All existing dirt roads accessing or within the launch site would be widened (ground disturbance) and improved using native aggregate materials. Other anticipated construction activities would include utility and security fencing and gate installation, security lighting and signs on or closely adjacent to State Highway 54 for safety and to identify the launch site access point(s) for construction vendors and the associated dust and glare (reflections) from light and heavy vehicle traffic. The construction may require additional temporary workspace on or adjacent to the right-of-way on State Highway 54 to accommodate construction traffic on the launch site access roads. As a result, these activities and impacts would be rated visually dominant during the construction phase.

The launch site facilities would be built five miles to the east of State Highway 54. Approximately 308 hectares (760 acres) of land would be disturbed to develop facilities and infrastructure including buildings, storage tanks, launch and landing pads, access roads, parking areas, fencing, and lighting. A fire break would be cleared along the perimeter fence to prevent the spread of fire on or off the launch site. It is anticipated that no more than the top half of the tallest building on the site would visible to motorists traveling south on State Highway 54 because of location of the highway in the valley floor and ridges between the highway and the launch site. However, Highway 54 reaches an elevation some 90 to 150 meters (300 to 500 feet) above the launch site when passing through the Baylor Mountains north of Van Horn. Although the launch site is some 13 to 16 kilometers (8 to 10 miles) from the highway at that point, most buildings would be visible as well as disturbed areas on the ground because the soils are white in color. Most conspicuous during the day would be fire break, roads, soil stockpiles, structures

under construction, support facilities and construction equipment and vehicles due to glare, reflections and dust generation. Most conspicuous during the night would be the launch site construction lighting. At night, lighting at the access gates and from the launch site construction areas would be visible along a six to eight mile stretch of State Highway 54 west and south of the launch site. As a result, these construction activities and impacts would be rated visually co-dominant given the landscape and duration they are observed.

Best construction practices would be used for dust and soil controls to mitigate the visual impact of construction both at State Highway 54 and within the launch site. Dust and lighting controls would also be implemented to avoid unnecessary impacts to the visual sensitivity of the area at night. It is anticipated that the lighting of the access points and launch site would be more visually dominant during the construction phase due to the number and types of lighting used, however; the majority of that lighting would be temporary.

4.6.1.2 Operation

The visual impacts associated with construction improvements of the two launch site access roads would be reduced because of the absence of construction vehicles, their associated glare and dust generation and the removal of temporary construction signs, fencing, gates and lighting. Permanent lighting would be installed that would minimize the impact of light pollution in this remote area by directing light to the ground where it is needed for safety and security. When the launch site becomes operational, approximately 90 hectares (223 acres) of land would be committed to facilities and infrastructure. This represents a two-thirds reduction in the acreage impacted during construction.

During operations, vehicle activity would include passenger vehicles of Blue Origin personnel and the occasional tractor trailer to and from the site. These vehicles would deliver supplies and equipment to the launch site in support of the launch vehicle(s). Light pollution would be negligible unless there was a night launch.

The visual landscape would be most impacted by the flight of the launch vehicle. The launch vehicle would leave a contrail as a result of the fuel mixture being combusted. During a day launch, the rocket would emit a white exhaust plume of smoke and steam and a combustion light source (flame). As the vehicle gains altitude, its vertical contrail would more closely resemble the generally horizontal contrail of a jet aircraft. The launch vehicle would free fall back to Earth and then the engines would be restarted for landing. If the FAA authorized night launches, the launch and landing facilities would have extra lighting for safety. The lighting would be directed to the grounds around the launch facilities and would produce minimal light pollution. The vehicle would produce the most light during night operations when the exhaust plume would be illuminated by the light produced by the combusting fuel. During a night launch, with clear skies, the vehicle would be visible from Highway 54 and the south side of the Guadalupe Mountains National Park. After the vehicle rises above the Baylor Mountains, the vehicle would be visible from Van Horn, when looking north. The vehicle's vertical contrail would resemble the generally horizontal contrail produced by a jet aircraft from a distance of 5 to 8 kilometers (3 to 5 miles).

The light emitted by the vehicle would be brief in duration due to the short operation of the engine. The nominal flight time for the vehicle is anticipated to be less than 10 minutes from lift-off to touchdown at the landing pad as described in Section 2.4.2.2. Further, the intensity of the light would be limited by the vehicle's altitude, the contrail and atmospheric conditions. As a result, the plume and contrail impacts would be rated visually co-dominant when the vehicle launches and lands during the day and the plume impacts would be rated visually dominant when the vehicle is launched and lands during the night.

As discussed in Section 4.2.1.2, weather balloons would be released in association with launches and could return to earth to land at the launch site. If this were to occasionally occur, the latex balloons or balloon pieces, which are generally light-colored, would quickly weather and degrade and would not be noticeable on the site, which is dotted with white rocks and patches of light-colored soil.

4.6.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued to Blue Origin for the proposed activities at the Culberson County, Texas location. There would be no visual impacts from launch operations.

4.7 Noise

4.7.1 Proposed Action

4.7.1.1 Construction

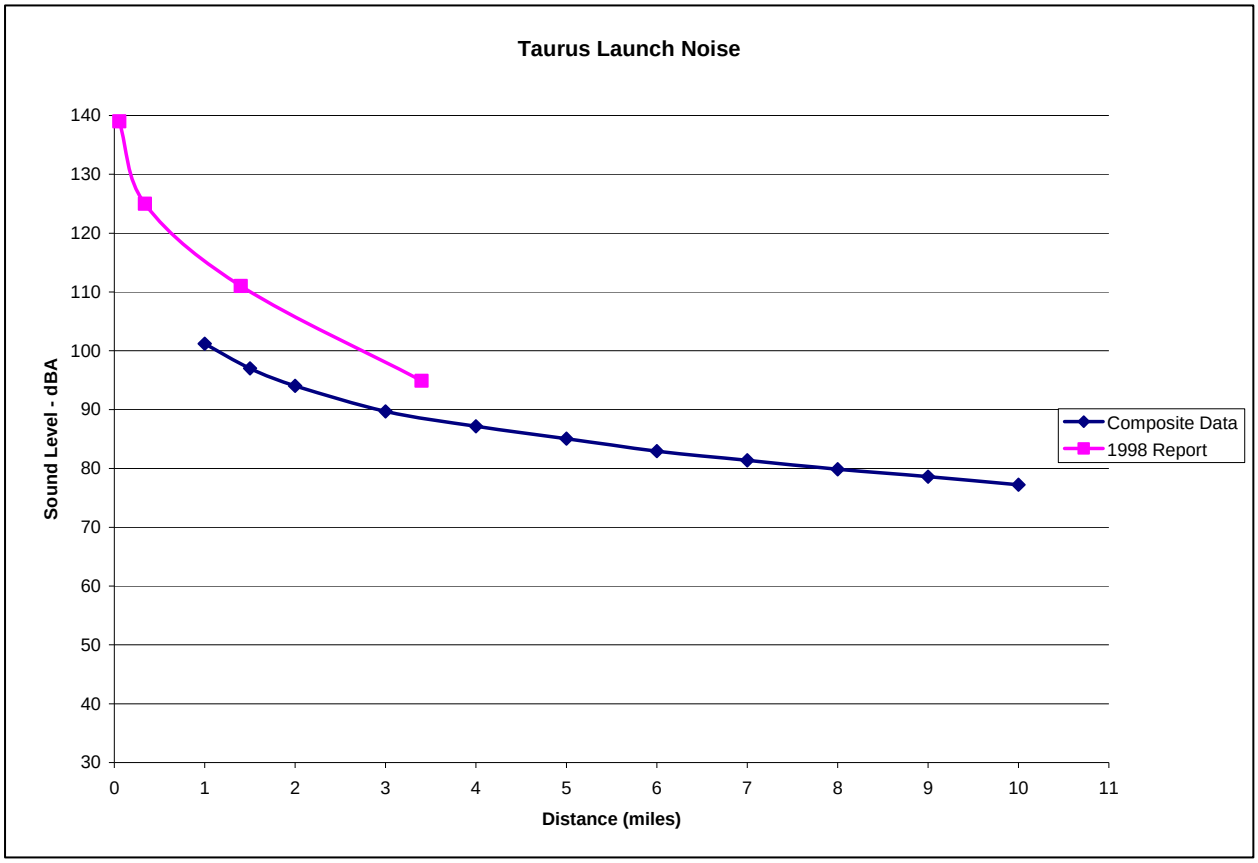
Construction activities would include excavation, digging and pouring of foundations, erection of buildings, and construction of roads and utilities. These activities would temporarily increase the ambient noise levels at the proposed launch complex. Such activities could potentially create individual noise sources ranging from 70 to 100 dBA at 30 meters (100 feet) from the activities. (Golden et al. 1980) Traffic noise from commuting workers' trucks on the road to the launch complex would also increase. The construction-related noise could last approximately 12 months, but would not be appreciable off site, given the size of the property, the proximity of the construction activity to the highway and the sparseness of the surrounding population. Workers would be protected from noise in accordance with OSHA regulations.

4.7.1.2 Operation

Rocket noise is a result of the interaction of the exhaust jet with the atmosphere, and to a lesser extent, the combustion of the fuel. The sound pressure from a rocket is related to the engine's thrust level and other design features. Blue Origin has not completed development of the New Shepard vehicle or its engines, and thus, there are no test results. Nevertheless, a thrust of 230,000 pounds force is expected at liftoff. This thrust is considerably less than that of the Castor 120 rocket motor, which has an average thrust of approximately 370,000 pounds force and a maximum thrust of 435,000 pounds force. Therefore, the Taurus rocket, which uses the Castor 120 motor, is used in this analysis as a surrogate for evaluation of launch noise impacts at the launch facility. The New Shepard vehicle would be expected to produce less noise.

The sound from Taurus launches has been extensively studied. The Kodiak Launch Complex EA (FAA 1996) provided a composite of three sources of noise studies. One source consisted of actual measurements of two static tests. Another data set resulted from computer modeling of a launch by Thiokol, the manufacturer of the Castor 120. The third source was from the Taurus Environmental Assessment. Exhibit 4-9 presents a composite of these three sources, as reported in the Kodiak EA. The sound from a Taurus launch was again measured in October 1998 at Vandenberg Air Force Base. (SRS Technologies 1998) The noise at the four measured locations is also depicted on Exhibit 4-8. The frequency distribution of Taurus rocket noise peaks around 70 hertz, which is typical of the very low frequency noise from rocket engines. At frequencies above 200 hertz, the sound pressure level is greatly decreased.

Exhibit 4-9. Predicted Overall Sound Levels from a Hypothetical Taurus Launch at the Blue Origin Launch Site



The nearest public access to the launch and landing platforms is approximately 8.5 kilometers (5.3 miles) away on Highway 54. Launch noise at that location would be approximately 85 dBA, approximately the same as that experienced by a person standing 9.1 meters (30 feet) from a highway when a heavy truck passes. The nearest residence, which is approximately 10.9 kilometers (6.8 miles) away, would experience slightly less than 85 dBA. The frequency distribution, however, would be much lower for both observers and, thus, typically less irritating to humans. The duration of launch noise is approximately one minute (FAA 2001; SRS

Technologies 1998), with the peak noise lasting from 5 to 15 seconds after launch. (FAA 2001) The nearest population center, Van Horn, is approximately 40 kilometers (25 miles) away.

These noise values are based on a Taurus launch and would be expected to be less for the New Shepard vehicle. Other than annoyance, there is no known adverse effect to humans from short term noises of this magnitude. (FAA 2001) Given the short duration of the launch noise and the infrequency of the launches (typically on an average of one per week), public annoyance is expected to be minimal.

During vehicle landing, the rocket engine would again produce noise. Maximum thrust during landing is in the range of 100,000 pounds force. This value is considerably less than the thrust at liftoff and begins at a height of approximately one-half mile. The thrust gradually decreases to approximately tens of thousands of pounds force as the vehicle approaches the ground surface. Therefore, the landing noise is substantially less than liftoff noise and lasts less than 20 seconds.

Blue Origin workers would normally be two miles away at the Operations Control Center during launches. Given the noise data in Exhibit 4-8, these workers would be unlikely to be exposed to sound levels greater than 115 dBA, the OSHA 15-minute standard. However, any workers potentially exposed to noise greater than any OSHA standard would be required to wear hearing protection.

The noise profile of the solid emergency separation motors is smaller than that of the New Shepard vehicle. Because emergency separation would be an infrequent occurrence, the impacts would be insignificant.

In addition to the noise of the rocket engine, sonic booms are possible. A sonic boom is a sound that is produced by a shock wave that forms around a vehicle that is traveling faster than the speed of sound. The effects of sonic booms are startle response in humans and biota, and, in extreme cases, damage to structures. The potential for, and the intensity of, a sonic boom being heard on the surface of the earth are dependent on the vehicle length, the vehicle shape, the trajectory of the launch, the vehicle velocity, and weather conditions. Sonic booms are discussed in more detail in the Programmatic EIS for Licensing Launches. (FAA 2001)

The standard method for determining sonic boom footprints for supersonic vehicles is the method of geometrical acoustics, or ray tracing. (Plotkin 1989) The theory states that the acoustic disturbance generated by a supersonic vehicle in steady flight at a particular instant propagates along a cone of rays opening forward of the aircraft's velocity vector. For a supersonic aircraft in horizontal flight, this ray cone will eventually intersect the ground at a future time, forming the hyperbolic boom footprint at ground level. The New Shepard vehicle launch trajectory is vertical, however, i.e., no pitch-over as in most other types of launches. Therefore, during the ascent portion of a launch, the ray cone and the corresponding sonic boom from the New Shepard vehicle would not intersect the ground. Instead, it would propagate away from the Earth's surface and not be heard. While the possibility exists that a boom propagating into free space may reflect off the thermosphere and back to the ground (referred to as an "over-the-top" boom), such booms are generally inaudible. (Plotkin 1989)

During landing, the vehicle descends base first in a nearly vertical trajectory. Under these conditions, the vehicle would produce a sonic boom footprint consisting of concentric circles centered on the landing pad, with the ground along a particular circle experiencing the same magnitude of sonic boom. Each concentric circle represents the intersection of a ray cone generated at a particular instant during the supersonic descent phase with the ground. The magnitude of the sonic boom would be weaker for the circles with larger radii and stronger nearer the test pad. The vehicle would decelerate as it drops through the atmosphere, producing an N-wave pressure profile rather than an amplified U-wave pressure profile that would be associated with an accelerating vehicle. Also, the vehicle would drop to subsonic speeds relatively high in the atmosphere (approximately 9,100 meters (30,000 feet) or higher), mitigating the boom felt at ground level.

The strongest boom would produce an N-shaped pressure wave with duration of less than 160 milliseconds and a peak overpressure of 0.7 kilograms (1.6 pounds) per square foot at approximately a 1.3-kilometer (0.8-mile) radial distance from the landing pad. The peak noise level from this boom would be equivalent to 90 dBA or 107 dBC for a fraction of a second. This highest intensity boom would be generated at the instant the vehicle decelerates to subsonic speeds.

At the closest location where workers and visitors could be located, a distance of 6.1 kilometers (3.8 miles) from the landing pad, the peak overpressure would be 1.0 pound per square foot (85 dBA or 103 dBC). At the nearest public access on Highway 54, the sonic boom overpressure would also be approximately 1.0 pound per square foot (85 dBA or 103 dBC). At 12.9 kilometers (8 miles) the sonic boom sound level drops to 80 dBA or 100 dBC and drops to 68 dBA or 93 dBC at 37 kilometers (23 miles). Beyond that distance, the sonic boom could be difficult to detect above normal conversation. These results are true for launch scenarios with attached propulsion module and crew capsule. Other flight profile scenarios envisioned, wherein the propulsion module and crew capsule would descend separately, would produce smaller sonic booms because the mass of each vehicle separately would be lower than the attached vehicle, and each vehicle descending separately would decelerate to subsonic speeds higher in the atmosphere than the attached vehicle.

As described in Section 2.1.1.2, a diesel generator set would be used to provide backup electrical power to the launch site. The diesel generator would be sound insulated to ensure no more than 74 dBA at 15 meters (50 feet). This noise would not be expected to be audible above background at the site boundary. Launch site personnel would be protected by engineering and administrative controls in accordance with OSHA regulation.

Other sources of noise would be associated with non-launch operations at the complex and could include operation of vehicles and equipment; public address system; and heating, ventilating, and air conditioning systems. These noise sources would not likely be audible off site.

As described in Section 3.7, the baseline noise levels in the region of the proposed launch site are those typical of a remote desert – approximately 22 to 38 dBA. The only noise sources from operation audible outside of the site boundary would be rocket noise during launch and landing and sonic boom during ascent. These activities would increase the Day Night Average Noise Level but because the noise would impact a sparsely-populated area there would be little or no

impact on sensitive receptors. Even at Blue Origin's stated launch rate of up to 52 launches per year from 2010 onwards (see Section 2.1.1.3), the average duration of audible noise outside the proposed site from rocket noise or sonic boom would only be approximately 10 to 15 seconds per day, with night launches (if authorized by the FAA) occurring no more than once a month (see Section 2.1.1.4.6).

4.7.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued and there would be no rocket launches. Therefore, noise in the area would remain characteristic of a remote desert environment, punctuated by the sound of occasional low-altitude jet aircraft.

4.8 Geology and Soils (including Floodplains)

4.8.1 Proposed Action

Impacts to geology, soils, and topography under the proposed action are discussed in this section. No impact on site geology or seismicity is anticipated from the construction or operations associated with the proposed action. Impacts on soils would be minor and mitigated by using best construction management practices.

4.8.1.1 Construction

Soil erosion is a potential concern during construction, but appropriate engineering and construction practices can reduce the likelihood of significant soil loss. Construction activities have the potential to disturb approximately 307 hectares (760 acres) of soil. Of this total, approximately 90 hectares (223 acres) are expected to be permanently covered with impermeable surfaces such as buildings, landing pads and parking areas. Because of the clay content of the site soils, it may be necessary to strip 30 to 122 centimeters (1 to 4 feet) below existing grade prior to construction of the facilities. Depending on the depth of excavation, the volume of soil excavated would range from approximately 3,822 to 15,291 cubic meters (15,000 to 60,000 cubic yards). All surface vegetation, debris, and loose fill would be removed prior to placement of appropriate fill material. Some excavated site soils may be suitable for use as fill materials. The remaining excavated soil would be stockpiled for later use on the launch site and the Corn Ranch property or removed from the site and disposed of in accordance with applicable county ordinances and/or state regulations.

Disruption of underlying bedrock would be limited to possible removal of geologic materials during construction of building foundations and facilities such as the flame bucket. These materials may be used for roads or foundations and additional geologic material may be removed from borrow pits at the site. Impact to topography would be limited to clearing areas for facility construction and road building.

The design and construction of the launch site would take into account the geologic hazards and other considerations described below:

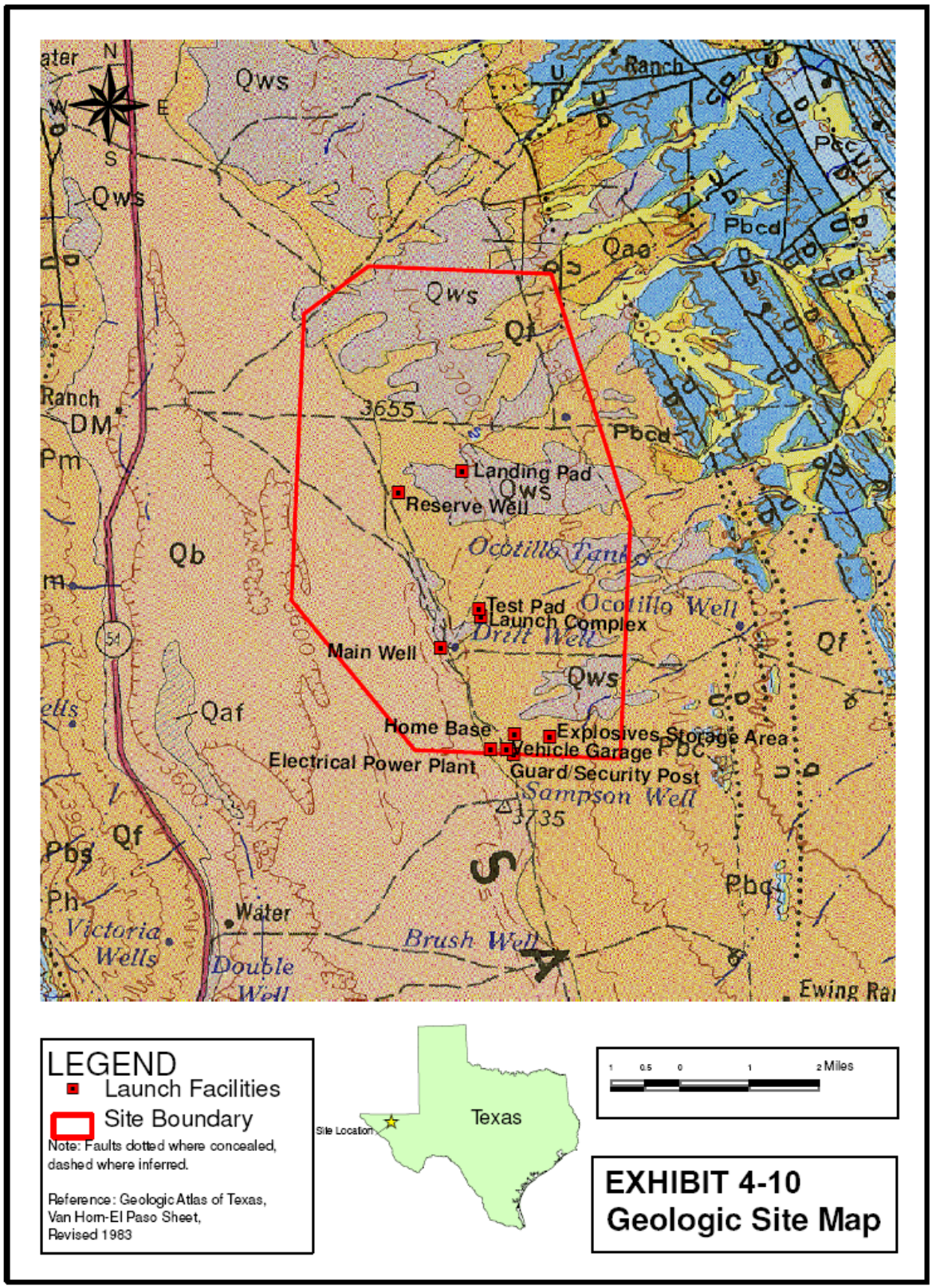
- Seismicity – There is seismic activity in the region (USGS NSHMP, 2002), but it is mainly concentrated in the Rio Grande area to the west (see Exhibit 3-10). There is no indication of active faults within the boundaries of the proposed launch site. While there are indications of numerous faults east of the site associated with the Delaware Mountains, none of the site facilities would be located within 3.2 kilometers (2 miles) of any mapped geologic faults, including concealed or inferred faults (Exhibit 4-10). Facility foundations and structures have been designed to withstand predicted maximum seismic loads (see Exhibit 3-10). Based on preliminary geotechnical investigations at the site, the site would be classified as Site Class D (Stiff Soil Profile). The adjusted maximum expected accelerations are S_{ms}=0.32 and S_{m1}=0.41. The design values of spectral acceleration are S_{DS}=0.213 and S_{D1}=0.096. The Seismic Use Group is 1 and the Seismic Design Category is B. Construction activities are not anticipated to impact site seismicity.

- Localized Flooding – Construction activities would be evaluated to ensure that any alteration of these drainage features does not result in flooding of the facilities. The major facilities would be located in a basin surrounded by mountains, and it would be necessary to adequately manage the flow of runoff water from upgradient areas, in particular the Delaware Mountains to the east. This hazard can be minimized through proper facility engineering, design, and construction.

- Localized flooding is possible during heavy rain events while construction is occurring. Facility structures would be located away from ephemeral streams that may flood during these events. Surface water runoff from precipitation events would be controlled in accordance with Best Management Practices. Ephemeral streams are indicated on the Exhibit 3-11 topographic map of the area by blue lines with long dashes separated by three dots. Three ephemeral streams are shown within the project area on this map. When water is flowing in these ephemeral streams, it will typically flow from east to west. The topographic map (Exhibit 3-11) indicates fairly well-defined ("vees" in the contour lines) drainage features for these streams as they cut across the 1,158- and 1,127-meter (3,800- and 3,700-foot) elevation contours. West of the 1,127 meter (3,700 foot) contour, these ephemeral streams are not as well defined; none are mapped more than about a mile west of the contour line.

- During one of the infrequent rain events in the area, it is anticipated that flow would be confined to the ephemeral stream beds where they are well defined, which could lead to a vertical rise in water levels and flooding concerns. However, once the flow leaves the well-defined drainage features, it will tend to spread laterally as it flows downhill (generally westward) to the salt basin(s) between the site and State Highway 54. This will reduce the vertical rise in water levels and reduce the impacts of flooding.

Exhibit 4-10. Geologic Site Map



- None of the proposed site facilities is located within 0.8 kilometer (0.5 mile) of any of these three mapped ephemeral streams (see Exhibits 1-1 and 3-11). During the design and construction phase of the project, engineers and construction managers would evaluate the possibility for ephemeral flow in unmapped features during rain events, and ensure that site facilities are located away from areas that may be impacted by flooding.

- Soil Erosion – Soil erosion due to surface water and wind would be of concern during construction. Approximately 308 hectares (760 acres) have the potential to be cleared and graded for construction. Construction activities would include road improvements, utility installation, site grading, installation of foundations and buildings, and landscaping. Best construction management practices would be employed to limit soil loss. These could include:

    - Soil stabilization (e.g., temporary and permanent seeding)

    - Structural controls (e.g., stabilized construction entrance, secured hay bales)

    - Management practices (e.g., construction sequencing, materials delivery sequencing, physical delineation of disturbed areas)

    - Topography – No significant impact on the site topography is expected from construction activities. Some disturbance is expected, but the facilities would be located on mostly flat terrain, which would minimize the impacts.

4.8.1.2 Operation

No disruption of underlying bedrock is expected during launch or landing operations. No impact to site seismicity is anticipated from proposed operations activities. No impact on topography is likely during operations. While localized flooding is possible from heavy rain events during the operations phase of the project, no significant impact is expected because site structures would be located away from areas prone to local flooding.

Operations activities have the potential to impact site soils as described below:

- Landing and Recovery Area – The landing and recovery area would be approximately 0.29 hectare (0.72 acre) with a circular area a small circular concrete pad approximately 0.13 hectare (0.32 acre). The immediate area around the landing pad would be cleared of vegetation to prevent the possibility of starting brush fires during landing activities. All of the soil in the landing and recovery area that is not covered by the concrete pad could be affected by the landing and recovery operations. Natural drainage would be rerouted around the concrete pad.

- Rocket Propellant Combustion Byproducts – The liquid rocket motor propellant would be rocket propulsion grade kerosene and the oxidizer would be hydrogen peroxide. The expected combustion byproducts of the RLV include carbon monoxide, carbon dioxide, and water. No significant impact to site soils in the launch area or in the landing and recovery area are expected from these emissions. In the case of a spill or release of RP or any

hazardous material, the Emergency Response Team would begin the process of containing the material. If any HTP is released, it would naturally decompose to water and oxygen, presenting no impact to the environment. Uncontained RP or hazardous material could contaminate the soil at the release area. A licensed environmental firm would be contracted to conduct tests and, if necessary, remove any contaminated soil from the site.

4.8.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued, and no launch operations activities would occur and there would be no impact on site geology or soils from these operations.

4.9 Socioeconomics (including Natural Resources and Energy Supply)

4.9.1 Proposed Action

4.9.1.1 Construction

During the estimated twelve-month construction period, approximately 32 construction vehicles a month would be used on the site for clearing, construction, and outfitting tasks. During the second quarter year of construction, the average number of vehicles would increase to about 45 vehicles per month.

Employment and Income

The construction phase would require a monthly average of approximately 45 FTE (full time equivalent) workers. The second quarter year of the construction phase would experience the highest number of FTE workers, approximately 70 workers per month. Virtually all the workers would have permanent residences outside of the ROI. From 1999 to 2003, the number of workers employed in Culberson County in the construction sector was too small to be disclosed. (BEA 2005) For the same period, the number of workers employed in the construction sector in Hudspeth County was minimal. In 1999, 2000, and 2003, the numbers were too small to disclose. In 2001 and 2002, there were 32 and 23 workers, respectively. Therefore, it is reasonable to assume that few workers within the two counties have the required skills. Some of the wages and salaries earned by these marginal (residing outside the ROI) construction workers would help to stimulate the local economy by creating a very small number of additional indirect jobs (food service personnel, service station personnel, casual entertainment employees, etc). Expenditures for goods and services to support the construction and building activities would generally occur outside of the ROI although merchants in the towns of Van Horn and Sierra Blanca would be expected to provide some construction materials. In addition, income taxes and sales taxes would be paid to the local and state governments. Taxes paid to the local and state governments would be beneficial because the government expenditures required to support construction workers (e.g., for schools, hospital care, etc.) would be minimal. The 2003 average per capita income was $16,482 ($7.92 per hour) in Hudspeth County and $15,522 ($7.46 per hour) in Culberson County. Wages for the skilled construction labor in the ROI is approximately $16 per hour, excluding benefits.

Population

Most of the current population in the ROI is less than one person per square mile 0.3 person per square kilometer (0.7 person per square mile). Most of the construction workers would be marginal laborers (residents from outside of the ROI), but some local residents probably would be hired. As a result of this hiring from outside the area, there would be only a very small, less than significant, (much less than 1 percent) increase in population. The two-county ROI had a population of 6,027 persons in 2004 (Culberson 2,727 and Hudspeth 3,300) and has been experiencing an annual decline in population for the last decade. (USCB 2005)

Housing

Any increase in the demand for housing would be temporary. An individual worker could be employed on site anywhere from one day to several months at a time. Existing rental units, given the vacancy rate (8.4 percent in Culberson County, 18.8 percent in Hudspeth County), would be sufficient to satisfy any increase demand for housing. The estimated monthly average of 45 construction workers, with a peak of 70 workers for a single month, would not put additional demand on the housing in the area. It is expected that most of the construction workforce would reside in one of the fifteen motels or 4 RV parks in the town of Van Horn.

Community Services

Schools - Given the short construction period**,** the small number of construction workers, and the fact that most workers would come from outside Culberson or Hudspeth Counties, most workers would be expected to commute to the site on a weekly basis and leave their families at home. Thus, no impact on the school system, despite the small existing enrollment within the schools, is expected.

Emergency Response Facilities - Because the number of construction workers is so small, workers are expected to be in area for a short time on their temporary assignment, and workers are expected to be in residence without family members, no impact on the existing medical facilities is expected. There are four medical centers/hospitals within 185 kilometers (115 miles) of the proposed Blue Origin site. The closest, and the one most likely to be used by Blue Origin personnel, is the Culberson County Hospital District in Van Horn.

Natural Resources and Energy

In accordance with FAA Order 1050.1E, the proposed action was examined to identify any proposed major changes in stationary facilities or the movement of ground vehicles that would have a measurable effect on local supplies of energy or natural resources. If there are major changes, power companies or other suppliers of energy would be contacted to determine if projected demands can be met by existing or planned source facilities. The use of natural resources other than for fuel need be examined only if the action involves a need for unusual materials or those in short supply. The proposed action does not create any major changes that would have a measurable effect on local supplies of energy or natural resources. The proposed action does not utilize unusual materials or materials in short supply.

4.9.1.2 Operations

Employment and Income

Staffing for the operations phase of the proposed launch site is expected to be 20 to 35 full time personnel traveling to the site. The average wage rate for professional level support services in the ROI is approximately $12 per hour (McCoy 2005). The majority of the security and support personnel would be expected to be drawn from the local area. Additional employment opportunities created by the proposed action, approximately 20 to 23 positions, would have no impact on the employment statistics for the area. The proposed action would represent an increase of less than one percent (0.86 percent) in the ROI labor force. (BEA 2005; TTNUS 2005)

The airspace above and around the launch site is used by commercial and military aircraft. Prior to scheduling flight countdown activities, the FAA would consider and grant approval for exclusive use of the airspace directly above the launch site for a specific launch and recovery time window. Blue Origin RLV flight timelines project a total mission not to exceed ten (10) minutes in National airspace. Because the launch/recovery time window is so small, commercial flights and military patterns are not expected to be affected, so no negative economic impact on either entity, or to the economy of the area, is anticipated.

Population

Although unlikely, very small population increases could occur as a result of the operations phase of the proposed action. Professional support workers, hired from outside the area, may elect to permanently reside in the area with their families. In 2000, the average household size in the United States was 2.59. (USCB 2000) Assuming that 10 workers from outside the area would move to Culberson or Hudspeth County and bring a family, there could be a population increase of 26 people or 0.43 percent over 2004 population levels in the ROI, a less than significant change.

Housing

There would be no impacts on housing availability during the operations phase of the proposed action for the same reasons cited above.

Community Services

Schools - There would be no impact on schools from the proposed action during operations phase for the reason cited above.

Emergency Response Facilities - No impact on medical services in the area is expected during the operations phase of the proposed action. The anticipated increase to the population base is less than one percent. There are four area medical clinics/hospitals within a 185-kilometer (115-mile) radius of the proposed action site.

During launch operations, on site fire services would be provided by the Emergency Response Team consisting of trained Blue Origin personnel. In the event of a fire resulting from a launch vehicle crash, the Emergency Response Team would mobilize with an emergency vehicle and auxiliary water tanker to the scene. The Emergency Response Team would prevent the spread of the fire until it can be extinguished and summon off-site fire services for assistance if required. The Emergency Response Team would also be responsible to secure the accident site and initiate an accident investigation when all fire and explosive hazards have been mitigated.

On site medical services would consist of an infirmary facility equipped to provide comprehensive first aid, resuscitation, and emergency defibrillation. Permanent launch site staff would be trained in first aid, and would summon assistance from off-site services as required.

4.9.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued and no launch site would be operated. Therefore, no new employment opportunities would be created from launch operations. There would be no change in population and no change to income within the ROI from launch operations. There would no change in the demand for public services such as schools, medical facilities, or public safety personnel in the ROI either.

4.10 Traffic and Transportation

Construction of the launch site and its subsequent operation would increase traffic in the region, especially on Highway 54. Impacts from increased traffic could potentially include air emissions from vehicle exhaust, noise, traffic congestion, road deterioration, traffic accidents, and exposure to hazardous materials following accidents. Methods for evaluating the impacts of vehicle exhaust are applicable to congested areas. Because the launch complex is being constructed in one of the most sparsely populated counties in Texas, vehicle emissions would not be addressed in this section. Section 4.1 addresses air emissions.

4.10.1 Proposed Action

4.10.1.1 Construction

Highway 54 (see Exhibits 1-1 and 3-5) would be the road most impacted by construction activities. It is the only access to the construction site. As described in Section 3.8, Highway 54 is an infrequently used highway. During the peak period of construction, 70 construction workers would be commuting to the site. The monthly average construction workforce is 45. Blue Origin intends to use a van pool to transport these workers from Van Horn to the launch site and back each day. In addition there would be approximately 4 to 6 daily deliveries of equipment, supplies, and building materials. Such an increase in traffic could create congestion and additional traffic noise of limited duration in Van Horn, but would not be expected to challenge the capacity of Highway 54 outside the city limits. Highway 54 is expected to undergo improvements at the beginning of 2006, so deterioration of the highway should not occur. If Highway 54 refurbishment occurs at the same time period as construction of the launch site, travelers on the highway could experience additional delays.

The number of traffic accidents in Van Horn and on Highway 54 could increase. Applying the national 10-year average (1994-2003) traffic accident rate (BTS 2005) to an assumed 100 round trips between Van Horn and the launch complex yields approximately 4 accidents over one year. Approximately half of these accidents would be severe enough to cause an injury.

Some small fraction (less than one percent) of the total trips would contain hazardous materials such as gasoline, diesel fuel, or compressed, flammable gases. If one assumes that the injury rate applies to accidents sufficiently energetic to release hazardous material and that one percent of all trips involves hazardous materials, then an estimated 0.02 accidents involving hazardous material releases would occur during the 12-month construction period. This rate assumes that the maximum trip rate continues throughout the year.

4.10.1.2 Operation

During facility operations, the commuting workforce would be approximately 23 workers. During launches, customers and other visitors would be visiting the site. Shipments of hydrogen peroxide (120 per year) and kerosene (20 per year) would be needed to fuel the RLVs. There would also be approximately 50 shipments per year of gaseous helium and nitrogen. Fifty-two shipments of diesel fuel would be needed per year for diesel generators. There would be other shipments of supplies and materials. However, the traffic from operations would be considerably less than that for construction. Existing roads would be well able to handle the traffic without congestion.

The potential does exist for sightseers to crowd Highway 54 during launches. Recent private space launch attempts associated with the X Prize attracted numerous sightseers, in part due to widespread pre-launch publicity. Given the small population density and, remoteness of the site, and the fact that Blue Origin does not plan to actively publicize launch times, the Blue Origin site is not expected to attract as many sightseers as do some other launch sites. Nevertheless, Highway 54 may become temporarily congested if cars accumulate along the highway shoulders to observe launches.

4.10.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued, and as a result traffic on roads in Culberson County would not increase. Hazardous materials shipments would not increase. Therefore, environmental conditions at the proposed launch site would remain as described in Chapter 3, Affected Environment.

4.11 Water Resources (including Wetlands and Wild and Scenic Rivers)

Ground water resources at the launch site are described in Section 3.9. The discussion there demonstrates that there is sufficient ground water to support current and proposed activities in the area of the launch site and that the amount of water in aquifer storage would, at a minimum, be unchanged from present amounts in the year 2050.

4.11.1 Proposed Action

Potential effects of the proposed action on local ground water resources include aquifer drawdown, water quality impacts from site discharges, and changes in aquifer recharge because of site development.

4.11.1.1 Construction

Ground water from existing or new on site wells, if necessary, would be used to supply construction activities. Construction of launch site facilities and roads would require an estimated 5.7 to 7.6 liters (1.5 to 2.0 gallons) per minute continuous flow for a period of one year. Aquifer drawdown for this withdrawal would be less than 3.8 centimeters (1.5 inches) within 9 meters (30 feet) of the withdrawal well (conservatively assuming withdrawal from a single well). Thus, the effects of this withdrawal on off site water use and, in fact, other uses on site, would be *de minimis*. Best management water control practices, including storage and control of liquids, would be employed for all construction activities in accordance with Texas State regulations.

There are no wetlands or wild and scenic rivers in the ROI and therefore none would be impacted by the construction activities.

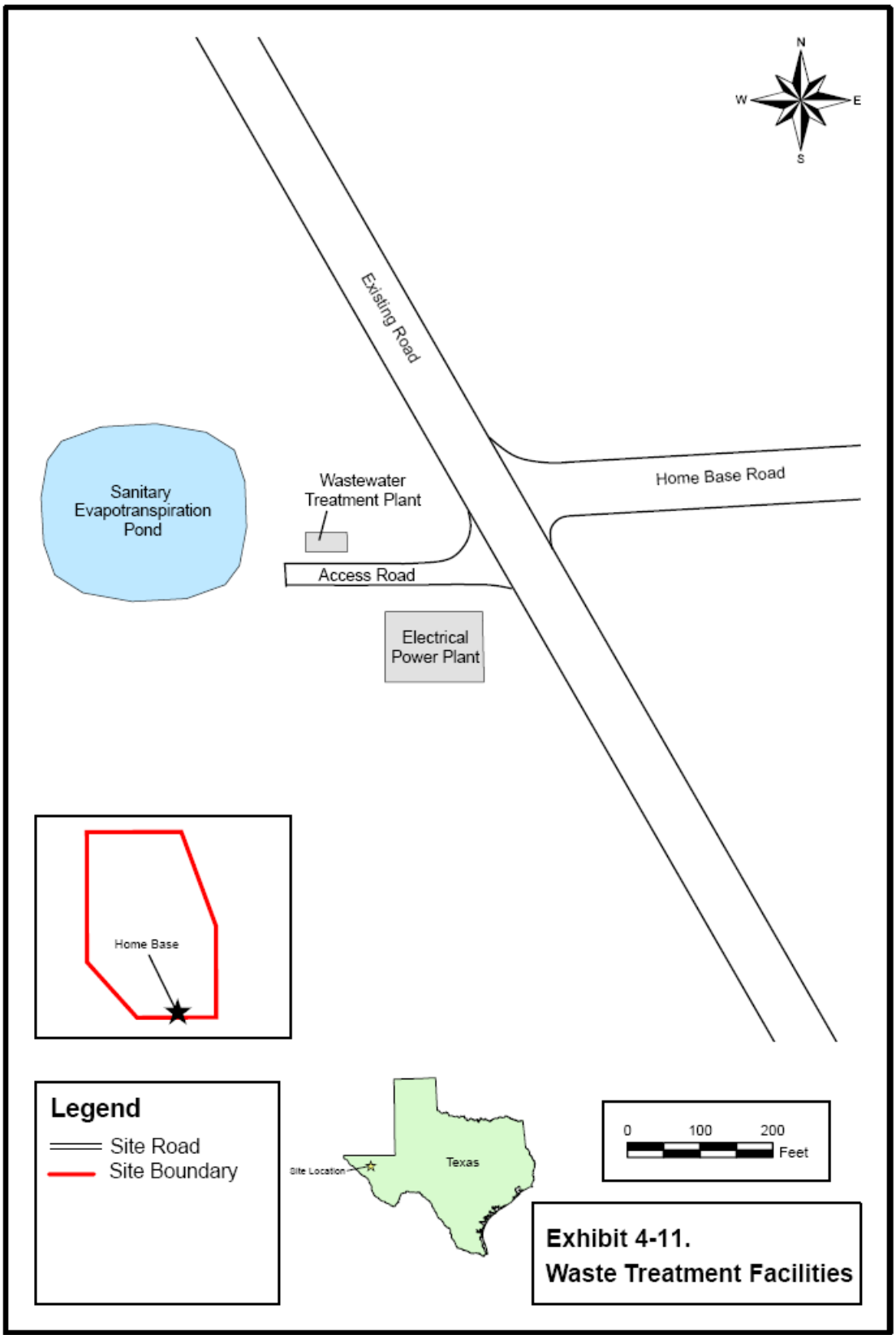
4.11.1.2 Operation

On site wells would be used to supply water for launch site operations. Average water use rates are expected to be approximately 5.7 liters (1.5 gallons) per minute. Although short term peak flows may be greater, aquifer responses would reflect long term averages. Aquifer drawdown, conservatively assuming double (11.4 liters [3 gallons] per minute) the expected average withdrawal rate is pumped from a single well, would be approximately 6.4 centimeters (2.5 inches) at 9.1 meters (30 feet) from the well after 10 years of pumping. As described in the affected environment section, measured flow rates of some existing on site wells greatly exceed 11.4 liters (3 gallons) per minute. Thus, impacts of this water withdrawal on other possible on site water uses and off site water uses would be below levels of concern.

An approximately 0.4 hectare (1 acre) pond located on the westward side of Home Base and next to the Power Generator Facility would receive an average of 3,407 liters (900 gallons) per day of particulate filtered wastewater from the central waste treatment plant. This flow is equivalent, for the given pond, to a flow depth of approximately one foot per year. Exhibit 4-11 shows the location of these facilities. With a gross lake evaporation rate of 2.1 meters (7 feet) per year and only 28 centimeters (11 inches) per year of precipitation, all of this flow would be expected to evaporate and evapotranspire. The launch site design would incorporate required water management methods for all building sites, parking lots and areas where a change in grading or ground cover has occurred as a result of construction. Launch site areas where potentially contaminated waste water or solutions may be inadvertently discharged would have fixed containment barriers.

Launch releases are expected to be chiefly gases and water vapor. Any minor amounts of chemicals which may deposit on the ground would be dispersed. Any chemical released would

Exhibit 4-11. Waste Treatment Facilities



not be expected to be transported to the water table because of the great depths from the surface to the water table and the lack of ground water recharge at the site.

Approximately 90.2 hectares (223 acres) would be covered with impervious surfaces, such as concrete, asphalt, or pavement. Recharge of groundwater in the area of the proposed site occurs around the margins of the basin and along channels of ephemeral streams. Because precipitation at the site does not recharge the ground water, no impact on ground water resources is expected from this change in ground cover.

There are no wetlands or wild and scenic rivers in the ROI and therefore none would be impacted by the operation activities.

4.11.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued and as a result there would be no impacts on ground water resources from launches or site operations.

4.12 Airspace

4.12.1 Proposed Action

4.12.1.1 Construction

All construction activities would use ground equipment without entering controlled airspace, and therefore construction activities are not relevant to analysis of impact on controlled airspace.

4.12.1.2 Operation

The proposed RLV would fly a vertical trajectory during both ascent and descent flight phases. During the flight, Blue Origin would track the IIP of its RLV in real-time and would terminate thrust immediately if the IIP departs from a pre-determined exclusion zone within the boundaries of the privately-owned ranchland. This steep flight ascent and descent profile in both nominal and off-nominal scenarios minimizes potential airspace conflicts. Therefore, air traffic within a 7.4-kilometer (4-nautical mile) radius of the test pad has been examined using data provided by FAA Air Traffic Control. During the period December 12, 2005 to December 16, 2005, aircraft tracks through this airspace ranged from 102 to 129 per day. This traffic included both commercial and military aircraft. The Air Force has two low-level training routes, 1R 192 and 1R 194, which are to the east and west of the proposed launch facility and pass within a 6.4-kilometer (4-mile) radius around the proposed launch site.

The FAA is charged with the overall management of airspace and has established certain criteria and limits for the use of various sectors of airspace. Airspace management is based largely on the number of aircraft that will be operating in an area, the nature of the operations conducted in that area and the level of safety needed to handle the air traffic. Any increase in airspace use can potentially affect the safety of aircraft and the health of people within the airspace. It also reduces the airspace availability to other aircraft. Blue Origin would consult with the FAA Southwest Region in developing a memorandum of agreement regarding coordination of

airspace use. The agreement would address timing, methods of requesting and granting airspace use, and verification procedures.

The proposed trajectories result in a total mission of less than ten minutes in national airspace. Prior to scheduling flight countdown activities, approval would be required from the FAA approval for exclusive use of the airspace directly above the launch site for a specific launch and recovery time window, which is anticipated to be less than three hours. During this window, it is expected that commercial flights would be rerouted and military flights would be rescheduled or rerouted. Blue Origin plans to ensure the airspace is clear by maintaining constant communication with Albuquerque Air Route Traffic Control Center during the flight operation and placing visual spotters on the ground during the operation to look for unauthorized aircraft. Except for its initial monopropellant prototypes, which are incapable of reaching an altitude greater than 610 meters (2,000 feet), Blue Origin would also provide the Air Route Traffic Control Center with the ability to know the real time position and velocity of its RLV while operating in the National Airspace System. The specific Blue Origin and FAA arrangements related to airspace use will be addressed in detail during the safety analysis portion of the permit and licensing processes.

Given the short window for need of exclusive airspace use, the infrequent launches (approximately once per week), and expected procedures for rerouting or rescheduling air traffic, the use of FAA-approved temporary restricted airspace procedures is not expected to significantly impact airspace use in the area.

4.12.2 No Action Alternative

Under the no action alternative, no experimental permits or licenses would be issued and as a result there would be no impacts on surrounding air space as a result of launches or site operations.

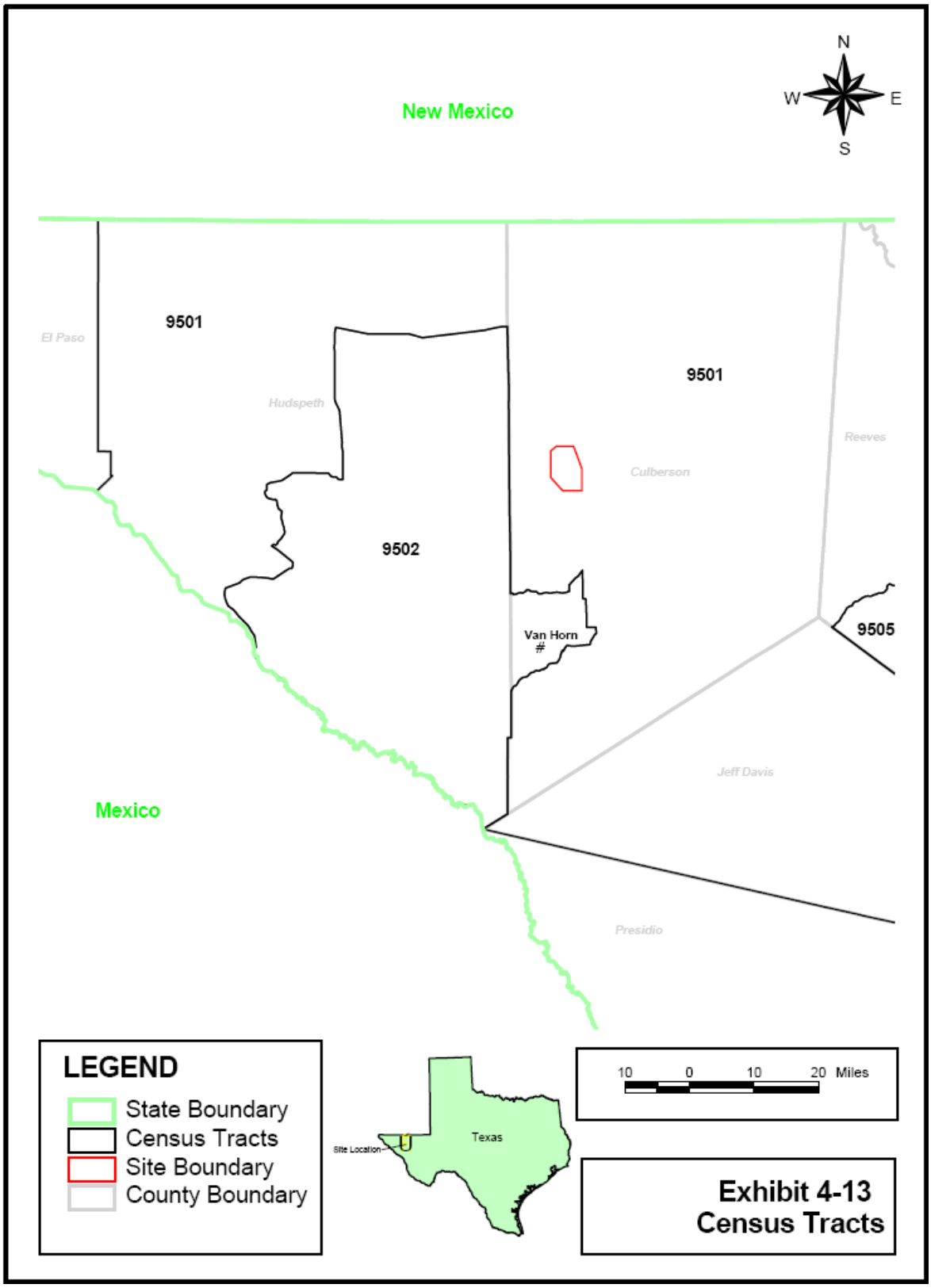
4.13 Environmental Justice

4.13.1 Proposed Action

The environmental justice analysis involved three steps. First, minority and low-income populations within the two-county region of influence were identified. Second, the impacts of the proposed action were assessed. Third, a review was conducted to identify any special considerations, such as unique exposure pathways or cultural practices that could contribute to any disproportionate impacts.

Impacts on minority or low-income populations that could result from the proposed action and alternatives were analyzed for the geographic areas in which the proposed launch site would be located to determine if they are disproportionately high and adverse. Impacts related to the proposed launch site were analyzed within the census tracts surrounding the launch site and contained in the socioeconomic ROI (see Exhibit 4-12).

Exhibit 4-12. Census Tracts Containing the Blue Origin West Texas Commercial Launch Site and Contained in the Socioeconomic ROI



In this assessment, potential impacts arising under the major disciplines and resource areas including socioeconomics, cultural resources, air resources, water resources, ecological resources, noise, hazardous waste and materials, and traffic and transportation were reviewed. As described earlier in Chapter 4, no high or adverse impacts to any of these resources were predicted for the activities analyzed in this EA. Impacts in every instance were predicted to be small. Furthermore, no means for minority or low-income populations to experience disproportionately high and adverse impacts have been identified.

Because impacts would not significantly impact the surrounding population, and no means were identified for minority or low-income populations to be disproportionately affected, no disproportionately high and adverse impacts would be expected on minority or low income populations from the construction and operation of the proposed launch site.

4.13.2 No Action Alternative

Under the no action alternative, experimental permits or licenses would be issued and no launch site would be operated. Therefore, there would be no disproportionately high or adverse impacts on minority or low income populations.

4.14 Health and Safety

4.14.1 Proposed Action

4.14.1.1 Construction

This section considers potential illness, injury, and fatality rates associated with construction of the launch site on the construction workforce. Health and safety impacts to workers were calculated using occupational injury, illness, and fatality rates obtained from U.S. Department of Labor, Bureau of Labor Statistics data.

The potential risk of occupational injuries and fatalities to construction workers would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for the five-year period from 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for the number of construction workers for the duration of construction activities. These values are shown in Exhibit 4-13. The average monthly workforce for the construction period is estimated to be 45 workers, with a peak monthly workforce of 70 workers. Construction contractors would employ standard measures to protect construction workers in accordance with OSHA regulations.

Exhibit 4-13. Injury, Illness, and Fatality Estimates for the 12-month Construction Phase of the Proposed Launch Site

Category	Number of Cases
Total Recordable Cases	3.8
Total Lost Workday Cases	1.8
Fatalities	0

No chemicals have been identified that would be a risk to members of the public from construction activities at the proposed launch site. Construction workers would be protected from hazardous chemicals by adherence to OSHA and EPA occupational standards that limit concentrations of potentially hazardous chemicals.

4.14.1.2 Operation

During normal operations, total facility staffing would be approximately 23 persons. The potential risk of occupational injuries and fatalities to workers operating the launch site were estimated using BLS data for the five-year period from 1997-2001. Using these data, annual Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for site operations workers. These values are shown in Exhibit 4-14.

Exhibit 4-14. Injury, Illness, and Fatality Estimates for Operation of the Proposed Launch Site

Category	Number of Cases
Total Recordable Cases	1
Total Lost Workday Cases	0.5
Fatalities	0

No chemical-related health impacts to workers or members of the public are associated with normal (accident-free) operations of the launch site. The facilities would be designed to include controls features to minimize worker exposures during facility operation. In addition to these controls, worker protection would be augmented by facility safety programs including work planning, chemical and industrial hygiene, personnel monitoring, and emergency preparedness.

All accidents, safety incidents, and reportable injuries would be investigated by an on site team of Blue Origin personnel, directed by Blue Origin's Safety Manager. The investigation team would enlist additional resources from Blue Origin headquarters staff in Kent, Washington as required. The purpose of the investigation would be to determine the root cause(s) of the accident/incident and implement corrective actions to prevent recurrence of the accident.

There are no health impacts to members of the public (adults or children) from the operation of the proposed launch site. Therefore, the requirements of EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks" are not applicable to this action.

4.14.1.3 Off-Nominal Operations

As described in the proposed action under section 2.1.1.1, the New Shepard RLV would have a system for containing its impact dispersion radius to a sparsely populated area by initiating an abort in the event of an off-nominal trajectory or other anomalous condition. The New Shepard RLV would be capable of initiating abort autonomously if its flight computer detects a significant off-nominal condition in flight path angle, attitude, or other health condition. The ground crew would also be tracking the IIP of the New Shepard RLV through vehicle telemetry or other means of tracking the vehicle such as ground radar. For vehicles capable of leaving a pre-determined safe zone, ground crews can initiate abort if the vehicles IIP leaves the safe zone.

During an abort, the crew capsule would separate, using small solid-rocket motors to safely recover the space flight participants. The abort module containing the solid-rocket motors would then jettison from the crew capsule. After the crew capsule departs, the propulsion module would attempt to steer back to the landing pad using aerodynamic surfaces and use its engines near the ground for a controlled, powered vertical landing.

In the majority of foreseeable off-nominal scenarios, the crew capsule, abort module, and propulsion module would all land within the perimeter fence of the launch site. In some rare cases, the vehicles may land outside the fence line. However, in nearly all cases, the vehicles will stay within the boundaries of private land controlled by Blue Origin and present no danger to the public. In the unlikely event the vehicles impact outside the privately controlled Blue Origin land, the surrounding properties consist of extremely sparsely populated rangeland. During any landing away from the landing pad, the potential exists for crushing vegetation and animals as the vehicle touches down to ground, fire, and, for the propulsion module and abort module, the dispersal of unused propellant.

Crew Capsule Off-Nominal Landing

Wherever the crew capsule would land, its environmental impact would be limited as it would contain no significant quantity of flammable or hazardous material. The crew capsule would come down slowly under a parachute canopy with impact further mitigated by airbags, crushable structure, or some other decelerator device.

Abort Module Off-Nominal Landing

During abort system test flights, and in unlikely abort cases of commercial flight operations, the vehicle would fire small solid rocket motors to separate the crew capsule from the propulsion module. The abort module contains multiple solid rocket motors to provide the necessary impulse for safe separation and recovery of the crew capsule.

In operations a jettisoned abort module would contain spent solid rocket motors, or a combination of spent and unfired solid rocket motors, depending on the flight conditions at

which the abort was commanded. Initial flight tests would explore the entire flight regime for abort cases and would therefore involve abort module impacts with all spent solid rocket motors, as well as cases where the abort module contains some live (unfired) solid rocket motors.

The jettisoned abort module would be visually tracked and the impact location determined by triangulation. A locator system may also be installed on each abort module. The HAZMAT/Emergency Response Team would be dispatched to the abort module impact site to prevent the spread of any fire which results from contact of hot solid rocket motor cases or nozzles with combustible vegetation, or impact ignition of unfired solid rocket motors.

The abort module would incorporate features to preclude the abort module from entering public property after jettison. These features would either preclude ignition of unfired solid rocket motors upon impact, or incorporate positive means to render the solid rocket motors nonpropulsive in the event of ignition at impact. These features would assure that debris resulting from aborted missions or abort system tests are contained within the boundaries of the launch site. Possible approaches include "soft" landing of the unfired solid rocket motors via aerodynamic decelerators, or providing massive vent area in the solid rocket motor cases via linear shaped charges initiated after abort module jettison.

In the case where impact of the spent abort module results in a fire, the Emergency Response Team would stand off at a safe distance and prevent the spread of the fire while waiting until all residual solid propellant is consumed.

In the case where impact of the spent abort module does not result in a fire, the Emergency Response Team would wait at a safe stand off distance until it is determined that a fire will not start (at least 60 minutes after impact).

After the fire resulting from impact has burned out or after it is determined that a fire will not start, the Emergency Response Team would don personal protective equipment (fire resistant Nomex coveralls, gloves, airpacks, face shields) and approach the impact site to inspect for unburned solid propellant. Unburned solid propellant remaining after abort module impact would most likely consist of large fragments of the propellant grain, either bonded to fragments of the motor case, or loose on the ground. The Emergency Response Team would safely collect any remaining igniters or solid propellant fragments and transport them to a designated burn pit (impervious concrete slab/metal pan covered with sand) for disposal by open air burning. Any waste water resulting from propellant collection operations would also be disposed of by incineration in a manner that complies with all applicable regulations. Solid rocket motor case/nozzle/igniter fragments remaining after open air burning would be disposed of as solid waste.

Propulsion Module Off-Nominal Landing

Although the propulsion module would be designed to attempt an intact landing after an abort, there is a small possibility it would crash into the ground or tip-over if it does not land on the landing pad. In this case, there would be some quantity of propellant on-board that may detonate or deflagrate if the propellant tanks rupture. The quantity of propellant on-board decreases the further into the flight that an abort is declared. For an abort that occurs just after liftoff, the

propellants involved in detonation or deflagration would be nearly the full vehicle propellant load of less than 48,534 kilograms (107,000 pounds) mass of HTP and 5,897 kilograms (13,000 pounds) mass of RP. If the crash results from an anomaly that occurs late in the flight after the vehicle has performed a nominal ascent and is approaching the ground for a powered landing, the propellant load would be approximately 3,629 kilograms (8,000 pounds) mass of HTP and 454 kilograms (1,000 pounds) mass of RP or less.

In the unlikely event of a propulsion module crash, a HAZMAT/Emergency Response Team consisting of trained Blue Origin personnel would be dispatched to the crash site to prevent the spread of any fire. In the event the crash results in a fire, the Emergency Response Team would stand off at a safe distance and prevent the spread of the fire while waiting until all residual propellant is consumed.

In the case where impact of the propulsion module does not result in a fire, the Emergency Response Team would wait at a safe stand off distance until it is determined that a fire will not start (at least 60 minutes after impact). After the fire resulting from impact has burned out, or after it is determined that a fire will not start, the Emergency Response Team would begin the process of containing any unburned propellants and salvaging the vehicle. Any unburned HTP would naturally decompose to water and oxygen, presenting no impact to the environment. Uncontained, unburned RP may contaminate the soil at the crash site. A licensed environmental firm would be contracted to conduct tests and, if necessary, remove any contaminated soil from the crash site.

4.14.2 No Action Alternative

Under the no action alternative, no Launch Authorization would be issued and therefore no launch site would be operated. Therefore, there would be no change in the health and safety of workers or the off site population from launch operations.

4.15 Cumulative Impacts

This section summarizes the foreseeable environmental effects that could occur as a result of the proposed launch site and identifies other reasonably foreseeable impacts that could accumulate with these effects. In its regulations for implementing the procedural provisions of the National Environmental Policy Act, the CEQ defines cumulative impacts as follows: the impacts on the environment that result 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. (40 CFR 1508.7)

As discussed in Section 3.4, most of the land within a 40 kilometer (25-mile) radius of the proposed launch facility is privately owned. This land includes working farms and cattle ranches and former ranch properties that are now leased to groups of hunters and managed for game species, primarily mule deer. The only industrial facilities in the general vicinity of the proposed launch facility are the Texas Architectural Aggregates Mine, approximately 8 kilometers (5 miles) to the west of the site, and the Delaware Mountain Wind Farm, approximately 16 kilometers (10 miles) to the northeast. The Texas Architectural Aggregates Mine is owned and operated by Texas Aggregates Incorporated; the Delaware Wind Farm is owned and operated by

Florida Power and Light Energy. Because of the remoteness of the proposed site and the near absence of industrial activity in this part of Culberson County, there are no facilities in the area producing liquid or gaseous effluents of any kind, and no significant users of surface water or groundwater. The only federally-owned land in the area is Guadalupe Mountains National Park, which is staffed by a small number of personnel and receives a relatively small number of visitors each day, roughly half the number that travels to nearby Carlsbad Caverns National Park.

Sections 4.1 through 4.14 analyze environmental impacts from constructing and operating the proposed launch site over the lifetime of the facility. The only past, present, or reasonably foreseeable future source of cumulative impacts (i.e., that could affect the same resources as the launch site) would be the operation of the marble mine in the Sierra Diablo Mountains resulting in traffic and transportation along State Highway 54. Other traffic along Highway 54 resulting from tourist traffic to Guadalupe Mountains National Park or Carlsbad Caverns National Park could also contribute to cumulative impacts.

As discussed in Section 4.10, State Highway 54 is a lightly used roadway. An average of 180 vehicles passes the area of the launch site each day on Highway 54. This total represents local traffic, workers at the Texas Aggregates marble mine, and travelers to Guadalupe Mountains National Park. Assuming one worker per vehicle, which is clearly conservative as some workers will share rides, the total number of vehicles using Highway 54 would increase to approximately 320 per day (13 vehicles/hour) during the peak construction phase and to approximately 230 per day (10 vehicles/hour) during the operations phase. Increases of this magnitude would have little or no effect on local traffic and would not hinder the normal flow of traffic to and from Guadalupe Mountains National Park from Interstate 10.

Another potential cumulative impact would be the additional traffic in the national airspace above the launch site. As described in Section 4.12, Blue Origin launches would compete for airspace with commercial and military aviation. Blue Origin would attempt to minimize this competition by appropriate timing of launches and coordination of overall air traffic with the FAA pursuant to a letter of agreement with the Albuquerque Air Traffic Control Center.

No significant cumulative impacts would be expected from the implementation of the proposed action.

4.16 References

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5 MITIGATION

As discussed in Chapter 4, there are no significant impacts from the proposed action, and therefore no mitigation measures would be needed. Nevertheless, Blue Origin plans to undertake mitigation measures to further reduce any impact from the proposed action. This chapter summarizes mitigation measures that Blue Origin would take to reduce or offset the potential environmental consequences of construction and operational activities. Mitigation measures described in the following sections include administrative or management controls and engineered systems that would be implemented through operating procedures. Further mitigation may be conducted in consultation with Federal and State agencies on an as needed basis.

5.1 Air Resources

During construction activities, water would be applied to disturbed areas for dust suppression. The cement batch plant would incorporate particulate control features such as the enclosure of conveyors and elevators, filters on storage bin vents, and the use of water sprays.

5.2 Ecological Resources

Blue Origin plans to add return-address labels to its radiosondes, so that anyone finding one after its launch may return it to Blue Origin. No other mitigation measures have been identified that would be specifically aimed at mitigating impacts to ecological resources. However, some of the mitigation measures intended to reduce impacts in other resource areas, such as dust suppression, would also serve to reduce impacts on plants and animals.

5.3 Cultural/Native American Resources

Actions to mitigate the effects of construction of the launch site on cultural resources would include:

- Rerouting a perimeter fence to avoid site 41CU695;
- Temporarily fencing site 41CU695 during construction of perimeter fence and firebreak;
- Recovering data from two 2.3-meter (7.5-foot) wide strips along the edge of an existing road corridor through site 41CU696;
- Implementing standard erosion control measures during all construction activities;
- Educating all employees and contractors conducting construction activities regarding cultural resources in the project area, appropriate avoidance measures, and associated restrictions regarding vandalism and illegal artifact collecting;
- Fencing or staking all construction areas during all construction activities to prevent any activities from proceeding outside of the approved construction area. Also, construction

management and staff would be educated on the requirement that all activities must take place within approved areas; and

- Stopping work if previously unknown cultural deposits are discovered during construction activities, ground-disturbing activities in the area would halt and a qualified archaeologist would evaluate the discovery.

With the concurrence of the SHPO, mitigation activities related to the 9.5-meter (31-foot) wide road corridor through site 41CU696 have been identified and implemented.

Actions to mitigate the effects of maintenance and operation of the Blue Origin launch site on cultural resources would include:

- Permanently fencing the south entrance road through site 41CU696 at the 9.5-meter (31-foot) boundary, preventing any expansion of the road width within the site as a result of maintenance activities;

- Educating all employees and contractors conducting maintenance activities regarding cultural resources in the project area, appropriate avoidance measures, and associated restrictions regarding vandalism and illegal artifact collecting;

- Fencing or staking all maintenance areas during all ground-disturbing activities to prevent any activities from proceeding outside of the approved maintenance area. Also, maintenance management and staff would be educated on the requirement that all ground-disturbing activities must take place within approved areas; and

- Stopping work if previously unknown cultural deposits are discovered during maintenance activities, ground-disturbing activities in the area would halt and a qualified archaeologist would evaluate the discovery.

5.4 Hazardous Materials/Waste Management

Possible actions to mitigate the effects of hazardous materials and solid and hazardous wastes at the Blue Origin launch facility include:

- Taking advantage of all pollution prevention opportunities,
- Recycling solid and some hazardous wastes to minimize the amounts generated,
- Purchasing environmentally friendly products whenever possible, and
- Maintaining appropriate site-specific clean-up materials.

5.5 Land Use (including Farmland and Section 4(f) Resources)

No mitigation measures have been identified that would be specifically aimed at mitigating impacts on land use.

5.6 Visual Resources

Actions to mitigate the effects of construction of the Blue Origin launch site on visual resources include employing dust and soils controls at the access and egress points at Highway 54.

No actions were identified to mitigate the effects of maintenance and operation of the proposed Blue Origin launch site on visual resources.

5.7 Noise

Construction contractors would employ standard measures to protect construction workers from noise in accordance with OSHA regulations.

During launch operations, workers would normally be two miles away at the Operations Control Center. These workers would be unlikely to be exposed to sound levels greater than 115 dBA, the OSHA 15-minute standard. However, any workers potentially exposed to noise greater than any OSHA standard would be required to wear hearing protection.

5.8 Geology and Soils (including Floodplains)

Construction contractors would employ soil stabilization measures, structural controls, and construction management practices to reduce soil loss during the construction phase of the project. Soil stabilization measures would include grading and seeding disturbed areas with a native grass mix. Structural controls, which could include silt fences and secured hay bales/straw wattles, would be designed to trap disturbed soil and prevent its movement off site or into streambeds. Management considerations would include timing and sequencing of construction work to reduce the amount of time areas remained exposed to the elements (seeding areas and installing controls quickly) and clearly marking areas that are to be avoided or protected because they are eroding or are likely to erode because of slope or soil type.

5.9 Socioeconomics (including Natural Resources and Energy Supply)

No mitigation measures have been identified that would be aimed at mitigating impacts on socioeconomics.

5.10 Traffic and Transportation

During construction of the proposed launch site, Blue Origin plans to transport construction materials from both the North and the South of the proposed launch site, which will mitigate the total volume of traffic (from Blue Origin's proposed launch site) in either direction on Highway 54. Blue Origin also plans to van pool construction workers who are temporarily residing in Van Horn, Texas, to minimize impact on commuter traffic. Blue Origin does not plan to actively publicize launch activities, to minimize traffic from curiosity seekers.

5.11 Ground Water Resources (including Wetlands and Wild and Scenic Rivers)

No mitigation measures have been identified that would be specifically aimed at mitigating impacts on ground water resources; however, measures taken to mitigate spills (Section 5.4) would prevent the movement of hazardous chemical into ground water.

5.12 Airspace

Any impacts to airspace would be mitigated by the use of FAA-approved temporary restricted airspace procedures that include mandatory horizontal and altitude separation safety standoff distances. Prior to scheduling flight countdown activities, the FAA would need to review and approve exclusive use of the airspace directly above the launch site for a specific launch and recovery time window. Blue Origin plans to enter into a memorandum of agreement with the FAA to coordinate exclusive use of the affected airspace, under which Blue Origin would schedule launches in advance and FAA would coordinate activates to maximize each party's safe use of airspace.

5.13 Environmental Justice

No mitigation measures have been identified that would be aimed at mitigating impacts on environmental justice.

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Van Horn, TX 79855

William Oliver
Van Horn, TX 79855

Brian Powell
Alpine, TX 79831

Jose Quintana
College Station, TX 77845

Shanna Roberts
Van Horn, TX 79855

David Scott
Van Horn, TX 79855

Andy Skadberg
Boyan, TX 77802

Vivian Snyder
Van Horn, TX 79855

Misty Sumner
Kent, TX 79855

Joan Tatse
College Station, TX 77845

Sol Thomas
Sierra Blanca, TX 79851

Chanley Turner
Van Horn, TX 79855

Adelina Zamarippa
Van Horn, TX 79855

Joann Carr
Van Horn, TX 79855

R.L. Davis
Van Horn, TX 79855

Artaro Gonzales
Van Horn, TX 79855

Ron Helm
Van Horn, TX 79855

Eileen Rouke
Van Horn, TX 79855

Whitney Snyder
Van Horn, TX 79855

Patricia Bell
Salt Flat, TX 79847

Gordon Bell
Salt Flat, TX 79847

Larry Brewton
Dell City, TX 79837

Billy Franklin
Dell City, TX 79847

Carmen Gentry
Dell City, TX 79847

Marcy Guillen
Dell City, TX 79847

Bobby Jones
Dell City, TX 79847

Martha Jones
Dell City, TX 79837

Mike Lafener
Studio City, CA 91604

Bonnie Larreau
Dell City, TX 79837

John Luclan
Salt Flat, TX 79847

Tom McMinn
El Paso, TX

Donna and W. Morrell
Dell City, TX 79847

Joel Muniz
Dell City, TX 79847

Robert Nightengaus
Studio City, CA 91604

Jennifer Nuholen
Dell City, TX 79837

Teri Page
Dell City, TX 79847

Rich Page
Dell City, TX 79847

Annette Snodgrass
Dell City, TX 79837

Janice Wobbenhorst
Salt Flat, TX 79847

DeAnne Page
Dell City, TX 79847

Chris Page
Dell City, TX 79847

Wayne and Susan Perry
Dell City, TX 79847

James and Mary Lynch
Dell City, TX 79847

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APPENDIX A – PUBLIC INFORMATION MEETING SUMMARY

A.1 Introduction

On June 14 and 15, 2005, Blue Origin, LLC (Blue Origin) conducted a series of information meetings in Van Horn, Texas and Dell City, Texas, to present its proposal to construct and operate a commercial launch facility in Culberson County, Texas. The meeting times were 3:30 pm, 5:30 pm and 7:30 pm in the respective city time zones (CDT and MDT). Public notice of the meetings was made twice in both English and Spanish (once during the week of May 31 and once during the week of June 6) in the following newspapers: The Van Horn Advocate, The Hudspeth County Herald & Dell Valley Review, and The Midland Reporter-Telegram.

Blue Origin held the meetings to provide members of the public information on its proposal and to provide a venue for input on the scope of environmental issues to be addressed in the required Environmental Assessment (EA) prepared for the Federal Aviation Administration (FAA) in accordance with the National Environmental Policy Act (NEPA). Blue Origin representatives made presentations on the company and its operating plans, and on the construction and operation of the launch facility. A representative of FAA's Office of Commercial Space Transportation made a presentation on their regulatory role in the environmental approval process. A question and answer period followed each session and Blue Origin specifically addressed each of these questions in the development of this EA. It was emphasized (in each session) that a handful of jobs would be created and that growth in the area would be slow and steady.

An attendance sheet was maintained by Blue Origin at each meeting session. The public was provided with two maps of the proposed project site and a summary of the project on poster boards in English and Spanish. Blue Origin also provided a session moderator, a stenographer, a Spanish interpreter and its environmental consultant to answer questions that arose during the presentation. The presentations were made orally and supported with computer generated materials or poster boards. Question cards were made available to the public to allow for written questions during the meeting or afterwards. The cards had the contact information of Mr. Doug Graham of the FAA's Office of Commercial Space Transportation. In addition, printed versions of the Office of Commercial Space Transportation presentation were available to the public.

A summary of the meeting highlights by location is provided below.

A.2 Public Information Meetings – June 14, 2005, Van Horn, Texas (58 attendees)

3:30 pm Session (49 attendees)

This session was the most heavily attended of the six sessions held. The session moderator acknowledged the presence of selected public officials in attendance. Forty-nine persons representing the public were present for the meeting. Upon completion of the presentations questions were raised by four individuals: Ms. Adelina Zamarippa, Ms. Jo Kincaid, Mr. Bill Addington and Commissioner John Jones. Twelve questions were raised, the majority of which dealt with the potential socioeconomic impact of the project. Issues raised included population influx, taxes, infrastructure effects, and the operating life of the facility. Other questions were

related to project funding, water use, the amount of pollution produced, quantities of fuel proposed to be stored on site, and the cost of a ride on the vehicle. Each question was answered by Blue Origin based on the current information available. In some instances, Blue Origin responded that the specific issue was being analyzed as part of the environmental assessment.

5:30 pm Session (3 attendees)

The presentation format changed to a less formal "in the round" type format for the three members of the public that attended. No questions were asked following the presentations.

7:30 pm Session (6 attendees)

The "in the round" type format continued for the six members of the public that attended. Upon completion of the presentations questions were raised by three individuals: Ms. Lois Flanagan, Mr. Arturo Gonzales and Mr. Ben Flanagan. Ten questions were raised. The focus of the questions was again primarily on the socioeconomic impact of the proposed project such as the impacts to traffic on State Highway 54, the construction bidding process, and the number of Blue Origin staff that would relocate to the area. Other questions were related to the potential impact of launches to wildlife, fencing around the facility, site flooding, water needs, and fuel storage.

A.3 Public Information Meetings – June 15, 2005, Dell City, Texas (31 attendees)

3:30 pm Session (24 attendees)

Twenty-four persons representing the public were present for the meeting. Upon completion of the presentations four questions were raised by Mr. Gordon Bell representing the Guadalupe Mountain National Park. He noted the importance of the National Park Services night skies initiative and asked if launches might be conducted at night. He also asked about the power plant that would be used, what type of fuel it would use, and whether emissions modeling would be done. Each question was answered by Blue Origin based on the current information available. In some instances, Blue Origin responded that the issue was being analyzed as part of the environmental assessment.

5:30 pm Session (5 attendees)

The presentation format changed to a less formal "in the round" type format for the five members of the public who attended. Upon completion of the presentations three questions were raised and one statement was made by two individuals: Mr. Wayne Perry and Mr. (illegible first name) Perry. The questions were related to the length of time the Office of Commercial Space Transportation has been in existence and the other commercial launch facilities under its jurisdiction. In addition, a question was asked about the number of required public meetings for the Blue Origin project. Lastly, a statement was made about the development of the property that credited the previous owner of the land with being a good custodian.

7:30 pm Session (2 attendees)

The "in the round" type format continued for the two members of the public that attended. Upon completion of the presentations a series of 12 questions were raised by Mr. James Lynch. He asked if the facility would be open to the public. Five of his the questions were related to Blue Origin's business operations. He asked questions about the socioeconomic impacts of the project, the facility power source, water needs and if status reports would be periodically available related to the project. He also made the statement that the rural location of the facility would help protect the project.

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APPENDIX B – AGENCY CONSULTATIONS

Copies of consultation letters between the FAA and Native American tribes, U.S. Fish and 3 Wildlife Service, and Texas State Historic Preservation Officer are included in this appendix.

Ysleta del Sur Pueblo
Tribal Council
119 S. Old Pueblo Rd. • P.O. Box 17579 • El Paso, Texas 79917 • (915) 859-8053 • Fax: (915) 859-4252

August 1, 2005

Ms. Patricia G. Smith
U.S. Department of Transportation
Federal Aviation Administrator
800 Independence Ave., S.W., Room 331
Washington D.C. 20591

Dear Ms. Smith

This is in response to your correspondence on behalf of Blue Origin LLC dated June 10, 2005 in which a request for consultation regarding a proposed Commercial Space Launch Facility in Culberson County, Texas.

While we would like to inform you that we believe this launch facility will not adversely affect traditional, religious or culturally significant sites to our Pueblo and have no opposition to them, we would still like to request consultation should any discovery be made during this launch facility construction that is to be determined to fall under NAGPRA guidelines.

Thank you for allowing us the opportunity to comment on this project.

Sincerely,

Arturo Senclair
Tribal Governor

AS:jmc

CONSULTATION POLICY

Ysleta Del Sur Pueblo

Preface: This document formalizes the existing procedures for consultation (government to government, or otherwise) between the Pueblo of Ysleta del Sur and the United States federal government including any and all agencies/offices/departments/bureaus therein. This policy statement reflects completely the procedures followed and adhered to by this federally recognized Indian tribe during previous consultations and therefore the procedures to be followed and adhered to in future consultations.

Consultation: Consultation is the formal, bilateral process of negotiation, cooperation and policy-level decision-making between two sovereign entities: the Tigua Tribe of Ysleta del Sur Pueblo and the United States Government or its designate. Consultation, therefore, is a process that leads ultimately to a decision. Consultation is not just a process or a mean to an end. As such, it should not be viewed by others and is not viewed by the Pueblo of Ysleta del Sur as a mere formality during the stages of any project. Consultation is not notifying our Tribal Council that an action will occur, requesting written comments on the action or alternative actions, and then proceeding with the action or one of the a priori alternatives. Such authoritarian, top-down procedures do not constitute consultation because a decision is not affected bilaterally between two sovereign entities.

Consultation Objectives:

1) Assures that the Tribal Council and its designates understand fully the technical and legal issues, implications, and probable impacts involved in and resulting from an action or alternatives so that an informed policy-level decision can be made.

2) Improved policy-level decision-making of both the Tribal Council and the federal government.

3) Bilateral decision-making between and among sovereigns leading to co-managerial structure.

4) Protection of Ysleta del Sur Pueblo's cultural and natural resources, cultural tradition, economy and lifestyle.

5) Compliance with and respect for Tribal laws and Tribal integrity.

6) Full compliance with federal Indian law, federal statutes, and federal policy.

7) Develop and achieve mutual decisions through working relationships.

8) Improve the integrity and efficacy of decisions over time.

9) Recognition that the Tribe is both a stakeholder and regulator in projects that have potential or real impacts on tribal resources, culture, and lifestyle.

Consultation Procedures:

The consultation venue works or proceeds in much the same way that federal agencies typically operate. This means a series of technical meetings followed by a series of policy meetings. The technical meetings provide opportunities for consultation by and with the appropriate technical staff of both entities. The policy meetings provide opportunities for the resolution of those issues left unresolved at the technical level and for the resolution of those issues that are clearly policy grounded. The outcome of this procedure is the development of a common understanding of the technical and legal issues affecting or are affected by a decision. It is this common understanding in a democratized context that provides the basis for decision-making. The Tigua Tribal Council will address more cooperatively those issues with which they had been thoroughly consulted with prior to a decision.

Consultation requires that federal agencies and the Tribal Council fully understand their roles in the context of the federally-mandated government-to-government relationship and the responsibilities which devolve upon the federal government under the Trust doctrine. In this environment, both the Tribal Council and the federal agency will benefit from the perspectives each brings to the table. This means personal communication, which is one of the foundations for meaningful consultation. To make this process work, the following series of activities should guide consultation:

1. Federal agency contacts the Governor of the Pueblo of Ysleta del Sur to inform him of an impending project or to conduct an activity which may or may not impact a tribal resource or tribal concern.

2. The Governor, after meeting with the Tribal Council and/or it designates, responds back to the federal agency that this issue is or is not important. If it is important, the Governor will communicate to the federal agency that the Tribe will initiate consultation.

3. Consultation is initiated through technical staff meetings which will inform the respective staffs in a comprehensive way so that each can brief and/or make recommendations to their

respective policy level entities in an informed way.

4. After the technical staff has briefed the Tribal Council, the Council will define the consultation protocol it wishes to follow, which will typically entail additional technical and policy level meetings, research activities, and a final policy level meeting to make a decision. These are then transmitted in written form to the federal agency. The outcome here should be a memorandum of agreement to establish a working relationship between entities.

5. The consultation protocol is followed.

6. A decision couched in bilateral cooperation between the federal agency and the Tribal Council is formulated. This decision will be fully compliant with federal and tribal laws and policies. The decision will protect the resources to which the Tigua Tribe of Ysleta del Sur Pueblo has specific aboriginal and Spanish land grant reserved rights. The decision will protect the cultural tradition and the religious practices of the Tribe.

This consultation policy will insure that Tribal Council and the federal government have not only communicated but have developed mutual understanding and trust. Within this context, policy level decision-making can and must work.

Cultural Affiliation Position Paper: Ysleta del Sur Pueblo

Introduction

The following statement is the official position of Ysleta del Sur Pueblo regarding its cultural affiliation to so-called prehistoric and historic areas, sites, locales, monuments and/or traditions. Tribal Council approached this report as a way of expediting any and all consultations pursuant to NAGPRA, AIRFA, NEPA, and the NHPA. Archaeological and ethnographic data, oral tradition, historic documentation and linguistic evidence were collected and analyzed in the development of this statement.

Position

1. The Tigua Tribe of Ysleta del Sur Pueblo is a Federally-Recognized Indian Tribe.

The Tribe received federal recognition on 12 April 1968 when President Johnson signed Public Law 90-287. The law stated that "the Indians now living in El Paso County, Texas, who are the descendants of the Tiwa Indians of Ysleta (Isleta) del Sur Pueblo, settling in Texas at Ysleta in 1682, shall from and after the ratification of this act be known and designated as the Tiwa Indians of Ysleta, Texas..." The bill also transferred the Tribe to the jurisdiction of the State of Texas. In 1987, the Ysleta del Sur Restoration Act transferred the Tribe to the jurisdiction of the United States government, as a dependent sovereign nation.

2. The Tigua Tribe of Ysleta del Sur Pueblo is a Pueblo Indian Nation.

The Tigua are "Pueblo Indians." As the Spanish pushed northward during the 16th century, they encountered a vast majority of indigenous peoples who were living in sedentary communities characterized by compact, multi-chambered structures situated around central plazas. The Spanish called these villages or settlements *pueblos* and the people living there, "Pueblo Indians." An important distinction emerged for the Spanish and other colonial powers between agricultural, village dwelling Pueblo Indians and other "roving" or "hostile" Indians, such as the Apache, who lived a more nomadic, foraging way of life. Virtually all European colonial powers recognized settled indigenous groups as more "civilized" compared to those "dissident" groups with nomadic inclinations. Therefore, Ysleta del Sur is culturally affiliated with all known Puebloan groups including the 19 New Mexico Pueblos, the Hopi Tribe in Arizona, and all Ancestral Puebloan groups including so-called Anasazi peoples and sites.

3. The Tigua Tribe of Ysleta del Sur Pueblo is affiliated with all "Ancestral Pueblo" or so-called "Anasazi" sites.

Broadly speaking, all Pueblos have a basis for claiming cultural affiliation from all

Anasazi sites in the San Juan region. Clan migrations, intermarriage and regroupings of people into communities as they are known today makes this statement possible. As a Tanoan speaking group, Ysleta del Sur maintains the same oral tradition which states that Tanoan speaking groups lived in the Four Corners region prior to the arrival of Keresan speakers. This affiliation is probably more substantial among some Tiwa speakers more than others.

4. The Pueblo of Ysleta del Sur is affiliated with all Jornada Mogollon, Piro, Suma, Manso and Jumano sites.

Broadly speaking, this affiliation is based on the fact that the Pueblo has ancestral ties to the Saline Province of New Mexico, an area of overlap between "Anasazi" and "Jornada Mogollon" cultural areas. Ysleta del Sur Pueblo consists of people who are descendants of the Tiwa of Isleta Pueblo, New Mexico, and the pueblos of the New Mexico Saline Province which includes the Tiwa pueblos of Quarai, Chilili, Tajique and Tompiro-speaking pueblos of Abo, Las Humanas (Gran Quivira) and Tabira. Ysleta del Sur Pueblo also has descendants from and hence affiliation with all archaeologically and historically known Piro communities found south of Isleta, New Mexico. Subsequent to the 1680 relocation to the El Paso area, the Tigua intermarried with Piros, Manso and Suma Indians. The Manso and Suma were part of the Jumano tradition and like the Jumano, were Tanoan speakers. Over time, the Tigua absorbed all these cultural traditions and today represents the only federally-recognized tribe having cultural affiliation with Piro, Suma, Manso and Jumano traditions.

5. The Pueblo of Ysleta del Sur is culturally affiliated with all prehistoric, protohistoric, and historic indigenous cultural traditions found in the Tribe's Spanish Land Grant areas as well as its aboriginal claim area.

The aboriginal claim area, including the Ysleta and Socorro Grants, covers the Texas counties of El Paso, Hudspeth, Culberson, Jeff Davis, Presidio and Brewster. Within this vast area are a number of religious shrines, historic sites, spiritual activity areas and biotic cultural resources of continuing critical importance to the Tribe's well-being.

Albert Alvidrez, Governor

EXHIBIT "A"

U.S. Department
of Transportation

Commercial Space Transportation

800 Independence Ave., S.W, Room 331
Washington, D.C. 20591

Federal Aviation
Administration

JUN 10 2005

Mr. Alonzo Chalepah, Chairman
Apache Tribe of Oklahoma
P.O. Box 1220
Anadarko, OK 73005

SUBJECT: Initial Consultation on the Proposed Blue Origin LLC Commercial Space Launch Facility in Culberson County, Texas

Dear Mr. Chalepah:

The Federal Aviation Administration (FAA) Office of Commercial Space Transportation (AST) has been notified by Blue Origin LLC of Seattle, Washington (a commercial space tourism company) of its interest in obtaining a launch license to conduct operations from a private launch facility in Culberson County, Texas. Because the FAA is a Federal agency, the decision of whether to issue a license for operation of the facility must be considered in terms of its potential impacts on the environment as required in the *National Environmental Policy Act* (NEPA). Thus FAA AST will prepare an environmental assessment (EA) to determine if the potential environmental impacts associated with the proposed licensing activity are significant. If the EA finds that no significant impacts would occur, the FAA would issue a finding of no significant impact and would proceed with the licensing process according to FAA AST regulations; however, should the EA find potentially significant impacts, the FAA would issue a notice of intent to prepare an environmental impact statement (EIS), and the issuance of the license would not occur until after the completion of the EIS.

The EA for the proposed licensing activity will evaluate the environmental impacts associated with the construction and operation of a commercial space launch facility in Culberson County, Texas. Blue Origin has proposed to construct a vehicle processing facility; launch pad complex; vehicle reentry, landing, and recovery area; astronaut training and processing facility; and other related infrastructure (e.g., airstrip, utilities, and security fencing). The geographic location of the proposed facility, shown on Attachment A, is in central Culberson County, just east of Highway 54 and approximately 30 miles

north of the town of Van Horn. The topographic location is in a salt flat with the Delaware Mountains to the east, Sierra Diablo to the west, Guadalupe Mountains to the north, and Baylor and Apache Mountains to the south.

Blue Origin will present additional information on the proposed action during two public information meetings on June 14, 2005 at the Van Horn Convention Center, 1801 West Broadway, Van Horn, Texas from 3:30 PM to 8:30 PM, and on June 15, 2005 at the Dell City Telephone Cooperative Meeting Center, 610 South Main Street, Dell City, Texas from 3:30 PM to 8:30 PM.

In accordance with NEPA, the National Historic Preservation Act, and the implementing regulations of each Act, we are initiating consultation with you so that you can identify concerns about historic properties on or off tribal lands, present views about the proposed undertaking's effects on such properties, and participate in the resolution of adverse effects. We are particularly interested in any information that you may have regarding resources, traditional cultural places, sites, or properties of tribal importance that may be adversely affected by the proposed activity. As required under Section 106 of the National Historic Preservation Act, we will undertake the steps of identifying and evaluating historic properties that may be affected by construction and operation of the proposed activities. In addition to identifying such sites, FAA AST is interested in the qualities of the site that could make it eligible for listing in the National Register of Historic Places, as defined at 36 Code of Federal Regulations 60.4:

> "The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that (a) are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction; or (d) that have yielded or may be likely to yield information important in history or prehistory."

Such information will assist us in defining the area of potential effect and the potential effects to such sites. As such information is defined through this process, we will provide you with the assessment for your review and comment. Mr. Douglas Graham, FAA AST's project contact, will be facilitating consultation with tribes for the EA and the Section 106 process, as appropriate. Mr. Graham will be in touch with you in the next two weeks to verify receipt of this letter and to discuss any issues or concerns you may have regarding culturally significant areas and potential adverse impacts of the proposed project to such areas. You may contact Mr. Graham at (202) 267-8568 or by e-mail at doug.graham@faa.gov. Project personnel will be available on request to meet with you to discuss any issues or concerns you may have, or to conduct a field visit to the proposed

project area. The distribution list for this letter is included as Attachment B. If you are aware of other Native American tribes not included on this distribution list that should be notified about the proposed project please let us know. The FAA welcomes your input and comments on the area of potential effect and on the findings of its inventory and evaluation effort on properties of tribal importance. Please feel free to communicate with us in writing, by phone, or via e-mail at any time.

Sincerely,

Patricia G. Smith
Associate Administrator for
Commercial Space Transportation

Attachments: A - Commercial Launch Facility Site Location Map
B - Consultation Letter Distribution List

Attachment B
Blue Origin West Texas Commercial Spaceport EA
Native American Tribes for Consultation
Mailing List (May 4, 2005)

Mr. Alonzo Chalepah, Chairman
Apache Tribe of Oklahoma
P.O. Box 1220
Anadarko, Oklahoma 73005

Mr. Wallace Coffey, Chairman
Comanche Nation of Oklahoma
HC 32-Box 1720
Lawton, Oklahoma 73502

cc: Mr. Jimmy Arterberry

Mr. Jeff Houser, Chairman
Fort Sill Apache Tribe
Route 2, Box 121
Apache, Oklahoma 73006

cc: Mr. Leland Michael Darrow

Mr. Wayne Taylor, Jr., Chairman
Hopi Tribal Headquarters
P.O. Box 123
Kykotsmovi, Arizona 86039

cc: Mr. Leigh Kuwanwisiwma, Director
Hopi Cultural Preservation Office

Mr. Levi Pesata, President
Jicarilla Apache Nation
P.O. Box 507
Dulce, New Mexico 87528

cc: Mr. Randy Sandoval

Mr. Billy E. Horse, Chairman
Kiowa Indian Tribe of Oklahoma
P.O. Box 369
Carnegie, Oklahoma 73015

cc: Rev. George Daingkau

Mr. Mark Chino, President
Mescalero Apache Tribe
P.O. Box 176
Mescalero, New Mexico 88340

cc: Ms . Naida Nachez, Tribal Historic Preservation Officer
Mescalero Apache Tribe
P.O. Box 227
Mescalero, New Mexico 88340

cc: Ms. Ellyn Bigrope
Mescalero Apache Tribe
P.O. Box 227
Mescalero, New Mexico 88340

Mr. George E. Howell, President
Pawnee Nation of Oklahoma
P.O. Box 470
Pawnee, Oklahoma 74058

cc: Mr. Francis Morris

Mr. Robert Benavides, Governor
Pueblo of Isleta
P.O. Box 1270
Isleta, New Mexico 87022

Mr.Teofilo Pino, Governor
Pueblo of Zia
135 Capital Square Drive
Zia Pueblo, New Mexico 87053-6013

Ms. Kathleen Wesley-Kitcheyan, Chairwoman
San Carlos Apache Tribe
P.O. Box 0
San Carlos, Arizona 85550

cc: Ms. Jeanette Cassa
cc: Ms. Vernelda Grant

Mr. Dallas Massey, Sr., Chairman
White Mountain Apache Tribe
P.O. Box 700
Whiteriver, Arizona 85941

cc: Dr. John Welch
Tribal Historic Preservation Officer
cc: Mr. Ramon Riley

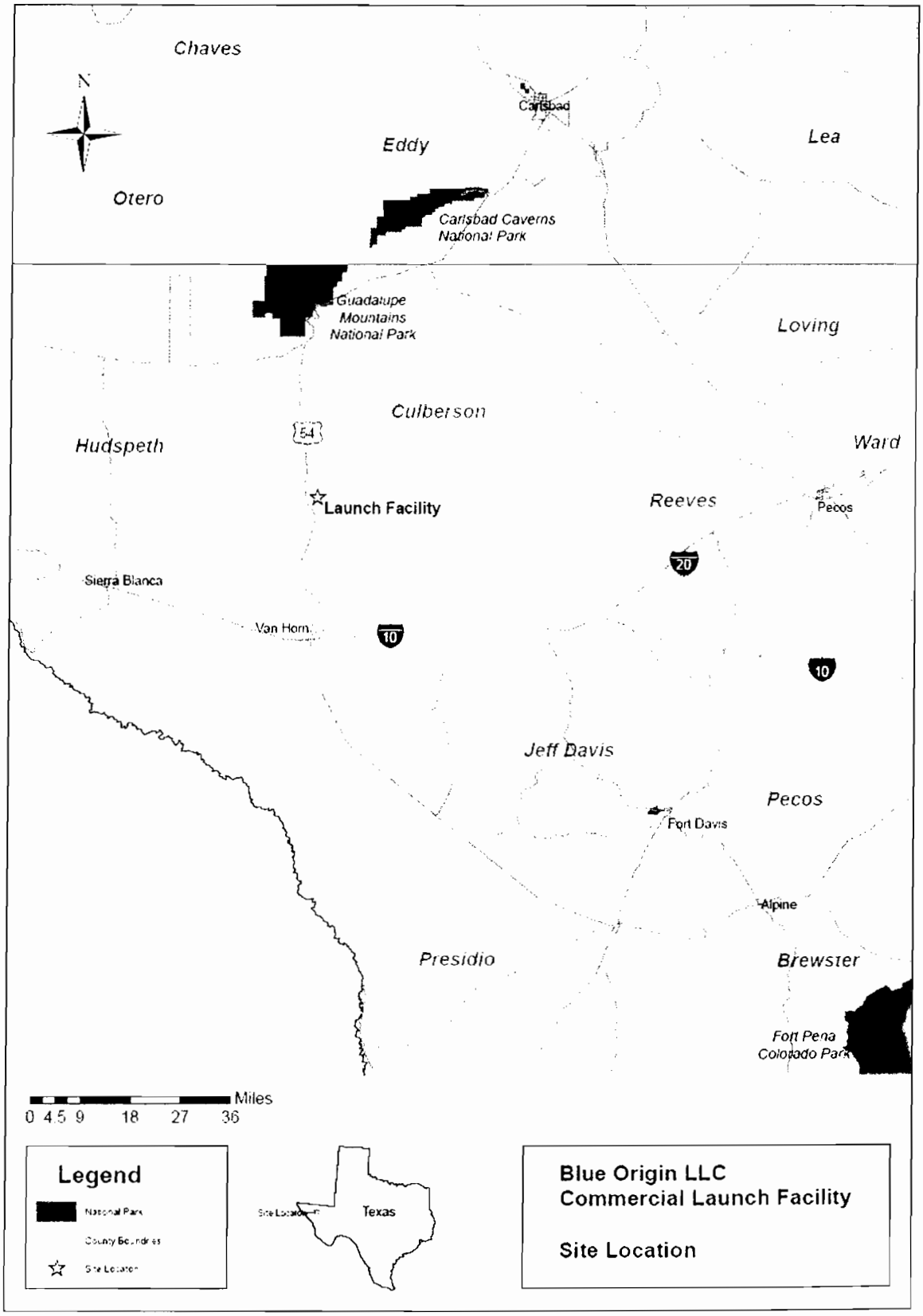
Mr. Arlen P. Quetawki, Governor
Zuni Tribe
P.O. Box 339
Zuni, New Mexico 87327

cc: Mr. Jonathan Damp

Mr. Arturo Senclair, Governor
Ysleta del Sur Pueblo
P.O. Box 17579, Ysleta Station
El Paso, Texas 79917

cc: Mr. Rick Quecade

Attachment A: Site Location Map



Herb

OFFICE OF THE GOVERNOR

505-869-3111 / 6333
FAX: 505-869-4236

PUEBLO OF ISLETA

P.O. BOX 1270 ISLETA, NM 87022

June 25, 2005

US Department of Transportation
Patricia G. Smith
800 Independence Avenue, S.W. Room 331
Washington, DC 20591

Dear Ms. Smith:

This letter is in response to your correspondence dated on June 10, 2005 regarding the proposed Blue Orgin LLC Commerical Space Launch in Culberson County, Texas.

I am pleased to inform you that this project will not have an impact on religious or cultural sites affiliated with the Pueblo of Isleta. However, in the event that discoveries are found during construction, we would appreciate being advised of such findings.

Thank you for your consideration in contacting this office to express our concerns.

Sincerely,

PUEBLO OF ISLETA

For Robert Benavides,
Governor

cc: files

U.S. Department of Transportation
Commercial Space Transportation
800 Independence Ave., S.W, Room 331
Washington, D.C. 20591

Federal Aviation Administration

JUN 9 2005

James Bruseth, Ph.D.
Director, Archeology Division
Texas Historical Commission
P.O. Box 12276
Austin, Texas 78711-2276

SUBJECT: Areas of Potential Effect and Inventory Research Design for the Proposed Blue Origin West Texas Commercial Launch Facility

Dear Dr. Bruseth:

As you are aware, Blue Origin, LLC is applying for a Reusable Launch Vehicle (RLV) Mission Specific License (to possibly include an experimental permit or waiver for non-commercial activities) from the Federal Aviation Administration (FAA), Associate Administrator for Commercial Space Transportation (AST). This license would be for the purposes of launching and landing suborbital RLVs from privately-owned land north of Van Horn, Texas. The FAA is preparing an Environmental Assessment under the National Environmental Policy Act for the proposed Blue Origin activities, which include the proposed launch activities and the development of the launch facility. The decision on whether to issue the license for proposed Blue Origin activities meets the definition of an "undertaking" under the National Historic Preservation Act (NHPA), thus the FAA is initiating consultation with the Texas Historical Commission (THC), State Historic Preservation Office (SHPO) under Section 106 of the NHPA for the proposed project.

Based on discussions with Blue Origin, FAA AST understands that preliminary construction activities would be required to support the proposed future development of the commercial launch facility. The preliminary construction activities would include

- A central North-South paved road,

- A batch plant/materials staging area,
- A main and reserve water well distribution area, and
- A vehicle maintenance facility.

In addition to the preliminary construction activities, the proposed action includes the development of the following features:

- Two utility (water, sewer, or electricity) corridors,
- A perimeter security fence with adjacent fire break,
- A guard house,
- A launch pad complex,
- A vehicle processing facility,
- An electric power plant,
- A test pad,
- A landing pad,
- An ordnance storage bunker, and
- Additional short facility access roads

The locations of the proposed roads, facilities, and associated infrastructure are shown in Figures 1 – 3.

FAA AST understands that you and Mr. Larry Oakes met with Blue Origin on May 11, 2005, to discuss the cultural resource inventory studies to be conducted at the proposed facility. Based on communications with Blue Origin, FAA AST understands that survey areas were developed to identify potential cultural resources within the area of potential effect (APE) related to the direct impacts of site preparation and development. With the assistance of Blue Origin, FAA AST will review the results of the initial survey, the APE, and assess the potential direct and indirect impacts associated with all components of the proposed action. The findings will be presented to you for your review and comment.

Because Blue Origin requires the construction of portions of the proposed project earlier then others, two cultural resource inventory reports would be prepared and delivered to the Texas SHPO by FAA AST for review and comment. Per the meeting, it is our determination that the APE related to the direct impacts of the proposed site preparation and development would include the following, which would be presented in the first report:

- A 200-foot wide corridor would be inventoried for construction of the central North-South paved road;
- A 100-foot wide corridor would be inventoried for construction of two connected East-West improved dirt roads that would be capped and compacted with native aggregate material; and
- Five acres would be inventoried for each of the following
  1. A vehicle maintenance garage,

2. A batch plant/construction materials staging area,
3. A main water well distribution area, and
4. A reserve water well distribution area.

The second report would contain the findings of the inventory of the remainder of the proposed developments, listed below.

- 100-foot wide corridors would be inventoried for construction of two utility (water, sewer, or electricity) corridors
- A 100-foot wide corridor would be inventoried for construction of a perimeter security fence with adjacent fire break
- 1 acre would be inventoried for construction of a guard house
- 10 acres would be inventoried for construction of a launch pad complex
- 5 acres would be inventoried for each of the following
  1. A vehicle processing facility
  2. An electric power plant
  3. A test pad
  4. A landing pad
  5. An ordnance storage bunker

Figure 2 shows the proposed Phase 1 survey areas, while Figure 3 shows the proposed Phase 2 survey areas. Blue Origin is interested in avoiding impacts on cultural resources in the project area, to the extent practicable. During the inventory activities, when cultural resources are identified that the archaeological contractor believes may be significant, Blue Origin may expand the inventory area for that particular facility away from the significant resource to facilitate avoidance of the resource. Likewise, for the linear road, fence, or utility corridors, re-routes may be inventoried to go around any significant resources to avoid impacting them.

Blue Origin may determine that additional facilities, roads, or utilities are required by the proposed project in addition to those listed herein. Any new facilities would be similar to those listed above. The inventory area for any additional facilities for this proposed project would be determined and inventoried in accordance with the standards listed above for the currently known facilities. If a new facility does not match those listed above, the FAA would consult with the Texas SHPO and THC to determine the inventory area for that new facility.

The following methodology would be used for the cultural resource inventory of the APE.

Proposed Methodology

Geo-Marine Inc. will be conducting the cultural resource inventory and preparing the inventory report in accordance with the Council of Texas Archaeological standards and the Texas Historical Commission standards, as appropriate. All work by Geo-Marine, Inc. will be under the oversight of Blue Origin, and Tetra Tech NUS, Inc. (Blue Origin's environmental contractor). Prior to fieldwork, a review of the site files at the Texas

Archeological Research Laboratory will be undertaken. This review will examine the records of known sites within a mile of the project APE. Should any of these sites fall within the APE, field examination will take place to determine their current status. In addition, historic maps of the area or County, as well as early road or soils maps that might yield locations of historic sites will be examined.

Geo-Marine will conduct an intensive survey that will include 100 percent coverage pedestrian survey of the APE. The pedestrian survey will be conducted by a team of up to five professional archeologists who will systematically traverse the survey areas at a uniform 15-meter interval. The professional archaeologists will meet the U.S. Secretary of the Interior's Professional Qualification Standards for Archaeology (48 FR 22716 or 36 CFR Part 61); or the requirements for Principal Investigator defined in Title 13, Part II of the Texas Administrative Code, Chapter 26. Shovel testing during survey will be conducted in accordance with current survey standards as approved by the THC, which include areas where ground cover hinders site detection or in areas of high site probability. The need for shovel testing during survey is expected to be low because (1) ground visibility is 80 to 100 percent throughout the proposed project area, and (2) the project area is uniformly flat with no nearby water sources, thus there are no locations where site probability is high.

Site designations will be applied only to clusters of artifacts (whether surface or subsurface) that represent occupation or activity areas. Should any cultural resource sites be located, the crew will delimit any surficial evidence of the site boundaries. A site form recording location information, vegetation cover, contextual integrity, estimated temporal period, and artifact material noted will be completed for each site. Two shovel tests, approximately 30 cm in diameter, will be placed in each site to get an initial assessment of soils and sediments, to assist with NRHP eligibility evaluation, and to help with projecting the level of effort for an evaluation phase, if needed. A scaled pace-and-compass map will be prepared in pencil for each site on metric graph paper. The site map will include site boundary, features, artifact concentrations, diagnostic artifacts, shovel tests, any noted disturbances, scale, and north arrow. All or a representative sample of surface artifacts and their attributes will be recorded. All diagnostic artifacts will be recorded. Sufficient information will be recorded to permit the completion of site forms approved by the THC for sites located in Texas.

A complete photographic record will be obtained and will be used to record identified cultural remains, the general topography and condition of the area at the time of the survey, and the field techniques and methodology employed by the Contractor. All photographs shall be documented as to date; digital format will be used to record the work conducted. Each site will be photographed from at least two viewpoints.

Each site located will be identified by a permanent datum marker placed on the site (rebar with aluminum cap). The marker will have an identifying number in the form of "GMI-XXX". This number is a temporary field number only. Site location will be recorded on topographic maps, in relation to numbered survey boundary markers, and

using GPS with an accuracy of 1 to10 meters. Field notes concerning sites will be maintained by the project archeologist. These field notes will document survey conditions, vegetation cover, and initial interpretations of the cultural properties. The data analysis for the project shall describe and evaluate all recorded cultural resource sites. The reports (there will be two of them) will present the results in a clear and concise manner. Collected data will be used to determine the potential eligibility of any sites identified during the survey for listing on the National Register of Historic Places. Information on the proposed project will be used to formulate determinations of the potential affect of the project on sites that are determined eligible. If effects to eligible properties can be avoided, the measures to be implemented to ensure avoidance will be detailed in the reports. Final Reports will be prepared in compliance with the guidelines published by the Council of Texas Archeologists, the THC, and the Secretary of Interior's Guidelines. These reports will undergo review and approval by Tetra Tech NUS, Blue Origin, and the FAA prior to being submitted by FAA AST to the Texas SHPO for review. The reports will include an introductory chapter discussing the conditions of the survey, a chapter treating the environmental and geological setting of the project area, a chapter discussing the prehistoric and historic cultural contexts of the project area including previous research in the area, a chapter regarding survey methodology, a chapter explaining the results of the survey, and finally a chapter summarizing recommendations. Upon completion of the fieldwork, all field forms, photographs, and results will be curated at the Texas Archeological Research Laboratory in Austin.

As required by 36 CFR 800.3 (f), the FAA AST is requesting any information you may have regarding other parties that may be entitled to be consulting parties on this action. As required by 36 CFR 800.4, the FAA AST is requesting the views of the Texas SHPO and your office on further actions to identify historic properties that may be affected by the proposed action. The FAA requests concurrence by the Texas SHPO on the APE related to the direct impacts of site preparation and construction activities and the inventory research design presented here.

As part of the Environmental Assessment process under the National Environmental Policy Act, the FAA AST will be hosting a public hearing after the publication of the draft Environmental Assessment where members of the public will be given the opportunity to present their comments. Note that Blue Origin will be hosting public information meetings on June 14, 2005 at the Van Horn Convention Center, 1801 West Broadway, Van Horn, Texas, on June 15, 2005 at the Dell City Telephone Cooperative Meeting Center, 610 South Main Street, Dell City, Texas from 3:30 PM to 8:30 PM. The comments received at the meetings, along with any information you provide, and material provided by Blue Origin to FAA AST will be used to document the affects in accordance with 36 CFR 800.4 and 800.5. Additionally, the Environmental Assessment process will be used for Section 106 purposes as described in 36 CFR 800.8.

If you have any questions or concerns, please contact me at (202) 267-8568, or e-mail doug.graham@faa.gov. We look forward to working with you.

Sincerely,

Douglas W. Graham
Environmental Specialist, AST-100

Cc: Blue Origin (E. Rutkowski)
Tetra Tech NUS (P. Young, K. Roxlau)

Attachment: Figures 1 – 3

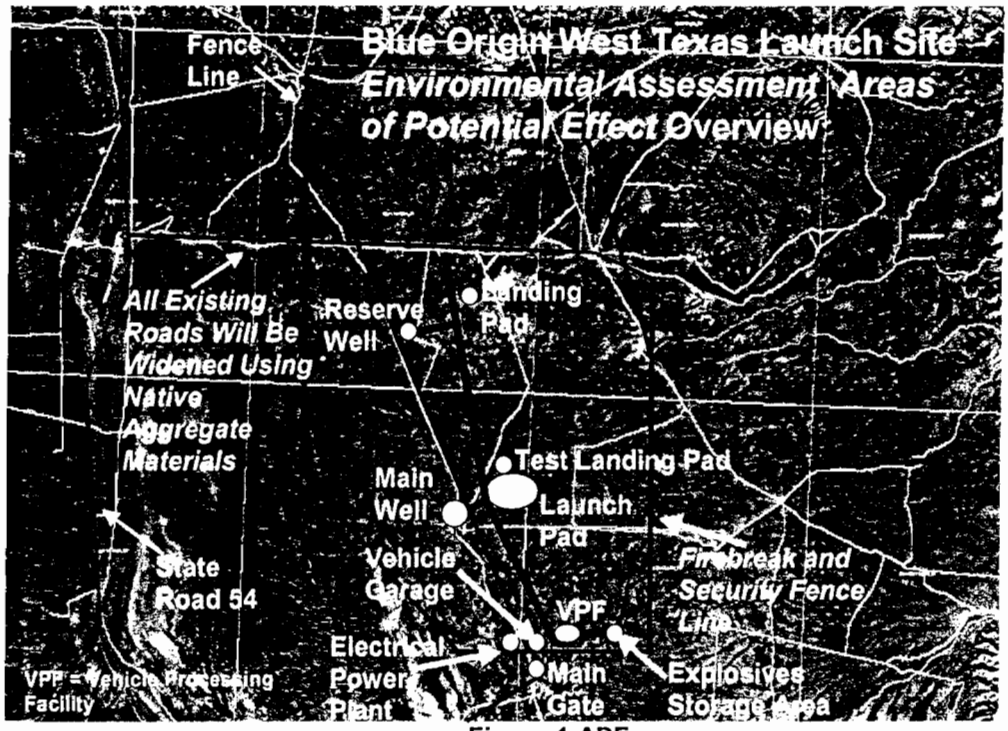


Figure 1 APE

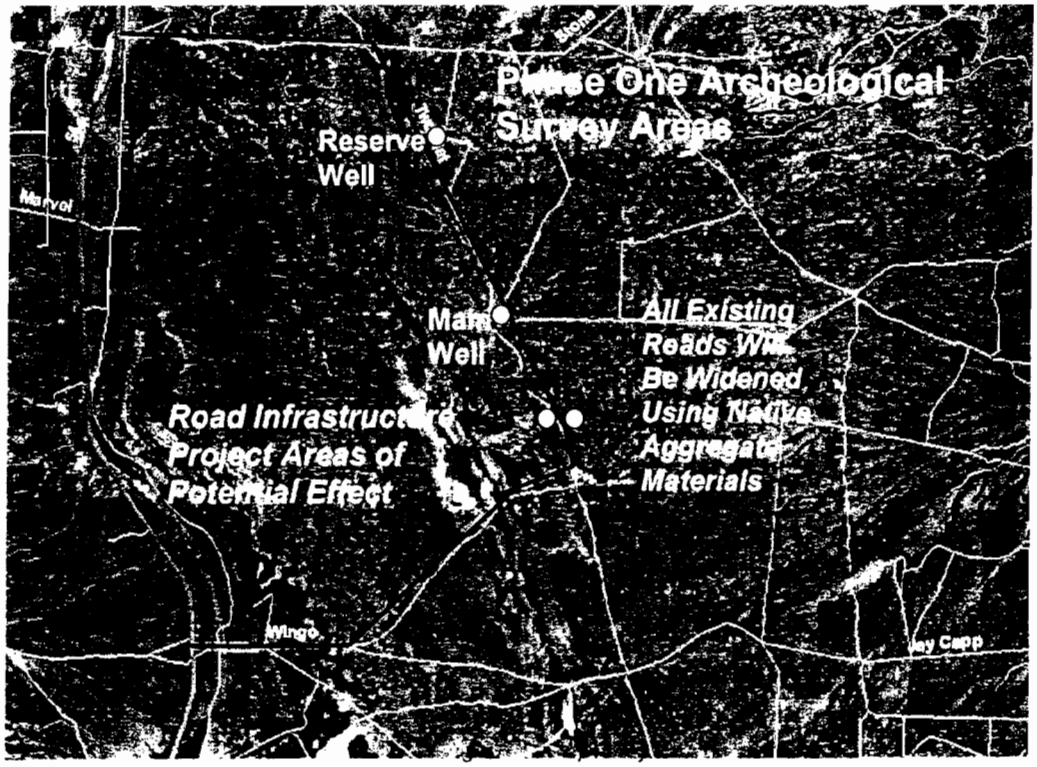


Figure 2 Proposed Phase 1 Survey Areas

U.S. Department
of Transportation
**Federal Aviation
Administration**

Commercial Space Transportation
800 Independence Ave., SW.
Washington, DC 20591

MAR 12 2006

Austin, Texas Ecological Services Field Office
Compass Bank Bldg, 10711 Burnet Rd, Ste 200
Austin, TX 78758

To Whom It May Concern:

In accordance with Section 7 of the Endangered Species Act, the Federal Aviation Administration, Office of Commercial Space Transportation (FAA-AST) is initiating informal consultation. Currently, the FAA-AST is preparing an Environmental Assessment in accordance with the National Environmental Policy Act to evaluate the potential environmental consequences associated with the Federal action proposed by FAA-AST to issue one or more experimental permits and a launch site operator license, and/or reusable launch vehicle (RLV) mission-specific licenses to Blue Origin to authorize Blue Origin to conduct launch activities.

Blue Origin proposes to launch space flight participant-carrying New Shepard RLVs on vertical suborbital, ballistic trajectories to altitudes in excess of 99,060 meters (325,000 feet) above mean sea level. Because the launches would be vertical launches, no off site areas would be over flown by the launch vehicle. The proposed location for the Blue Origin launch site is privately-owned land in Culberson County, Texas (see Exhibit 1). Operations at the launch site would include pre-flight processing, launch, flight, landing, and recovery activities.

To conduct these operations, Blue Origin proposes to construct a private launch site, including a vehicle processing facility, launch pad complex, vehicle landing and recovery area, a space flight participant training facility, and other minor support facilities. Exhibit 2 shows the relative size and location of these facilities on the Blue Origin site.

Blue Origin proposes to conduct the following activities at the West Texas launch site during the next five years.

- 2006: The majority of facility construction at the site would occur during this period. In the fourth quarter of 2006, Blue Origin would ship the first prototype low-altitude test vehicle to the site and conduct the first flight test. Approximately five flight tests could be conducted in 2006, each to an altitude of approximately 610 meters (2,000 feet) for less than one minute.

Exhibit 1. Location of Proposed Launch Site in Texas

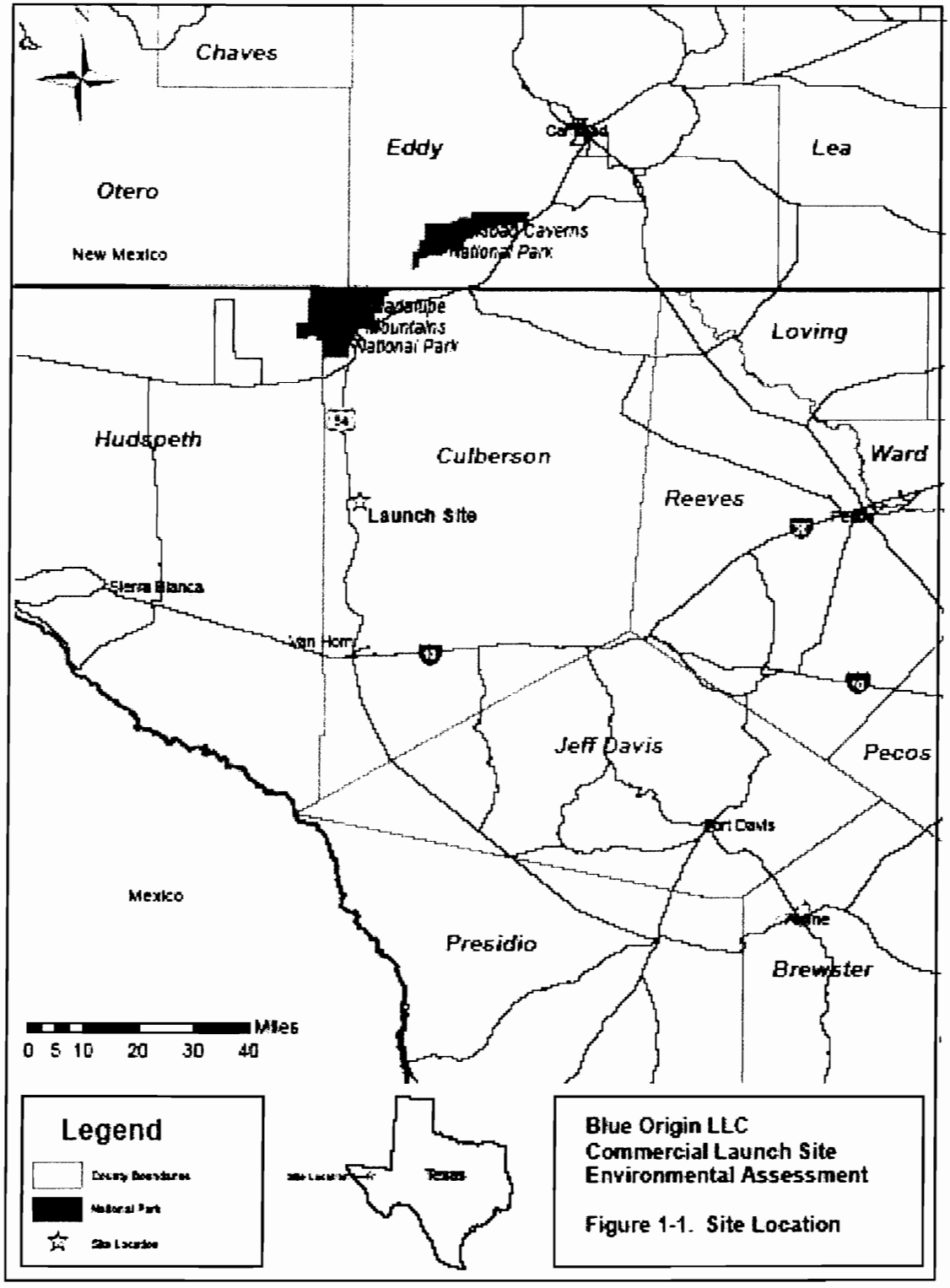
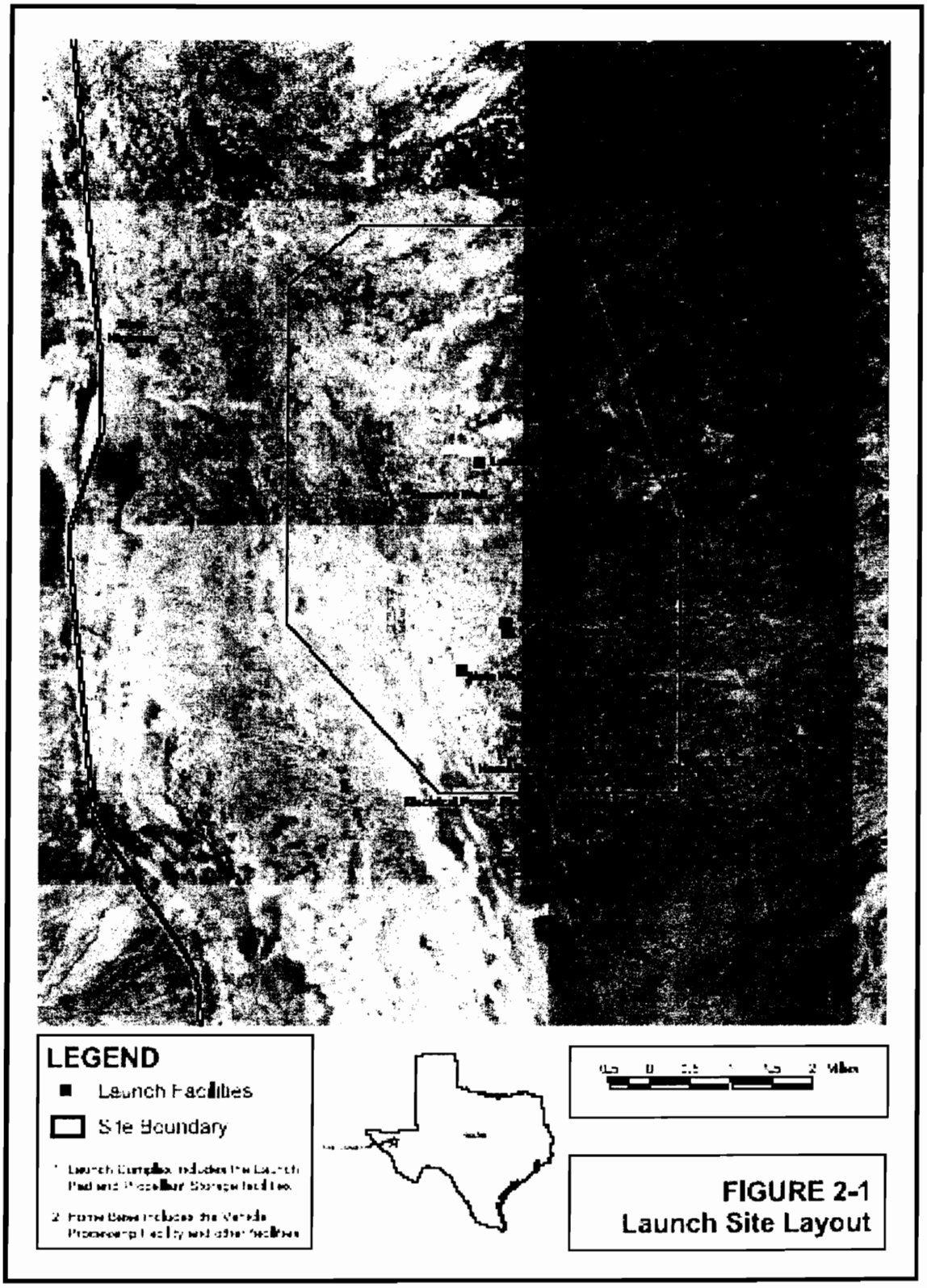


Exhibit 2. Proposed Layout of Launch Facility



- 2007-2009: Continued flight-testing of prototype vehicles with incrementally increasing capability. During these years, Blue Origin proposes to gradually expand the operational envelope of its vehicles, conducting 25 or fewer launches per year. A wide range of tests are anticipated, ranging in altitude from under 610 meters (2,000 feet) to greater than 99,060 meters (325,000 feet), lasting one minute or less to over 10 minutes. Development tests of the crew capsule abort system would be conducted during this time frame. During this time, some construction to upgrade the facility would also occur, adding additional infrastructure to support the increasing capabilities of the system.

- 2010: Commercial operations may commence with the operational New Shepard vehicle in this timeframe. The flight rate would depend on market demand, but Blue Origin anticipates rates up to approximately 52 launches per year of the New Shepard RLV. Although Blue Origin proposes to continue operations at roughly the same rate beyond the 2010 timeframe, these operations are outside the scope of this analysis and are analyzed in this EA only with respect to potential cumulative impacts.

FAA-AST reviewed the threatened and endangered species list for Culberson County, Texas to identify federally-listed threatened or endangered species that may be affected by the proposed action. Exhibit 3 includes all the federally-listed species for Culberson County based on records from the U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department.

Exhibit 3. Special Status Species in Culberson County, Texas

Species	Federal Status[a]	State Status[a]	Habitat Requirements and Notes
Birds			
Mexican spotted owl (*Strix occidentalis lucida*)	T	T	Nests in mixed conifer forests with high canopy closure, high stand density, a multi-layered canopy, uneven-aged stands, numerous snags, and downed woody matter.[b, c]
Northern aplamado falcon (*Falco femoralis septentrionalis*)	E	E	Open country, especially savannah and open woodland, and sometimes in barren areas, grassy plains and valleys with scattered mesquite, yucca, and cactus.[b, c]
Southwestern willow flycatcher (*Empidonax traillii extimus*)	E	E	Riparian thickets, especially willow and cottonwood; also known to use dense thickets dominated by tamarix and mesquite in close proximity to surface water.[b, c]
Yellow-billed cuckoo (*Coccyzus americanus*)	C	-	Lowland deciduous woodlands of cottonwood and willow in riparian and mesic areas; nests in dense understory foliage.[b, c]
Mammals			
Black-footed ferret (*Mustela nigripes*)	E	E	Considered extirpated in Texas, the last Texas records were from Dallam (1953) and Bailey (1963) counties in the panhandle; this species is associated with large prairie dog colonies.[b,d,e]
Gray wolf (*Canis lupus*)	E	E	Formerly known throughout the western two-thirds of the state in forests, brushlands. Extirpated.[b,d]

Exhibit 3. Special Status Species in Culberson County, Texas			
Species	**Federal Status[a]**	**State Status[a]**	**Habitat Requirements and Notes**
Plants			
Guadalupe Mountains fescue (*Festuca ligulata*)	C	-	Gravelly and sandy loams in woodlands and grasslands on mesic slopes and in creek bottoms above 1,800 meters (6,000 feet) in the Guadalupe and Chisos mountains. Habitat types not found within the proposed launch site.[b]
Gypsum wild buckwheat (*Eriogonum gypsophilum*)	T	-	Restricted to almost pure gypsum that is sparsely vegetated with other gypsophilous plants.[b,f]

Notes:
[a] E = Endangered, T =Threatened, C = Candidate, - = Not listed
[b] Texas Parks and Wildlife Department (TPWD) 2005. Annotated County Lists of Rare Species; Culberson County. E-mail from S. Holton, TPWD, Wildlife Division, Wildlife Diversity Office, Austin, Texas, to M.L. Whitten, Tetra Tech NUS, Aiken, South Carolina
[c] Rappole, J.H. and G.W. Blacklock. 1994. Birds of Texas: a Field Guide. Texas A&M University Press, College Station, Texas
[d] Schmidly, D.J. 2004. The Mammals of Texas. University of Texas Press, Austin, Texas
[e] U.S. Fish and Wildlife Service. 1988. Black-footed Ferret Recovery Plan. Denver, Colorado
[f] New Mexico Rare Plant Technical Council (NMRPTC). 1999. New Mexico Rare Plants, Eriogonum gypsophilum (Gypsum wild buckwheat). Available online at http://nmrareplants.unm.edu; Latest update: 11 January 2005

Additional Source: U.S. Fish and Wildlife Service. 2005. Southwest Region Ecological Services, Endangered Species Program, Endangered Species List for Culberson County, Texas. Available online at http://ifw2es.fws.gov/EndangeredSpecies/lists/

The proposed action would have no effect on the Mexican spotted owl, the southwestern willow flycatcher, the yellow-billed cuckoo, the black-footed ferret, the gray wolf, the Guadalupe mountains fescue, or the gypsum wild buckwheat. No suitable habitat or designated critical habitat is present and at the proposed launch site and none of the species were recorded within the boundaries of the proposed launch site during onsite surveys completed in January and April of 2005.

The Northern aplomado falcon (federally-listed as endangered) is the only federally-listed special status species that may occur at the proposed launch site. The project area is located within the historic range of the Northern aplomado falcon and is more than 50 miles northwest of a site in Jeff Davis County where falcons were recently released; therefore, the species may use portions of the habitat at the proposed launch site. This species is typically associated with large Chihuahuan grassland expanses; however, the grasslands in the launch site are not extensive. Only about 59 hectares (145 acres) of the 7,527-hectare (18,600-acre) proposed launch site are classified as grassland. Because the launch site does not represent prime habitat for the Northern aplomado falcon, and none were observed within the boundaries of the proposed launch site during on-site surveys conducted in January and April of 2005, the construction of the proposed launch site would have no effect on the Northern aplomado falcon.

There are no records of Northern aplomado falcons nesting in Culberson County and no documented occurrences of these falcons foraging in the area of the proposed launch site. Individual birds have been seen in other parts of Culberson County, however, and they could move through the proposed launch area during seasonal migrations or while foraging.

Because the habitat in the area is sub-optimal for breeding and foraging, the probability that falcons would forage or nest on site is small.

Modeling data for noise characteristics specific to the New Shepard launch vehicle are not available because the vehicle design has not yet been finalized. To provide a conservative estimate of the noise associated with a launch of the New Shepard launch vehicle, Blue Origin reviewed the noise associated with a Taurus rocket, which has been thoroughly studied. The predicted launch-related noise associated with a Taurus rocket within 9.7 to 12.9 kilometers (6 to 8 miles) would be greater than 80-85 dBA, the noise threshold for startling birds and mammals. The duration of launch noise would be approximately one minute. With the exception of the sonic boom, noise while landing would be substantially less than liftoff and would last for less than 20 seconds. Because the proposed launch trajectory would be essentially vertical, i.e., no pitch-over of the vehicle as occurs with most other types of launches, the resulting sonic boom from the vehicle during ascent would propagate away from the Earth's surface and would likely not be heard. During descent, the sonic boom would be equivalent to 90 dBA at approximately 1.3 kilometers (0.8 miles), 85 dBA at 12.9 kilometers (8 miles) from the landing pad.

Because there are no recorded nests of the Northern aplomado falcon in Culberson County, the low probability that a falcon would forage or nest at the site, and relatively short duration of noise over 80 dBA, the noise associated with human activity and with launches would have no effect on the Northern aplomado falcon population.

Formal consultation under Section 7 of the Endangered Species Act does not appear to be warranted for these activities. The FAA-AST is requesting your comments and/or concurrence on this determination. Please note that you will be provided with a copy of the Draft Environmental Assessment upon completion for review and comment.

Thank you for your assistance in this matter. Please feel free to respond in writing or to contact Douglas Graham by phone at (202) 267-8568 or by e-mail at doug.graham@faa.gov.

Sincerely,

Douglas W. Graham
Environmental Specialist

United States Department of the Interior

FISH AND WILDLIFE SERVICE
10711 Burnet Road, Suite 200
Austin, Texas 78758
512 490-0057
FAX 490-0974

MAY 25 2006

Consultation No. 21450-I-2006-0163

Douglas W. Graham
Environmental Specialist
Federal Aviation Administration
800 Independence Ave., SW
Washington, DC 20591

Dear Mr. Graham:

Thank you for your March 12, 2006, letter regarding preparation of an environmental assessment by the Federal Aviation Administration's Office of Commercial Space Transportation (FAA-AST) on the issuance of permits and launch site operator license to Blue Origin on privately owned land in Culberson County, Texas.

We have reviewed the information provided. Based on data in our files, we believe it is unlikely that any federally listed threatened or endangered species occur within the proposed site boundaries. However, FAA-AST should review the potential for groundwater development directly or indirectly associated with the project to impact springs in Jeff Davis and Reeves counties, including Phantom Lake Spring and San Solomon Springs. Although the distance between the project and these springs is about 100 kilometers, some groundwater flow paths in the Trans-Pecos have been hypothesized to flow from Culberson County to the San Solomon spring group, which is home to federally listed endangered Comanche Springs pupfish and Pecos gambusia.

If you have any questions about these comments, please contact Patrick Connor at 512 490-0057, extension 227.

Sincerely,

Robert T. Pine
Supervisor

TAKE PRIDE IN AMERICA

7:30 pm Session (2 attendees)

The "in the round" type format continued for the two members of the public that attended. Upon completion of the presentations a series of 12 questions were raised by Mr. James Lynch. He asked if the facility would be open to the public. Five of his the questions were related to Blue Origin's business operations. He asked questions about the socioeconomic impacts of the project, the facility power source, water needs and if status reports would be periodically available related to the project. He also made the statement that the rural location of the facility would help protect the project.

APPENDIX C – BIOLOGICAL SURVEY

Baseline biological surveys were conducted at the proposed launch site in January and April 2005. The purpose of the field surveys was to evaluate the project area as potential habitat for special status species, to record the presence of such species if they were observed, and to characterize vegetation communities and wildlife habitat. The surveys did not include the establishment of formal grids. Instead, vehicular surveys were conducted on all dirt roads at the site. Pedestrian surveys focused on areas of proposed project-related disturbance and areas identified during vehicular surveys as possible habitat for rare or unusual species. Other areas were selected for pedestrian surveys based on a review of soil maps, topographic maps, and aerial photographs.

C.1 Vegetation

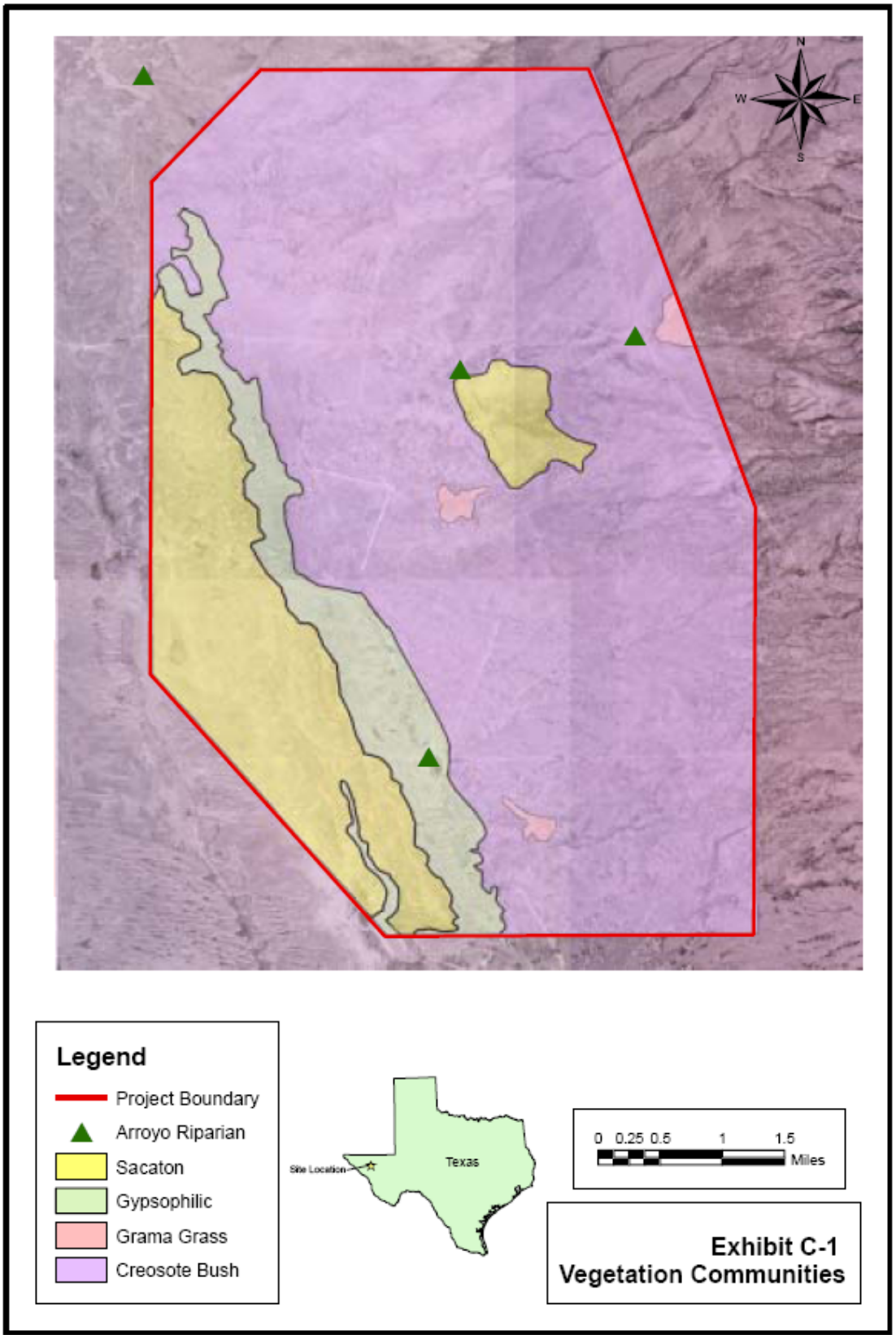
Preliminary determinations of site vegetation types were made using United States Geological Survey (USGS) color aerial digital orthophotos with one-meter accuracy. Ground truthing of vegetation community delineation was conducted in April 2005 using the aforementioned vehicular and pedestrian surveys. Approximate boundaries of vegetation communities were digitally mapped (Figure C-1) based on the reconnaissance surveys, digital orthophotos, topography, and soil associations. Vegetation communities were classified based on Dick-Peddie (1993), which describes plant communities of New Mexico as well as the Trans-Pecos region of Texas and the project area.

The project area is located within the Chihuahuan Desert, which is the largest of the four North American deserts. Most of the Chihuahuan Desert is in Mexico, but northward fingers extend along the Rio Grande and Pecos rivers into portions of Texas and New Mexico. The general vegetation community known as Chihuahuan Desert Scrub encompasses the project area. Overgrazing, climate change, and fire suppression have extended this vegetation community type northward over the last 100 to 250 years into areas previously characterized as grasslands (Dick-Peddie 1993). Creosote (*Larrea tridentata*) and tarbush (*Flourensia cernua*) are co-dominant indicator species of Chihuahuan Desert Scrub. Located in the Salt Basin, the proposed project area is situated within the basin formed by the Sierra Diablo Mountains on the west and the Delaware Mountains on the east. Gently sloping alluvial fans dominate the eastern portion of the site, draining to the west. A northwest-to-southeast trending gypsum ridge ranging from approximately 1.7 to 8.3 meters (five to 25 feet) in height is located in the west-central portion of the site and overlooks a large similarly aligned depression to the west.

Five subsets of Chihuahuan Desert Scrub vegetation community occur within the project area.

- Creosote bush
- Sacaton
- Grama grass
- Gyposphilic
- Arroyo Riparian

Exhibit C-1. Vegetation Communities



The distribution of these community types is based on edaphic and topographical features. (Dick-Peddie 1993) These community types are not contiguous or all-inclusive, and thus create a mosaic pattern of distribution resulting from minor variations in topography and soil types. In some respects, the site vegetative communities are characteristic of transitional zones with blurred distinctions. Therefore, large areas of vegetation types illustrated on Figure C-1 also contain smaller inclusions of different community types. Given the relatively large size of the proposed site and the many transitional zones, these inclusions are too small to accurately map. Descriptions of each community type are provided below.

The creosote bush community comprises the majority of vegetation within the proposed project area, and encompasses nearly three quarters of the site. The community is dominated by creosote, and the presence of soaptree yucca (*Yucca elata*) and fluff grass (*Erioneuron pulchellum = Dasyochloa pulchellum*) with minimal tarbush occurrence indicates recent (within the past 150 years) grassland succession. (Dick-Peddie 1993) Within the project area, this community encompasses some areas that could be characterized as desert grassland shrub-mixed grass community, based on the presence of creosote, black grama (*Bouteloua eripoda*), fluff grass, and bush muhly (*Muhlenbergia porteri*). However the two community types are so intermingled that accurate identification and absolute separation is beyond the scope of this document.

Topographically the creosote bush community coincides with gently sloped alluvial fans and level expanses. Soil texture ranges from silt loam to sandy loam with large sandy gravelly loam areas. Black to gray colored cryptobiotic crusting is present with an estimated 15 percent cover. Nominal areas of silty to sandy loams support tarbush and honey mesquite (*Prosopis glandulosa*) as co-dominants with creosote. In general, vegetation cover was visually estimated to range from an average of 35 to 45 percent, with creosote typically comprising 40 percent of total cover. Frequent thick patches of tobosa (*Hilaria mutica*) are interspersed with areas of nearly barren ground. Other major grass species include fluff grass, alkali sacaton (*Sporobolus airoides*), burro grass (*Scleropogon brevifolius*) and black grama (*Bouteloua eripoda*). A number of early annual forbs such as bladderpod (*Lesquerella fendleri*), pepper grass (*Lepidium montanum*), scorpion weed (*Phacelia coerulea* and *P. integrifolia*), blanket flower (*Gaillardia pinnatafida*), purple mat (*Nama hispidum*) and verbena (*Verbena bracteata)* comprise the shrub understory. Desert holly (*Perezia nana*), prickly pear (*Opuntia polyacantha* and *O. phaeacantha*), Mormon tea (*Ephedra trifurca*), Christmas cactus (*O. leptocaulis*), and allthorn (*Koeberlinia spinosa*) are associative community species.

The sacaton community occurs in poorly drained saline, calcareous clay loam soils prevalent along the western-southwestern edge of the site, and in one relatively large area in the central portion of the site. These flat areas are interspersed with swales and are characterized by alkali sacaton and four-winged saltbush (*Atriplex canescens*) intermixed with patches of burro grass, fluff grass, tobosa, and threeawn (*Aristida sp.*). Overall vegetative cover ranges between 20 to 50 percent, with the lowest coverage occurring in areas dominated by low-growing burro grass. This community type is moderately diverse with peppergrass, bladderpod, verbena, scorpion weed, prickly pear, and thistle (*Cirsium neomexicana* and *Carduus nutans*) established on soils with less clay content and coarser textures. Succulent or shrubby species are represented by

widely scattered mesquite, cholla (*Opuntia imbricata*), soaptree yucca, Torrey yucca (*Y. torreyi*) and broom snakeweed (*Gutierrezia sarothrae*).

The grama grass community is characterized by black grama being the dominant grass species. In the project area, these grasslands have an estimated cover of 40 to 45 percent, and also sustain alkali sacaton, tobosa and burro grass. Depending on the grassland successional stage, shrub cover ranges from 25 to 40 percent of total cover and includes creosote, honey mesquite and tarbush. Annual forbs are represented by peppergrass, bladderpod, blanket flower, chinch weed (*Pectis papposa*), goldenweed (*Machaeranthera gracilis*), and spectacle pod (*Dithyrea wislizenii*).

The linear gypsum ridge in the west-central portion of the site supports the Gypsophilic community type. The ridge surface layer is composed of rocky consolidated limestone with presumably high levels of calcium carbonate and calcium sulfate in surface soils. Highly crusted dark cryptobiotic soils cover approximately 30 to 35 percent of the ridge. The Gypsophilic community is the least diverse in the project area; it contains few species, and the vegetative ground cover is only about 15 percent. Hairy coldenia (*Tiquilia hispidissima*), alkali sacaton, allthorn, soaptree yucca, evening primrose (*Oenothera missouriensis*), bush muhly (*Muhlenbergia porteri*), and stickleaf (*Mentzilia albicaulis*) are the primary plant species.

Arroyo riparian vegetation within the project area is uncommon and occurs only near man-made arroyos and impoundments. There are no naturally occurring surface waters within the site, nor any true riparian vegetation communities. Thus, the arroyo vegetation communities at the site have been termed “pseudo-riparian.” These communities encompass small circular areas around former livestock ponds and tanks or thin linear swales along ephemeral drainages. Although water is no longer pumped to these ponds and tanks, they apparently hold water after rains and tend to be more lushly vegetated than surrounding areas. The psuedo-riparian areas have basal and canopy cover up to one hundred percent in some patches. With the additional soil moisture, the dominant plant species exhibit greater stature and density than elsewhere within the site, and form a noticeably different vegetation type. This community type is dominated by large honey mesquite typically exceeding fifteen feet in height and eight inches diameter at breast height, sumac (*Rhus microphyllum*), desert willow (*Chilopsis linearis*) and thick, tall, bunch stands of alkali sacaton. Virgin’s bower (Clematis drummondii), buffalo gourd (*Cucurbita foetidissima*), and the non-native saltcedar (*Tamarix ramosissima*), are minor components of the pseudo-arroyo community.

C.2 Wildlife

C.2.1 Birds

At least 482 bird species have been recorded in the Trans-Pecos region of Texas (Peterson 2003); many of these could potentially occur in the project area. Bird species observed during the April 2005 biological survey included Western kingbird (*Tyrannus verticalus*), red-tailed hawk (*Buteo jamaicensis*), Swainson’s hawk (*B. swainsoni*), Cooper’s hawk (*Accipiter cooperii*), American kestrel (*Falco sparverius*), Western burrowing owl (*Athene cunicularia*), ladder-back woodpecker (*Picoides scalaris*), loggerhead shrike (*Lanius ludovicianus*), common raven (*Corvus corax*), turkey vulture (*Cathartes aura*), greater roadrunner (*Geococcyx californianus*),

mourning dove (*Zenaida macroura*), Northern mockingbird (*Mimus polyglottos*), brown towhee (*Pipilo fuscus*), horned lark (*Eremophila alpestris*), Western meadowlark (*Sturnella neglecta*), pyrrhuloxia (*Cardinalis sinuatus*), scaled quail (*Callipepla squamata*), cactus wren (*Campylorhynchus brunneicapillus*), long-billed curlew (*Numenius americanus*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), lark bunting (*Calamospiza melanocorys*) and several sparrow species. Some of these are year-round residents of the Trans-Pecos region (e.g., raven, scaled quail) while others are present only during seasonal migrations (e.g., yellow-headed blackbird, long-billed curlew) or only during the breeding season (e.g., Western kingbird). Wintering birds had vacated the project area by the time of the late-April 2005 survey. Bird species observed during the January 2005 survey were those that either winter in the area or use the area year-round, and included the Swainson's hawk, American kestrel, loggerhead shrike, common raven, greater roadrunner, Northern harrier (*Circus cyaneus*), Western meadowlark, pyrrhuloxia, and great horned owl (*Bubo virginianus*). The above list of birds seen during the January and April surveys is not intended to be a complete list of all birds that occur at the site. Other birds such as thrashers (*Toxostoma spp.*), flycatchers (*Empidonax spp.*), various wrens and other birds undoubtedly occur in the project area.

No active nests were observed in the project area during the April 2005 survey, but a long-eared owl (*Asio otus*) was observed on an active nest slightly beyond the boundary of the project area, and Western burrowing owls (apparent breeding pairs) were observed at two prairie dog colonies that are within or immediately adjacent to the site. A pair of Swainson's hawks was sighted soaring over the eastern portion of the site. Raptor and/or raven nests used during previous breeding seasons (sometimes containing bones of small mammals) were observed in many of the larger mesquite trees within the project area. Several old cactus wren nests were noted in soaptree yuccas and Torrey yuccas.

C.2.2 Mammals

The Chihuahuan Desert is home to a number of mammalian species, though large predators are limited by the naturally harsh conditions. Mammals observed during biological surveys included coyotes (*Canis latrans*), pronghorn "antelope" (*Antilocapra americana*), chipmunks (*Eutamias sp.*), black-tailed prairie dogs (*Cynomys ludovicianus*), and numerous black-tailed jackrabbits (*Lepus californicus*) and desert cottontails (*Sylvilagus aududoni*). Burrows, scat, and/or other evidence of badger (*Taxidea taxus*), pocket gophers, and collared peccary (*Tayassu tajacu*) were observed during one or both surveys.

A small cave located along the eastern side of the limestone ridge in the west-central portion of the surveyed site contained a small colony of bats during the April 2005 survey. The bats appeared to be cave myotis (*Myotis velifer*), which is a common bat species in the Trans-Pecos region of Texas. A positive identification was not possible.

Two black-tailed prairie dog colonies occur in the vicinity of the project area. The larger of the two colonies is located slightly outside the northwest boundary of the project area. The colony covers approximately 20 to 25 acres, and the eastern edge of the colony is approximately 600 feet west of the project area's western boundary. The other prairie dog colony is located in the southeastern portion of the project area within the sacaton vegetation community, and covers approximately 8-10 acres.

C.2.3 Reptiles and Amphibians

Numerous snakes and lizards inhabit the Trans-Pecos region. Few snakes in the region are diurnal; most avoid the heat of the sun and are nocturnal, prowling during darkness. No reptiles or amphibians were observed during the January 2005 survey, which was not surprising because they hibernate during the winter. The little striped whiptail lizard (*Cnemidophorus inornatus*) was commonly seen throughout the site during the April survey. One bull snake (*Pituophis melanoleuca sayi*) and one prairie rattlesnake (*Crotalus viridis viridis*) were observed within the project area during the April 2005 survey, but no amphibians were observed.