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PROGRAMMATIC ENVIRONMENTAL ASSESSMENT FOR JET PROPULSION LABORATORY PERIODIC SCIENTIFIC DEVELOPMENT AND TESTING ACTIVITIES ON-SITE AND IN THE ARROYO SECO

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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JANUARY 2018

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Acronyms and Abbreviations

AB	Assembly Bill
ACM	asbestos containing material
ACOE	U.S. Army Corps of Engineers
ANF	Angeles National Forest
APEFZ	Alquist-Priolo Earthquake Fault Zones
ASTM	American Society for Testing and Materials
ATHLETE	All-Terrain Hex-Limbed Extra Terrestrial
ATV	All-Terrain Vehicle
bgs	below ground surface
BLM	Bureau of Land Management
BMP	best management practice
CAAQS	California Ambient Air Quality Standards
CAA	Clean Air Act
CalDTSC	California Department of Toxic Substances Control
CalRecycle	California Department of Resources Recycling and Recovery
Caltech	California Institute of Technology
CAMP	Central Arroyo Seco Master Plan
CATEX	Categorical Exclusions
CCAA	California Clean Air Act
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEPA ARB	California Environmental Protection Agency Air Resources Board
CESA	California Endangered Species Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CGS	California Geological Survey
CLARS	California Laboratory for Atmospheric Remote Sensing
CNEL	Community Noise Equivalent Level
CO	carbon monoxide
CO_2	carbon dioxide
COA	Certificate of Authorization
CWA	Clean Water Act
DARPA	U.S. Defense Advanced Research Projects Agency
dB	decibels
dBA	decibels-A-weighted scale
DSN	Deep Space Network
EA	Environmental Assessment

Acronyms and Abbreviations (continued)

EIR	Environmental Impact Report
EO	Executive Order
EPCRA	Emergency Planning and Community Right to Know Act
ERD	Environmental Resource Document
ESA	Endangered Species Act
ESA	Environmental Site Assessment
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FFRDC	Federally Funded Research and Development Center
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FR	Federal Register
GDSCC	Goldstone Deep Space Communication Complex
GHG	Greenhouse Gas
H_2S	Hydrogen Sulfide
HMMWV	High-Mobility Multi-Wheeled Vehicle
HMP	Hahamongna Watershed Park Master Plan
HWP	Hahamongna Watershed Park
I-	Interstate
IS	Initial Study
LAMP	Lower Arroyo Seco Master Plan
JPL	Jet Propulsion Laboratory
LACDPW	Los Angeles County Department of Public Works
LACFD	Los Angeles County Fire Department
LACSD	Los Angeles County Sanitation Department
LBP	lead-based paint
LOS	Level of Service
MBTA	Migratory Bird Treaty Act
MWD	Metropolitan Water District
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NH_4	methane
NMFS	National Marine Fisheries Service
NO	nitrous oxide
NOx	nitrogen oxides
NO_2	nitrogen dioxide
NPD	NASA Policy Directives
NPDES	National Pollution Discharge Elimination System
NPG	NASA Policy Guidance

Acronyms and Abbreviations (continued)

NPL	National Priority List
NPR	NASA Procedural Requirement
NPS	National Park Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
O_3	ozone
OHP	California State Office of Historic Preservation
OU	Operating Unit
PCB	Polychlorinated Biphenyl
PEA	Programmatic Environmental Assessment
Pb	lead
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
PM_{10}	particulate matter less than or equal to 10 microns in diameter
PMC	Pasadena Municipal Code
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SHMP	Seismic Hazard Mapping Program
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulfur dioxide
SOCAB	South Coast Air Basin
SPP	Sustainability Performance Plan
SR	State Route
SRA	Source Receptor Areas
sUAS	small Unmanned Aerial System
SWPPP	Storm Water Pollution Prevention Plan
TMF	Table Mountain Facility
TSCA	Toxic Substances Controls Act
TSP	total suspended particulates
UGV	unmanned ground vehicle
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
vpd	vehicles per day
VRP	Visibility Reducing Particle

EXECUTIVE SUMMARY

ES-1 INTRODUCTION

The preparation of this Programmatic Environmental Assessment (EA) is consistent with regulations issued by the Council on Environmental Quality (CEQ), 14 Code of Federal Regulations (CFR) Part 1216.3, *Procedures for Implementing the National Environmental Policy Act (*NEPA) and *CEQ Guidance on Preparation on Effective Use of Programmatic NEPA Reviews (18 December 2014)*. Further, this Programmatic EA follows National Aeronautics and Space Administration (NASA) Procedural Requirement (NPR) 8580.1A, *Implementing the National Environmental Policy Act*. Programmatic NEPA reviews are governed by the same regulations and guidance that apply to non-programmatic NEPA reviews; however, CEQ guidance requires that programmatic reviews address the general environmental issues relating to broad decisions – such as those establishing policies, plans, programs, or suite of projects – and effectively frame the scope of subsequent site- and project-specific Federal actions. A programmatic NEPA review provides the basis for decisions to approve such broad or high-level decisions such as identifying geographically bounded areas within which future proposed activities can be taken.

ES-2 PURPOSE AND NEED

The *purpose* of the Proposed Action is to programmatically allow for a suite of outdoor scientific development and testing activities at NASA Jet Propulsion Laboratory (JPL) on-site and within other appropriate landscapes in close proximity to NASA JPL, including the adjacent Arroyo Seco. These outdoor testing actions are small-scale, non-intrusive, short-duration outdoor testing, verification, and calibration activities, and are necessary to support and fulfill NASA scientific and technology demonstration missions as well as tasks conducted by NASA JPL under technology development agreement with other Federal agencies. These activities often require short-notice or unscheduled mobilization. These small-scale, research-related testing activities would support NASA JPL in accomplishing its mission.

The *need* for the Proposed Action is driven by testing requirements for the technology demonstration programs at NASA JPL. NASA JPL often requires short-notice or unscheduled outdoor testing for the verification and calibration of these technologies and systems in open space environments that are analogous to other locations on Earth (e.g., similar or comparable geology, topography, etc.) or other planetary surfaces (e.g., Mars). Specifically, field testing must meet several unique criteria:

- Areas on or in close proximity to the NASA JPL facility to facilitate expeditious deployment for testing and validation as well as to reduce risks associated with asset transport.
- Areas with existing land use types that would permit a variety of testing activities, including testing of mobile equipment.
- Locations that would help facilitate consistency with Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade* as well as NASA Policy Directive (NPD) 8500.1C and NASA Sustainability Performance Plan (SPP).
- The ability to quickly mobilize testing equipment and personnel under short-notice and / or unscheduled conditions.
- The ability to perform outdoor scientific development and testing activities on short notice and/or unscheduled conditions by not requiring individual consideration and approval.

To fulfill the purpose and need identified above, on-site, outdoor research would continue to be conducted throughout the NASA JPL facility and off-site, outdoor research would take place within the Arroyo Seco. These testing activities would generally occur during park hours and would range from small-scale testing of instrumentation to larger vehicle testing.

ES-3 PROPOSED ACTION

Under the Proposed Action on-site, outdoor research would continue to be conducted throughout the NASA JPL facility (e.g., existing roadways, the Mesa hillside, etc.) including the Mars Yard and the Robotics Arena south of Building 198. Off-site, outdoor research would take place within the Arroyo Seco, which provides a local, convenient, cost-effective, and realistic setting for such small-scale, non-intrusive, short-duration outdoor testing for activities that develop vision sensing, programming applications and deployable equipment,

etc. The geographic scope of aerial activities (i.e., small Unmanned Aerial System [sUAS] flights) would be limited to the bounds of the existing Certificate of Authorization (COA) that has been established within the Hahamongna Watershed Park (HWP) by the Federal Aviation Administration (FAA) under Section 333 for NASA JPL quadrotor testing below a ceiling of 200 feet (FAA 2015). All other NASA JPL small-scale, research-related testing activities would occur within and/or underneath the footprint of this existing COA or within the outdoor testing facilities at NASA JPL. Prior to any individual testing activity in the Arroyo Seco, NASA JPL would coordinate with the City of Pasadena to determine any schedule or specific use conflicts in the desired area.

Under the Proposed Action, future testing activities in the Arroyo Seco would generally occur during park hours and would potentially include the use of enclosed laser systems, batteries, small generators, etc. Programmatic research-related testing activities included in the Proposed Action would range from small-scale testing of camera and radar technologies, which would involve little ground disturbance, to larger rover testing which may include limited vegetation removal.

ES-4 ALTERNATIVES CONSIDERED

All alternatives were screened against the following criteria requirements and were identified to fulfill the purpose and need of the Proposed Action at NASA JPL. Alternatives not meeting these criteria were not carried forward for further analysis within this EA.

ES-3.1 Alternatives Eliminated from Further Study

NASA JPL can perform outdoor testing its two off-site facilities: Goldstone Deep Space Communications Complex (GDSCC) at Fort Irwin in the Mojave Desert and at the Table Mountain Facility (TMF) near Wrightwood in the San Gabriel Mountains. However, these locations are remote, have restrictive radio spectrum requirements, and require a permit from the U.S. Army or the U.S. Forest Service. Additional, but less frequent, outdoor testing has been conducted on land owned by other federal agencies (e.g., Bureau of Land Management [BLM], National Park Service [NPS], etc.). NASA JPL coordinates closely with these

federal agencies to ensure permits are submitted and NEPA review is compliant with NEPA per 40 CFR 1508.4. However, these locations are remote, include additional costs (e.g., permit fees), and require long-lead times for coordination and approval. These locations would not meet the purpose and need for expeditious deployment for testing and validation and would result in additional air quality impacts as well as safety risks associated with asset transport. As such, these activities at GDSCC, TMF, and at other locations managed or owned by other federal agencies are not discussed or analyzed within this Programmatic EA.

ES-3.2 No Action Alternative

Under the No Action Alternative, the proposed small-scale, research-related testing activities would continue to require individual consideration and approval. Testing activities are currently approved under individual Categorical Exclusions (CATEXs) and agreements with other Federal, state, and local agencies. Under the No Action Alternative, it is anticipated that such testing activities would require individual approvals limiting the need to implement testing on short-notice or unscheduled conditions. Such approval processes would restrict NASA JPL's ability to expeditiously conduct outdoor testing and calibration activities and may, in some circumstances, require NASA JPL to pursue other less suitable outdoor testing areas, which would also require asset transport and associated risks and sustainability impacts.

CEQ regulations stipulate that the No Action Alternative be analyzed to assess any environmental consequences that may occur if the Proposed Action is not implemented. The No Action Alternative also provides a baseline against which the Proposed Action can be compared. Consequently, this alternative will be carried forward for analysis within this Programmatic EA.

ES-5 SUMMARY OF ENVIRONMENTAL IMPACTS

The proposed alternatives would not result in significant impacts to the affected environment. Based on the analysis conducted under NEPA, there would be no significant impacts to the affected human or natural environment.

Table ES-1. Projected Environmental Impacts

Resource Area	Projected Impact Proposed Action (Alternative A)	Projected Impact No Action	Control Measures
Air Quality	Temporary less than significant adverse impacts associated with fugitive dust emissions and combustion emissions generated during testing activities.	Potential long-term less than significant adverse impacts associated with transport of assets and equipment to more remote testing areas.	None.
Noise	Temporary less than significant adverse impacts associated with noise during testing activities. No impacts to sensitive receptors.	Potential temporary less than significant impacts associated with noise generation off-site.	None.
Geological Resources	Less than significant short-term and/or long-term related impacts on affected soils, geologic resources, and topography within the project area.	Potential less than significant impacts to off-site geological resources.	None.
Water Resources	Potential for impacts to surface water quality as a result of unintentional spills hydrology and/or water quality from sediment and stormwater runoff. No impacts to floodplains	Potential less than significant impacts to off-site surface water features, if present.	None.

Table ES-1. Projected Environmental Impacts

Resource Area	Projected Impact Proposed Action (Alternative A)	Projected Impact No Action	Control Measures
Biological Resources	Less than significant adverse impacts related to potential trampling of vegetation and wildlife as well as minor vegetation clearing.	Potential minor off-site indirect impacts to biological resources (e.g., noise impacts, trampling, vegetation removal), if present.	Vehicles would be cleaned before and after all testing activities, which would limit the potential for invasive species transport.
Land Use	No impact on existing land use designations, plans, or zoning.	Potential for off-site land use conflicts.	NASA JPL would continue to coordinate with the City of Pasadena regarding testing activities in the Arroyo Seco.
Traffic and Transportation	No impacts related to traffic flow patterns, circulation, or parking both on-site and in the immediate surrounding vicinity, including pedestrian and/or bicycle facilities.	Potential less than significant impacts associated with additional vehicle trips for transport of assets and equipment.	None.
Cultural Resources	No short-term or long-term impacts on historic or cultural resources would be expected.	Potential for off-site impacts to cultural resources, if present.	None.
Socioeconomics and Environmental Justice	No anticipated short-term or long-term impacts to socioeconomic resources, low-income populations, or minority populations would be anticipated.	No anticipated short-term or long-term impacts to socioeconomic resources, low-income populations, or minority populations would be anticipated.	None.

Table ES-1. Projected Environmental Impacts

Resource Area	Projected Impact Proposed Action (Alternative A)	Projected Impact No Action	Control Measures
Visual Resources	Short-term temporary impacts, no long-term impacts to visual and aesthetic resources.	Short-term temporary impacts, no long-term impacts to visual and aesthetic resources.	None.
Hazardous Materials and Wastes	Impacts related to hazardous materials and wastes would be less than significant.	Impacts related to hazardous materials and wastes would be less than significant.	None.

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1.0 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL) is a Federally Funded Research and Development Center (FFRDC) operated by the California Institute of Technology (Caltech) under a contract with NASA.[1] NASA JPL is NASA's only FFRDC and is the lead U.S. center for the robotic exploration of the solar system and is responsible for operating NASA's Deep Space Network (DSN). NASA JPL's primary mission is the planning, advocacy, and execution of unmanned exploratory scientific flight through the solar system. This includes activities in the areas of planetary exploration, earth science, astrobiology, telecommunications, and astrophysics. NASA JPL also conducts research and development tasks for other Federal agencies creating international expertise in key fields such as space science instrumentation and telecommunications, spacecraft component design and systems integration, micro-devices, electronics, and software automation. All work is conducted pursuant to the contract with NASA.

There are three NASA Caltech-managed facilities in California: the main JPL facility on Oak Grove Drive in Pasadena (hereafter referred to as NASA JPL), Goldstone Deep Space Communication Complex (GDSCC) near Barstow, and the Table Mountain Facility (TMF) in Wrightwood. NASA JPL also includes two off-site complexes, the California Laboratory for Atmospheric Remote Sensing (CLARS) and the Woodbury Complex in Altadena; however, recurring lease costs for the Woodbury Complex have led to a proposed long-term plan to relocate the Woodbury employees to NASA JPL. In 2015, NASA JPL updated the Environmental Resources Document (ERD) for the NASA JPL facility which serves as the baseline description for the resources described. The NASA JPL facility (described in greater detail below in Section 1.2, *Facility Description*) is located on approximately 169 acres within the City of La Cañada Flintridge. It is

[1] FFRDCs are public-private partnerships which conduct research for the U.S. Government. They are administered in accordance with 48 U.S. Code (USC) §35.017 by universities and corporations.

located immediately adjacent to the west of the Arroyo Seco a predominantly dry riverbed (see Section 2.2.1.2, *Arroyo Seco and Hahamongna Watershed Park*).

NASA JPL viewed from the overlook point off N. Windsor Avenue.

1.2 FACILITY DESCRIPTION

The NASA JPL facility is located in the northern metropolitan Los Angeles area, within the City of La Cañada Flintridge (see Figure 1-1). NASA JPL encompasses approximately 169 acres, and contains 2.7 million square feet of facility space (see Figure 1-2).[2] The on-site workforce at NASA JPL consists of approximately 5,000 full-time equivalent employees.

NASA JPL is surrounded by natural settings on the northern, eastern, and southern boundaries. The facility is separated from residential neighborhoods by the foothills of the San Gabriel Mountains to the north and the Arroyo Seco Canyon to the east (see Section 2.2.1.2, *Arroyo Seco and Hahamongna Watershed Park*). The residential area of La Cañada Flintridge borders NASA JPL on the west. Flintridge Riding Club, a local equestrian club, and a Los Angeles County Fire Department facility are located to the southwest. La Cañada High School, Hahamongna Watershed Park (HWP), and Devil's Gate Dam are located farther south.

[2] 156.9 acres are federally owned, the remainder is leased from the Flintridge Riding Club and the City of Pasadena.

Figure 1-1

1-1 NASA JPL Regional Map

No warranty is made by NASA as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document," in that it is intended to change as new data become available and are incorporated into the GIS database.

1.3 PURPOSE AND NEED FOR PROPOSED ACTION

1.3.1 Statement of Purpose

The *purpose* of the Proposed Action is to programmatically allow for a suite of outdoor scientific development and testing activities at NASA JPL on-site and within other appropriate landscapes in close proximity to NASA JPL, including the adjacent Arroyo Seco. These outdoor testing actions are small-scale, non-intrusive, short-duration outdoor testing, verification, and calibration activities and are necessary to support and fulfill NASA scientific and technology demonstration missions as well as tasks conducted by NASA JPL under technology development agreement with other Federal agencies. These activities often require short-notice or unscheduled mobilization. These small-scale, research-related testing activities would support NASA JPL in accomplishing its mission.

1.3.2 Statement of Need

The *need* for the Proposed Action is driven by testing requirements for the technology demonstration programs at NASA JPL. NASA's primary mission is to "[d]rive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth." In order to support this mission, NASA JPL scientists, engineers, and researchers develop and test innovative technologies and deployable systems outdoors. Further, NASA JPL often requires short-notice or unscheduled outdoor testing for the verification, and calibration of these technology and systems in open space environments that are analogous to other locations on Earth (e.g., similar or comparable geology, topography, etc.), or other planetary surfaces (e.g., Mars). Specifically, field testing areas must meet several unique criteria:

- Areas on or in close proximity to the NASA JPL facility to facilitate expeditious deployment for testing and validation as well as to reduce risks associated with asset transport.
- Areas with existing land use types that would permit a variety of testing activities, including testing of mobile equipment.
- Location that would help facilitate consistency with Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade* as well as NASA

Policy Directive (NPD) 8500.1C and NASA Sustainability Performance Plan (SPP).

- The ability to quickly mobilize testing equipment and personnel under short-notice and / or unscheduled conditions.
- The ability to perform outdoor scientific development and testing activities on short notice and / or unscheduled conditions by not requiring individual consideration and approval.

To fulfill the purpose and need identified above, on-site, outdoor research would continue to be conducted throughout the NASA JPL facility and off-site, outdoor research would take place within the Arroyo Seco. These testing activities would generally occur during park hours and would range from small-scale testing of instrumentation to larger vehicle testing. NEPA compliance for any NASA JPL proposed research-related outdoor testing actions would follow existing NASA JPL compliance processes and would be evaluated for adequate coverage by this Programmatic EA and documented in the appropriate NASA JPL NEPA checklist.

1.4 REGULATORY FRAMEWORK

The preparation of this Programmatic EA is consistent with regulations issued by the Council on Environmental Quality (CEQ), 14 Code of Federal Regulations (CFR) Part 1216.3, *Procedures for Implementing the National Environmental Policy Act* (NEPA) and *CEQ Guidance on Preparation on Effective Use of Programmatic NEPA Reviews (18 December 2014)*. Further, preparation of this Programmatic EA follows NASA Procedural Requirement (NPR) 8580.1A, *Implementing the National Environmental Policy Act*. Programmatic NEPA reviews are governed by the same regulations and guidance that apply to non-programmatic NEPA reviews; however, CEQ guidance requires that programmatic reviews address the general environmental issues relating to broad decisions – such as those establishing policies, plans, programs, or suite of projects – and effectively frame the scope of subsequent site- and project-specific Federal actions. A programmatic NEPA review provides the basis for decisions to approve such broad or high-level decisions such as identifying geographically bounded areas within which future proposed activities can be taken.

Table 1-1 lists statutes, regulations, EOs, as well as NPRs and NPDs that govern and/or influence the scope of this Programmatic EA. A number of statutes were considered but found to have no influence on this Proposed Action. Although this list is not all-inclusive, the Proposed Action and its alternatives comply with applicable regulatory requirements.

Table 1-1. Summary of Applicable Regulatory Requirements

Regulatory Requirements
Statutes
National Environmental Policy Act (NEPA) of 1969 (42 U.S. Code [USC] §4321-4347)
National Historic Preservation Act (NHPA) of 1966 (16 USC § 470 et seq.) (89 Public Law [PL] 966)
Clean Air Act (CAA) of 1970 as amended (42 USC § 7401 et seq.)
Clean Water Act (CWA) of 1977 as amended (33 USC § 1251 et seq.)
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 USC § 9601et seq.)
Archaeological Resources Protection Act of 1979 (16 USC §470aa-mm)
Endangered Species Act of 1973 (16 USC §1531-1544)
Resource Conservation and Recovery Act (42 USC § 6901 et seq.)
Regulations
CEQ Regulations (40 CFR Parts 1500-1508)
CEQ Guidance on Preparation on Effective Use of Programmatic NEPA Reviews (18 December 2014)
36 CFR Part 800 – Protection of Historic Properties
32 CFR Part 229 – Protection of Archaeological Resources: Uniform Regulations
40 CFR 6, 51, and 93 – Conformity of General Federal Actions to State or Federal Implementation Plans
29 CFR Part 1910 – Occupational Safety and Health Standards
CFR Title 40 – Protection of the Environment
33 CFR 320-330 – U.S. Army Corps of Engineers (USACE) Regulations
40 CFR Parts 300-399 – Hazardous Substance Regulations
40 CFR Part 61 Subpart M – National Emission Standard for Asbestos Secretary of the Interior Standards and Guidelines for Archeology and Historic Preservation (Federal Register [FR] Vol. 48, No. 190, 44716-44742)
Executive Orders
EO 11593 – Protection and Enhancement of the Cultural Environment
EO 11988 – Floodplain Management
EO 11990 – Protection of Wetlands
EO 12898 – Environmental Justice
EO 13175 – Consultation and Coordination with Indian Tribal Governments
EO 13287 – Preserve America
EO 13327 – Federal Real Property Management
EO 13423 – Strengthening Federal Environmental, Energy, and Transportation Management
EO 13514 – Federal Leadership in Environmental , Energy, and Economic Performance
EO 13693 – Planning for Federal Sustainability in the Next Decade

Regulatory Requirements
NASA Procedural Requirements, Policy Directives, and Policy Guidance
NPR 8553.1B, "NASA Environmental Management System", September 22, 2009
NPR 8580.1A, "Implementing the NEPA and EO 12114", November 26, 2001
NPD 8500.1C, "NASA Environmental Management"
NPD 8831.1C and 2D, "Maintenance and Operations of Institutional and Program Facilities and Related Equipment"

1.5 ENVIRONMENTAL ISSUES

The potential impacts of the Proposed Action and its alternatives that are described in this Programmatic EA are assessed in accordance with NPR 8580.1A, which requires that impacts to resources be analyzed in terms of their context, duration, and intensity. In order to facilitate public and decision-maker understanding, impacts to resources are described as short-term, long-term, or cumulative impacts, based on an understanding and interpretation by resource professionals and specialists.

This EA evaluates potential environmental impacts to the following resources that would likely be affected by implementation of the Proposed Action or its alternatives:

- Air Quality
- Noise
- Geological Resources
- Water Resources
- Biological Resources
- Land Use
- Traffic and Transportation
- Cultural Resources
- Socioeconomics and Environmental Justice
- Visual Resources
- Hazardous Materials and Wastes

Per NEPA, other resource areas that are anticipated to experience either no or negligible environmental impact under implementation of the Proposed Action or its alternatives are not examined in detail in this Programmatic EA.

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2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This section describes the elements included in the Proposed Action that is being evaluated in this Programmatic Environmental Assessment (EA). Additionally, guidance for complying with the National Environmental Policy Act (NEPA) and National Aeronautics and Space Administration (NASA) Procedural Requirement (NPR) 8580.1A, *Implementing the National Environmental Policy Act* requires an assessment of potentially effective and reasonably feasible alternatives for implementation of the Proposed Action. Beyond the Proposed Action (Alternative A), no other alternatives have been identified that would meet the *purpose* and *need* of the Proposed Action (see Section 2.2.4, *Alternatives Sites Not Considered*). However, because CEQ regulations Section 1502.14(d) stipulate that the No Action Alternative be analyzed to assess any environmental consequences that may occur if the Proposed Action is not implemented, this alternative is also carried forward for analysis in the EA (see Section 2.2.3, *No Action Alternative*). In situations where there are existing programs, plans, or policies, CEQ expects that the No Action Alternative in an EA would typically be the continuation of the present course of action until a new program, plan, or policy is developed and decided upon.

2.2 PROPOSED ACTION AND ALTERNATIVES

2.2.1 Proposed Action (Alternative A)

The Proposed Action would implement programmatic NASA JPL small-scale, non-intrusive, short-duration outdoor testing, verification, and calibration activities on-site and within the Arroyo Seco immediately east of the NASA JPL facility. These small-scale, research-related testing activities would support NASA JPL in accomplishing its mission as described in Section 1.3, *Purpose and Need for Proposed Action*. The proposed geographic location and scope of NASA JPL testing activities is described in detail below.

2.2.1.1 NASA JPL On-Site Facilities

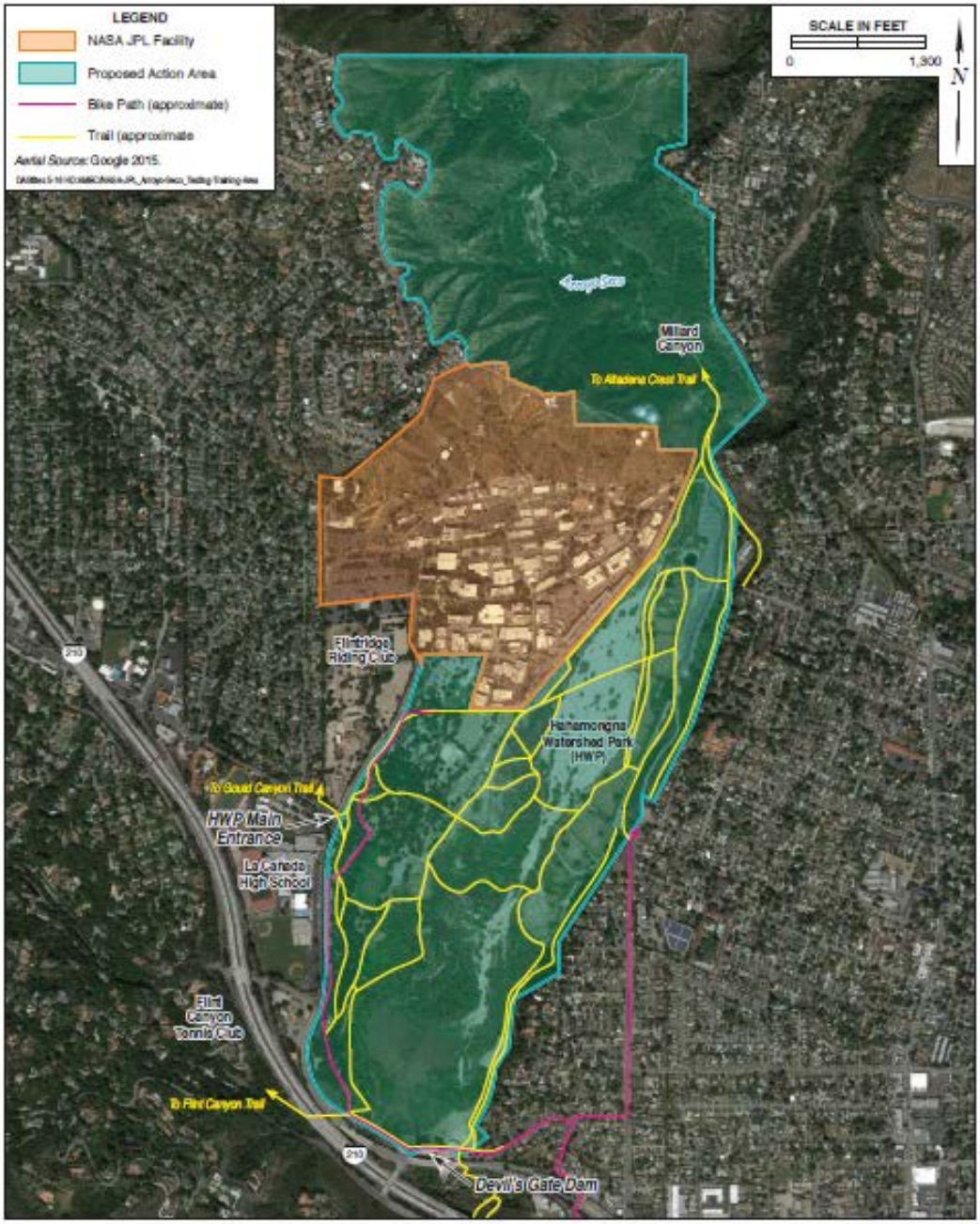
On-site outdoor testing within NASA JPL currently takes place regularly throughout the NASA JPL facility (e.g., existing roadways, the Mesa hillside, etc.); however, focused outdoor research also takes place at the Mars Yard and the Robotics Arena south of Building 198. These facilities are used for component and technology testing activities that are generally conducted adjacent to or in close proximity to fabrication bays or other industrial areas of the facility. The Mars Yard is a simulated Martian landscape used by the research and flight projects to test different robotic prototypes. This facility provides a large test area and an outdoor environment to test different robotic applications under natural lighting conditions. The soil characteristics are matched to some regions on Mars, and the rock colors, sizes and distribution are intended to match images from Martian missions. Adjacent to the outdoor test area are trailers housing researchers, computers, measuring equipment, and storage areas for the vehicles. Similarly, the Robotics Arena includes a sandbox, a wood and false rock structure as well as various plywood structures which mimic a small urban environment. The arena is currently used in support of various robotic research tasks.

The Mars Yard (left) and Robotics Arena (right) are the primary designated outdoor testing areas within the NASA JPL facility. These areas are used to test rovers as well as other robotic devices in appropriate outdoor settings that mimic the natural environment, but also in close proximity to fabrication and development facilities.

2.2.1.2 Arroyo Seco and Hahamongna Watershed Park

The Arroyo Seco, Spanish for "dry gulch," flows out of the San Gabriel Mountains in the northwest corner of the City of Pasadena and forms a physical link between the San Gabriel Mountains and the Los Angeles River (City of Pasadena 2003). The Hahamongna Watershed Park (HWP), which is included in the Hahamongna Management Plan (HMP),[3] is located adjacent to NASA JPL and is comprised of approximately 330 acres in the southernmost area of the Upper Arroyo Seco (City of Pasadena 2010). The lower eastern portion of the HWP area is comprised of a sediment plain located upstream of the Devil's Gate Dam. This area is dominated by passive recreation uses, water conservation, and flood control activities. The entire basin is designated as Open Space in the Land Use Element of the City of Pasadena Comprehensive General Plan (City of Pasadena 2015). HWP is zoned as *Open Space* with the exception of two parcels zoned as *Planned Development Districts* (PD-16) (City of Pasadena 2010).

[33] The HMP is one of four master planning documents collectively referred to as Arroyo Seco Master Plans, which also include: Central Arroyo Seco Master Plan (CAMP); Lower Arroyo Seco Master Plan (LAMP); and Rose Bowl Operating Company Use Plan.



EA

Proposed Action Area

FIGURE 2-1

No warranty is made by NASA as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document," in that it is intended to change as new data become available and are incorporated into the GIS database.

2.2.1.3 Proposed Scope of Programmatic Testing Activities

Under the Proposed Action, on-site, outdoor research would continue to occur throughout the NASA JPL facility (e.g., existing roadways, the Mesa hillside, etc.), including the Mars Yard and the Robotics Arena south of Building 198. Off-site, outdoor research would take place within the Arroyo Seco, which provides a local, convenient, cost-effective, and realistic setting for such small-scale, non-intrusive, short-duration outdoor testing for activities that develop vision sensing, programming applications and deployable equipment, etc. The geographic scope of aerial activities (i.e., small Unmanned Aerial System [sUAS] flights) would be limited to the bounds of the existing Certificate of Authorization (COA) that has been established within the HWP by the Federal Aviation Administration (FAA) under Section 333 for NASA JPL quadrotor testing below a ceiling of 200 feet (FAA 2015; see Section 2.2.1.3, *Proposed Scope of Programmatic Training Activities*). All other NASA JPL small-scale, research-related testing activities would occur within and/or underneath the footprint of this existing COA or within the outdoor testing facilities at NASA JPL. Prior to any individual testing or training activity outside of NASA JPL boundaries, NASA JPL would coordinate with the City of Pasadena to determine any schedule or specific use conflicts in the desired area of the Arroyo Seco.

Under the Proposed Action, future testing activities in the Arroyo Seco would generally occur during park hours and would potentially include the use of enclosed laser system,[4] batteries, small generators, etc. Programmatic research-related testing activities included in the Proposed Action would range from small-scale testing of camera and radar technologies, which would involve little ground disturbance, to larger rover testing which may include limited vegetation removal. Examples of a variety of NASA JPL activities are provided below.

[44] For more information about laser classification refer to the Stanford University Laser Safety Manual (2012). Available at: https://web.stanford.edu/dept/EHS/prod/researchlab/radlaser/laser/program/program.pdf.

Recent and ongoing activities include:

- Flights of sensor-mounted small Unmanned Aerial System (sUAS) platforms (e.g., within trees, open spaces, and above targets placed on the ground); and
- Driving a sensor-mounted Polaris All-Terrain Vehicle (ATV).

Past activities have included:

- Tripod-mounted prototype camera imaging;
- Driving a sensor-mounted NASA JPL Humvee (retired);
- Instrument deployment and testing from the NASA JPL Bridge;
- Radar deployment and testing on Devil's Gate Dam; and
- Operating a 15-foot tall All-Terrain Hex-Limbed Extra Terrestrial (ATHLETE) Rover.

Currently, these types of activities – conducted both on-site and in the Arroyo Seco – are assessed under individual Categorical Exclusions (CATEXs) compliant with NEPA per 40 CFR 1508.4 and (for activities in the Arroyo Seco) with individual agreements with the City of Pasadena.

Small-scale testing activities in the Arroyo Seco have ranged from camera imaging (left; representative photograph from the Mojave Desert) to ATHLETE Rover testing (right; representative photograph). These activities are currently carried out in the Arroyo Seco under individual agreements with the City of Pasadena and other relevant state and/or Federal agencies (e.g., Federal Aviation Administration [FAA] for quadrotor flights).

2.2.2 No Action Alternative

Under the No Action Alternative, the proposed small-scale, research-related testing activities would continue to require individual assessment and approval. Testing activities are currently approved under individual Categorical Exclusions (CATEXs) and agreements with other Federal, state, and local agencies. Under the No Action Alternative, it is anticipated that such testing activities would require individual approvals impacting the scheduling of on short-notice or unscheduled outdoor testing. Such approval processes would restrict NASA JPL's ability to expeditiously conduct outdoor testing and calibration activities and may, in some circumstances, require NASA JPL to pursue other less suitable outdoor testing areas, which would also require asset transport and associated risks and sustainability impacts.

CEQ regulations stipulate that the No Action Alternative be analyzed to assess any environmental consequences that may occur if the Proposed Action is not implemented. The No Action Alternative also provides a baseline against which the Proposed Action can be compared. Consequently, this alternative will be carried forward for analysis within this Programmatic EA.

2.2.3 Alternative Sites Not Considered

NASA JPL can perform outdoor testing its two off-site facilities: Goldstone Deep Space Communications Complex (GDSCC) at Fort Irwin in the Mojave Desert

and at the Table Mountain Facility (TMF) near Wrightwood in the San Gabriel Mountains. However, these locations are remote, have restrictive radio spectrum requirements, and require a permit from the U.S. Army or the U.S. Forest Service. Additional, but less frequent, outdoor testing has been conducted on land owned by other federal agencies (e.g., Bureau of Land Management [BLM], National Park Service [NPS], etc.). NASA JPL coordinates closely with these federal agencies to ensure permits are submitted and NEPA review is compliant with NEPA per 40 CFR 1508.4. However, these locations are remote from NASA JPL, include additional costs (e.g., permit fees, transportation, fuel), and require long-lead times for coordination, approval, access, and execution. These locations would not meet the purpose and need for expeditious deployment for training and validation and would result in additional air quality impacts and energy consumption as well as safety risks associated with asset transport. As such, these activities at GDSCC, TMF, and at other locations managed or owned by other federal agencies are not discussed or analyzed within this Programmatic EA.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

3.1 INTRODUCTION

This section describes the existing physical environment and socioeconomic setting within the affected project area including and surrounding the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL) facility and Hahamongna Watershed Park (HWP) within the Upper Arroyo Seco (refer to Section 2.2.1.2, *Arroyo Seco and Hahamongna Watershed Park*). The section includes an analysis of potential environmental impacts from the Proposed Action (Alternative A) and the No Action Alternative. Impacts identified for Alternative A are programmatic in nature and based primarily on the representative activities described in Section 2.2.1.3, *Proposed Scope of Programmatic Testing Activities*. It is presumed that future on-site and off-site testing activities would be similar in scope and would have similar impacts to those described in this Programmatic EA.

Potential impacts have been evaluated to determine whether they would constitute a "significant effect" on a particular environmental resource area. Impacts identified in this Environmental Assessment (EA) are described as having No Impact, Significant Adverse Impact, or Beneficial Impact, to the environment. The terms "impact" and "effect" are used synonymously in this EA. Impacts may apply to the full range of natural, aesthetic, historic, cultural, and socioeconomic resources. This section also describes potential incremental cumulative impacts from the alternatives under consideration.

Information used to develop and describe the existing settings for each resource area has been obtained from research of existing datasets and databases as well as from the *NASA JPL Oak Grove Master Plan Update Final Programmatic Environmental Assessment (*NASA 2012a*), NASA Jet Propulsion Laboratory Facility Master Plan Updates* (NASA 2012c), *NASA JPL Environmental Resource Document (ERD)* (NASA 2015d), and other studies completed for the NASA JPL facility that have been incorporated by reference. Additionally, the existing setting for the HWP and Upper Arroyo Section has developed based on the *City of Pasadena General Plan Update* (City of Pasadena 2015), *City of Pasadena Hahamongna Watershed Park Mast Plan Addendum* (City of Pasadena 2010), and *Arroyo Seco*

Master Environmental Impact Report (City of Pasadena 2002) as well as other studies completed for the HWP and Upper Arroyo Seco.

3.1.1 Regulatory Setting

Environmental impacts have been assessed according to the Federal guidelines included in Council on Environmental Quality (CEQ), 14 Code of Federal Regulations (CFR) Part 1216.3, *Procedures for Implementing NEPA,* and NASA Procedural Requirement (NPR) 8580.1A, *Implementing NEPA*. In accordance with CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508, Section 1502.13), this section describes the affected environment, as well as anticipated foreseeable impacts to the affected environment from the implementation of the Proposed Action (Alternative A) and its alternatives.

3.1.2 Impact Analysis

Direct Impacts: Caused by the action and occur at the same time and place.

Indirect Impacts: Caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect impacts may include growth inducing impacts and other impacts related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, water and other natural systems, including ecosystems.

Impacts include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historical, cultural, economic, social, or health, whether direct, indirect, or cumulative. Impacts may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (40 CFR 1508.8).

3.1.2.1 Significance of Environmental Impacts

According to CEQ regulations 40 CFR 1500-1508, the determination of a significant impact is a function of both context and intensity, as summarized below.

Context: This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of a proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

Intensity: This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action.

To determine significance, the severity of the impact must be examined in terms of the type, quality and sensitivity of the resource involved; the location of the proposed project; the duration of the effect (short or long-term) and other consideration of context. Significance of the impact will vary with the setting of a proposed action and the surrounding area (including residential, industrial, commercial, and natural sites).

3.2 AIR QUALITY

3.2.1 Definition of Resource

3.2.1.1 Climate

Climate is defined as long-term atmospheric patterns that characterize a region or location, and includes measures of temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count, and other meteorological variables. Knowing the climate of an area enables the predictability of short-term weather phenomena; however, only the weather can specify actual short-term atmospheric conditions. Some geographic regions with great topographic variations over relatively short distances (e.g., slope steepness, aspect, etc.) have micro-climates that are distinct to small areas (e.g., canyons, leeward vs. windward, hilltops, basins, etc.).

3.2.1.2 Air Quality

Air quality at a given location is a function of several factors including the quantity and type of pollutants emitted locally and regionally, as well as the dispersion rates of these pollutants. Primary factors affecting pollutant dispersion are wind speed and direction, atmospheric stability, temperature, the presence or absence of inversions, and topography. Air quality is affected by both stationary sources (e.g., industrial development) and mobile sources (e.g., motor vehicles).

Air quality at a given location is determined by the concentration of various pollutants in the atmosphere. National Ambient Air Quality Standards (NAAQS) are established by the U.S. Environmental Protection Agency (USEPA) for criteria pollutants, including: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than or equal to (≤) ten microns in diameter (PM_{10}) and ≤2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). The State of California adopted the NAAQS and promulgates additional California Ambient Air Quality Standards (CAAQS) under the California Clean Air Act (CCAA). The CCAA identifies ten criteria pollutants and the standards are generally more stringent than the Federal standards.

Ozone (O_3). The majority of ground-level (or terrestrial) O_3 is formed as a result of complex photochemical reactions in the atmosphere involving volatile organic compounds (VOC), nitrogen oxides (NO_x), and oxygen. O_3 is a highly reactive gas that damages lung tissue, reduces pulmonary function, and sensitizes the lung to other irritants. Although stratospheric O_3 shields the earth from damaging ultraviolet radiation, terrestrial O_3 is a highly damaging air pollutant and is the primary source of smog.

Carbon Monoxide (CO). CO is a colorless, odorless, and poisonous gas produced by incomplete burning of carbon in fuel. The health threat from CO is most serious for those who suffer from cardiovascular disease, particularly those with angina and peripheral vascular disease.

Nitrogen Dioxide (NO_2). NO_2 is a highly reactive gas that can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections.

Repeated exposure to high concentrations of NO_2 may cause acute respiratory disease in children. Because NO_2 is a key precursor in the formation of O_3 or smog, control of NO_2 emissions is an important component of overall pollution reduction strategies. The two primary sources of NO_2 in the U.S. are fuel combustion and transportation.

Sulfur Dioxide (SO_2). SO_2 is emitted from volcanoes, stationary source coal and oil combustion, steel mills, refineries, pulp and paper mills, and from nonferrous smelters. High concentrations of SO_2 may aggravate existing respiratory and cardiovascular disease; asthmatics and those with emphysema or bronchitis are the most sensitive to SO_2 exposure. SO_2 also contributes to acid rain, which can lead to the acidification of lakes and streams and damage trees.

Particulate Matter (PM_{10} and $PM_{2.5}$). Particulate matter (PM) is a mixture of tiny particles that vary greatly in shape, size, and chemical composition, and can be comprised of metals, soot, soil, and dust. PM_{10} includes larger, coarse particles, whereas $PM_{2.5}$ includes smaller, fine particles. Sources of coarse particles include crushing or grinding operations, and dust from paved or unpaved roads. Sources of fine particles include all types of combustion activities (e.g., motor vehicles, power plants, wood burning) and certain industrial processes.

Exposure to PM_{10} and $PM_{2.5}$ levels exceeding current standards can result in increased respiratory- and cardiac-related respiratory illness. Short-term effects from PM may include headaches, breathing difficulties, eye irritation, and sore throat. The USEPA has concluded that $PM_{2.5}$ are more likely to contribute to health problems than PM_{10}.

Airborne Lead (Pb). Airborne Pb can be inhaled directly or ingested indirectly by consuming Pb-contaminated food, water, or non-food materials such as dust or soil. Fetuses, infants, and children are most sensitive to Pb exposure. Pb has been identified as a factor in high blood pressure and heart disease. Exposure to Pb has declined dramatically in the last 10 years as a result of the reduction of Pb in gasoline and paint, and the elimination of Pb from soldered cans.

Visibility Reducing Particles (VRPs). VRPs consist of suspended particulate matter, which is a complex mixture of tiny particles that consist of dry solid

fragments, solid cores with liquid coatings, and small droplets of liquid. These particles vary greatly in shape, size and chemical composition, and can be made up of many different materials such as metals, soot, soil, dust, and salt (California Environmental Protection Agency Air Resources Board [CEPA ARB], 2014a).

Sulfates. Sulfates are the fully oxidized ionic form of sulfur. Sulfates occur in combination with metal and / or hydrogen ions. In California, emissions of sulfur compounds occur primarily from the combustion of petroleum-derived fuels (e.g., gasoline and diesel fuel) that contain sulfur. This sulfur is oxidized to SO_2 during the combustion process and subsequently converted to sulfate compounds in the atmosphere. The conversion of SO_2 to sulfates takes place comparatively rapidly and completely in urban areas of California due to regional meteorological features (CEPA ARB 2014b).

Hydrogen Sulfide (H_2S). H_2S is a colorless gas with the odor of rotten eggs. It is formed during bacterial decomposition of sulfur-containing organic substances. Also, it can be present in sewer gas and some natural gas, and can be emitted as the result of geothermal energy exploitation (CEPA ARB 2014c).

Vinyl Chloride. Vinyl chloride is a colorless gas with a mild, sweet odor. Most vinyl chloride is used to make polyvinyl chloride (PVC) plastic and vinyl products. Vinyl chloride has been detected near landfills, sewage plants, and hazardous waste sites, due to microbial breakdown of chlorinated solvents (CEPA ARB 2014d).

3.2.1.3 Greenhouse Gases (GHGs)

GHGs trap heat in the earth's atmosphere, affecting climate change and contributing to global warming. Both naturally occurring and anthropogenic (man-made) GHGs include: water vapor, carbon dioxide (CO_2), methane (NH_4), nitrous oxide (NO), and O_3. According to guidance from the CEQ, during an analysis of direct effects it is appropriate to: (1) quantify cumulative emissions over the life of the project, (2) discuss measures to reduce GHG emissions, including consideration of reasonable alternatives, and (3) qualitatively discuss the link between such GHG emissions and climate change. However, it is not

currently useful for NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand. The estimated level of GHG emissions can serve as a reasonable proxy for assessing potential climate change impacts, and provide decision makers and the public with useful information for a reasoned choice among alternatives (CEQ 2010).

3.2.2 Regulatory Setting

The U.S. Clean Air Act (CAA) Amendments of 1990 place most of the responsibility to achieve compliance with NAAQS on individual states. The CEPA ARB is responsible for the promotion and protection of public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants while recognizing and considering the effects on the economy. The major goals of the board are to: provide safe, clean air to all Californians; protect the public from exposure to toxic air contaminants; reduce California's emission of GHGs; provide leadership in implementing and enforcing air pollution control rules and regulations; provide innovative approaches for complying with air pollution rules and regulations; base decisions on best possible scientific and economic information; and provide quality consumer service to all air resource board clients (CEPA ARB 2014e).

The USEPA requires each state to prepare a State Implementation Plan (SIP). A SIP is a compilation of goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all NAAQS for CO, PM_{10}, $PM_{2.5}$, SO_2, NO_2, and O_3 to thus reach attainment status. Areas not in compliance with a standard can be declared nonattainment areas by USEPA or the appropriate state or local agency. There can be lenience for Exceptional Events, which are defined as "unusual or naturally occurring events that can affect air quality but are not reasonably controllable using techniques that tribal, state, or local air agencies may implement in order to attain and maintain the NAAQS" (USEPA 2013). An example of an Exceptional Event is a volcanic eruption, which affects air quality by causing exceedances of NAAQS and cannot be controlled by human intervention.

3.2.3 Existing Conditions

The following describes the local climate air quality standards, air quality conditions, and the NASA JPL air pollution sources, controls, and reporting requirements.

CEPA ARB has delegated the responsibility for implementation of the CAA and CCAA to local air pollution control agencies. NASA JPL and the surrounding communities of Pasadena, Altadena, and La Cañada Flintridge, including the adjacent HWP located to the east of NASA JPL, are located in the eastern portion of the Los Angeles metropolitan area, within the South Coast Air Basin (SOCAB). SOCAB consists of Orange County, all of Los Angeles County except for the Antelope Valley, the non-desert portion of western San Bernardino County, and the western and Coachella Valley portions of Riverside County (NASA 2012b).

3.2.3.1 Climate

SOCAB has a distinctive climate determined by its geographical location. Regional meteorology is dominated by a persistent high-pressure area, which resides over the eastern Pacific Ocean. SOCAB has a Mediterranean climate characterized by warm, dry summers and mild winters, infrequent rainfall and moderate humidity, with moderate daytime onshore breezes. This mild climatic condition is occasionally interrupted by periods of hot easterly winds associated with Santa Ana winds, winter storms, and infrequent summer thunderstorms. Santa Ana winds can be strong near the mouths of canyons oriented along the direction of airflow, such as the Arroyo Seco (NASA 2012b).

3.2.3.2 Air Quality Standards

Pollutant transport in SOCAB generally follows the on-shore and offshore air flow characteristic of coastal areas. The South Coast Air Quality Management District (SCAQMD) has divided the air basin into 38 Source Receptor Areas (SRA), each containing one or more monitoring stations. These SRAs are designated to provide a general representation of the local meteorological conditions within the particular area. NASA JPL and the HWP are located within SRA 88, and the nearest monitoring station is the West San Gabriel Valley

station, located 5 miles to the southeast of NASA JPL. Pollutants monitored at the station include O_3, CO, total suspended particulates (TSP), SO_2, and NO_2. The station is not equipped to monitor ambient PM_{10} or $PM_{2.5}$ levels or Pb.

In the SOCAB, emissions of NO_x are heavily distributed in the western portion of the basin. Daytime wind flow, mountain barriers, a persistent temperature inversion, and intense sunlight all contribute to high O_3 concentrations in the downwind, inland valleys and coastal areas. Maximum O_3 concentrations usually are recorded during the summer. Ozone is associated with eye irritation, reduced visibility, and adverse health effects at high concentrations. CO concentrations are highest near heavily congested roadways.

According to the most recent conformity designation, the SOCAB is in *attainment* or *maintenance* for SO_2, CO, and NO_2. In 2014, Los Angeles County was designated as a *nonattainment* area for O_3, PM_{10}, $PM_{2.5}$, and Pb (Table 3-1).

Table 3-1. Attainment Status and *de minimis* Emission Thresholds for NASA JPL and Surrounding Communities

Pollutant	SOCAB Attainment Designation	*de minimis* Threshold (tpy)
O_3	Nonattainment / Extreme	10
PM_{10}	Nonattainment / Serious	70
$PM_{2.5}$	Nonattainment	100
Pb	Nonattainment	25
SO_2	Attainment/Maintenance	100
CO	Attainment/Maintenance	100
NO_2	Attainment/Maintenance	100

Source: USEPA 2014.

3.2.3.3 Air Pollution Sources, Controls, and Reporting Requirements

NASA JPL submits annual emissions inventory reports to SCAQMD, which include emissions analyses from permitted and unpermitted sources. All sources of air pollutants and permit status are evaluated under a comprehensive air pollutant source identification and evaluation program, which includes an extensive equipment listing maintained by NASA JPL's Environmental Affairs

Program Office as part of their emissions and waste management database. Table 3-2 lists the volumes of criteria pollutants reported to the SCAQMD in 2010.

Table 3-2. Criteria Pollutants Reported by NASA JPL to SCAQMD

Pollutant	Annual Emissions (tpy)
CO	6.06
NO_x	10.21
ROG	2.20
SO_x	0.07
TSP	0.94

Source: NASA 2012b.

NASA JPL is currently permitted by the SCAQMD as a Regional Clean Air Incentives Market facility, and as a Title V facility under the Federal Operating Permit Program because the volumes of criteria pollutants and toxic (non criteria) pollutants exceed regulatory thresholds, respectively. NASA JPL received its initial Title V Facility Permit in September 2001 due primarily to annual emissions of NO_x exceeding the threshold amount shown in Table 1 of SCAQMD Rule 3001.

The type of air emission sources that usually require SCAQMD permits to operate (Rule 201 and Rule 203) include boilers, internal combustion engines, emergency generators, painting operations, degreasers, fuel storage tanks, dispensers, and various research and development processes. Various types of these individual emissions units currently operate under SCAQMD permits at NASA JPL. Although NASA JPL has a substantial amount of research and development activities, only one facility requires that air pollution control equipment be installed: the Microdevices Laboratory (Building 302) requires a wet scrubber to control emissions for clean room laboratory operations. NASA JPL is currently in compliance with air quality permitting regulations.

3.2.3.4 Toxic Release Inventory

NASA JPL complies with other reporting requirements, such as the Section 313 Reporting Requirements under the Emergency Planning and Community Right

to Know Act (EPCRA) and toxic emission inventory reporting under Air Toxics "Hot Spots" Information and Assessment Act Assembly Bill (AB) 2588. NASA JPL has submitted required inventory data; however, due to the low facility priority ranking, which is based on both toxicity and quantity of emissions, NASA JPL has not been required to submit a follow-up risk assessment of reported emissions.

3.2.4 Approach to Analysis

The 1990 Amendments to the CAA require that Federal agency activities conform to the SIP with respect to achieving and maintaining attainment of NAAQS and to addressing air quality impacts. The USEPA General Conformity Rule requires that a conformity analysis be performed, which demonstrates that a proposed action does not: 1) cause or contribute to any violation of any NAAQS in the area; 2) interfere with provisions in the SIP for maintenance or attainment of any NAAQS; 3) increase the frequency or severity of any existing violation of any NAAQS; or 4) delay timely attainment of any NAAQS, any interim emission reduction goals, or other milestones included in the SIP. Provisions in the General Conformity Rule allow for exemptions from performing a conformity determination only if total emissions of individual nonattainment area pollutants resulting from a proposed action fall below the de minimis threshold values.

3.2.5 Environmental Impacts

3.2.5.1 Alternative A

Fugitive Dust Emissions

Under this alternative, fugitive dust may be generated during maneuvers performed in on-site testing locations (e.g., Mars Yard and Robotics Arena south of Building 198) as well as open space areas within the Arroyo Seco during testing operations conducted with manned or unmanned vehicles or wheeled equipment. Dust emissions generated by such activities could vary depending on prevailing meteorological conditions and terrain. Within the NASA JPL facilities equipment operates on paved surfaces or within small designated areas with natural surfaces that approximate extraterrestrial conditions. Within the HWP

and Upper Arroyo Seco, vehicles operate either on existing roads, landscaped/manicured vegetation, or in the Arroyo Seco dry creekbed which is characterized by cobbles and boulders with little-to-no vegetation. Larger wheeled vehicles are generally not programmed to access or be tested in the densely wooded portion of the Arroyo Seco north of the NASA JPL Bridge. For the majority of testing within HWP and the Arroyo Seco no vegetation removal would be required. In instances where minor vegetation removal would be required, these activities would be coordinated with the City of Pasadena well in advance of the commencement of any testing activities (e.g., previous testing of the ATHLETE, which was closely coordinated with the City of Pasadena). Inhalable coarse particles (PM_{10}) could be generated directly from the source such as windblown dusts from bare soil and re-entrained dust from vehicle travel on unpaved roads. However due to the relatively low number and infrequency of use of vehicles and equipment used for testing, the nature of existing soils, and the frequency of testing conducted, fugitive dust emissions generated during off-road and/or on-road vehicles would be expected to be less than significant.

Ground disturbing activities that could generate fugitive dust would largely be limited to testing associated with wheeled equipment in on-site at NASA JPL or off-site within open areas in the HWP and Upper Arroyo Seco.

Combustion Emissions

Off Highway Vehicles emit criteria pollutants such as nitrogen oxides, sulfur oxides, carbon monoxide, and volatile organic compounds. Both NO_x and VOCs are precursors for the non-attainment pollutant O_3. Additionally, inhalable coarse particles can be emitted directly such as soot from engine exhaust.

Under Alternative A, testing activities would include the use of wheeled equipment. However, the number of vehicles to be used and the frequency of testing activities is expected to be negligible compared to the area use as a whole (e.g., the number of privately owned vehicles accessing NASA JPL and the surrounding residential and commercial areas adjacent to the facility and HWP). Additionally, emissions resulting from testing activities would be well below *de minimis* threshold levels, as promulgated in 40 CFR 93.153(b). Consequently, combustion emissions associated with on-site and off-site testing activities would result in less than significant impacts to air quality.

3.2.5.2 No Action Alternative

Under implementation of the No Action Alternative, deployment to testing sites, off-road driving activities, and associated fugitive dust or vehicular emissions would be considered on a case-by-case basis. Implementation of the No Action Alternative would result in no change to the existing approval process. However, under the No Action Alternative, if approval for testing operations in the Arroyo Seco cannot be obtained, NASA JPL would be required to pursue more remote outdoor testing areas located at a much greater distance from the facility, which would also require asset transport and an associated increase in vehicle emissions.

3.3 NOISE

3.3.1 Definition of Resource

Noise is generally defined as unwanted sound. Noise can be any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise annoying. Human responses to noise vary depending on the type and characteristics of the noise, distance between the noise source and receptor, receptor sensitivity, and time of day.

Determination of noise levels are based on: 1) sound pressure level generated (decibels [dB] scale); 2) distance of listener from source of noise; 3) attenuating and propagating effects of the medium between the source and the listener; and 4) period of exposure.

An A-weighted dB sound level (dBA) is one measurement of noise. The human ear can perceive sound over a range of frequencies, which varies for individuals. In using the A-weighted scale for measurement, only the frequencies heard by most listeners are considered. This gives a more accurate representation of the perception of noise. The noise measure in a residential area, similar to conditions within the project area, is estimated at approximately 70 dBA. Normal conversational speech at a distance of five to ten feet is approximately 70 dBA. The decibel scale is logarithmic, so, for example, sound at 90 dBA would be perceived to be twice as loud as sound at 80 dBA.

Passenger vehicles, motorcycles, and trucks use the roads in the vicinity of the project area. Noise levels generated by vehicles vary based on a number of factors including vehicle type, speed, and level of maintenance. Intensity of noise is attenuated with distance. Some estimates of noise levels from vehicles are listed in Table 3-3.

Table 3-3. Typical Noise Sources

Source	Distance (feet)	Noise Level (dBA)
Automobile, 40 mph	50	72
Automobile Horn	10	95
Light Automobile Traffic	100	50
Truck, 40 mph	50	84
Heavy Truck or Motorcycle	25	90

Note: mph – miles per hour.

3.3.2 Existing Conditions

A survey of ambient noise conditions at NASA JPL was conducted in 2007. Noise sources at NASA JPL include vehicle traffic, cooling towers, pumping stations, compressors, backup generators, building ventilation systems, maintenance and construction equipment. Sound level meters were set up around the perimeter of the NASA JPL facility in order to estimate NASA JPL's contribution to noise within the surrounding affected acoustic environment (NASA 2012a).

Generally, the highest noise levels measured around the perimeter of the NASA JPL facility were on the east side of the property, while the lowest noise levels occurred at the northern portion of the property. According to the results of the

noise level measurements, it was determined that while the NASA JPL facility generates noise from the sources identified above, it is not creating significant noise emissions to the surrounding residential and recreational areas at or above normal land use compatibility standards for office-type and residential land uses, as identified in the noise elements of the La Cañada Flintridge and Pasadena General Plans (NASA 2012a).

Noise within the HWP and Upper Arroyo Seco is characteristic of natural open space and recreation areas. Primary ambient noise in the vicinity of the HWP is generated by traffic volumes along the surrounding road network which serves NASA JPL to the west as well as the residential areas to the east of the HWP. Noise monitoring conducted in 2001 as part of the Arroyo Seco Master Plans Environmental Impact Report (City of Pasadena 2002) indicate that noise levels range from 59 to 63 Community Noise Equivalent Level (CNEL).[5]

3.3.3 Approach to Analysis

Noise impact analyses typically evaluate potential changes to existing noise environments that would result from the implementation of a proposed action. These potential changes may be beneficial if they reduce the number of sensitive receptors exposed to unacceptable noise levels. Conversely, impacts may be significant if they result in an introduction to unacceptable noise levels or increased exposure to unacceptable noise levels. Noise associated with an action is compared with existing noise conditions to determine the magnitude of potential impacts.

3.3.4 Environmental Impacts

3.3.4.1 Alternative A

Under Alternative A there would be minor, short-term noise generated from on-site and off-site testing activities, including the use of wheeled equipment. Additionally, the use of small Unmanned Aerial System (sUASs) would also

[5] Community Noise Equivalent Level (CNEL) is a weighted average of noise level over time. It is used to compare the noisiness of neighborhoods.

result in minor noise generation within the heavily wooded areas of the HWP and north of the NASA JPL Bridge.

Sensitive receptors within close proximity the proposed testing areas include the NASA JPL facility, Flintridge Riding Club, HWP, and surrounding residential areas. However, noise generated from mobile equipment testing would be consistent with background noise existing in the general vicinity, which is dominated by vehicle traffic. Much of the noise would be dampened by surrounding vegetation and testing activities would be conducted in limited durations such that they would not measurably affect the ambient noise environment. Impacts from operation of these vehicles would not affect the surrounding residential and recreational areas at or above normal land use compatibility standards for office-type and residential land uses, as identified in the noise elements of the La Cañada Flintridge (City of La Cañada Flintridge 2013) and Pasadena General Plans (City of Pasadena 2015).

Alternative A would not be anticipated to result any in significant short-term or long-term noise impacts to the existing noise environment.

3.3.4.2 No Action Alternative

Under the No Action Alternative there would be no change to the approval process for testing activities on-site within NASA JPL and off-site within the HWP and Upper Arroyo Seco. No activities leading to the substantial generation of noise or the exposure of sensitive receptors to noise levels above applicable thresholds would be anticipated. However, under the No Action Alternative, if approval for testing operations in the Arroyo Seco cannot be obtained, NASA JPL may be required to pursue more remote outdoor testing areas located at a much greater distance from the facility, which could result in minor potential off-site noise impacts, particularly if sensitive receptors are present within the vicinity.

3.4 GEOLOGICAL RESOURCES

3.4.1 Definition of Resources

Geological resources typically consist of surface and subsurface materials and their inherent properties. Principal geologic factors affecting the ability to support structural development are soil stability, topography, and seismic properties (i.e., potential for subsurface shifting, faulting, or crustal disturbance).

The term soil, in general, refers to unconsolidated materials overlying bedrock or other parent material. Soils play a critical role in both the natural and human environment. Soil structure, elasticity, strength, shrink-swell potential, and erodibility all determine the ability for the ground to support man-made structures and facilities. Soils typically are described in terms of their complex type, slope, physical characteristics, and relative compatibility or constraining properties with regard to particular construction activities and types of land use.

Topography is the change in elevation over the surface of a land area. An area's topography is influenced by many factors, including human activity, underlying geologic material, seismic activity, climatic conditions, and erosion. A discussion of topography typically encompasses a description of surface elevations, slope, and distinct physiographic features (e.g., mountains), and their influence on human activities.

Natural hazards prone to the area include earthquakes and tsunamis. Earthquakes typically result from release of energy from the earth's crust and manifest themselves by shaking and sometimes displacement of the ground which can result in property damage. When the epicenter of a large earthquake is located offshore, the seabed may be displaced sufficiently to cause a tsunami. A tsunami is a series of water waves caused by the displacement of a large volume of a body of water. Great wave heights can be generated by large events; although the impact of tsunamis is limited to coastal areas, their destructive power can be enormous.

3.4.2 Regulatory Setting

The California Geological Survey (CGS) has delineated special study zones along known active and potentially active faults in California pursuant to the Alquist-Priolo Earthquake Fault Zones (APEFZ) Act of 1972. The state designates the authority to local government to regulate development within APEFZ. Construction of habitable structures is not permitted over potential rupture zones.

The CGS has also identified Seismic Hazard Zones that are delineated in accordance with the Seismic Hazard Mapping Program (SHMP) of the Seismic Hazards Act of 1990. The Act is "to provide for a statewide seismic hazard mapping and technical advisory program to assist cities and counties in fulfilling their responsibilities for protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure and other seismic hazards caused by earthquakes."

The CGS identifies several earth resource issues that should be taken into consideration in evaluating whether proposed projects are likely to be subject to geologic hazards, particularly related to earthquake damage. These considerations include the potential for existing conditions to pose a risk to the project, and the potential for the project to result in an impact on the existing conditions for geology or soils. The State of California (Uniform) Building Code sets standards for investigation and mitigation of facility conditions related to fault movement, liquefaction, landslides, differential compactions/seismic settlement, ground rupture, ground shaking, tsunami, seiche, and seismically induced flooding. Mitigation of geological (including earthquake) and soil (geotechnical) issues must be undertaken in compliance with the California Building Code.

3.4.3 Existing Conditions

3.4.3.1 Geology

The NASA JPL facility as well as the HWP and Upper Arroyo Seco are situated on an alluvial plain south of the San Gabriel Mountains. These mountains are of

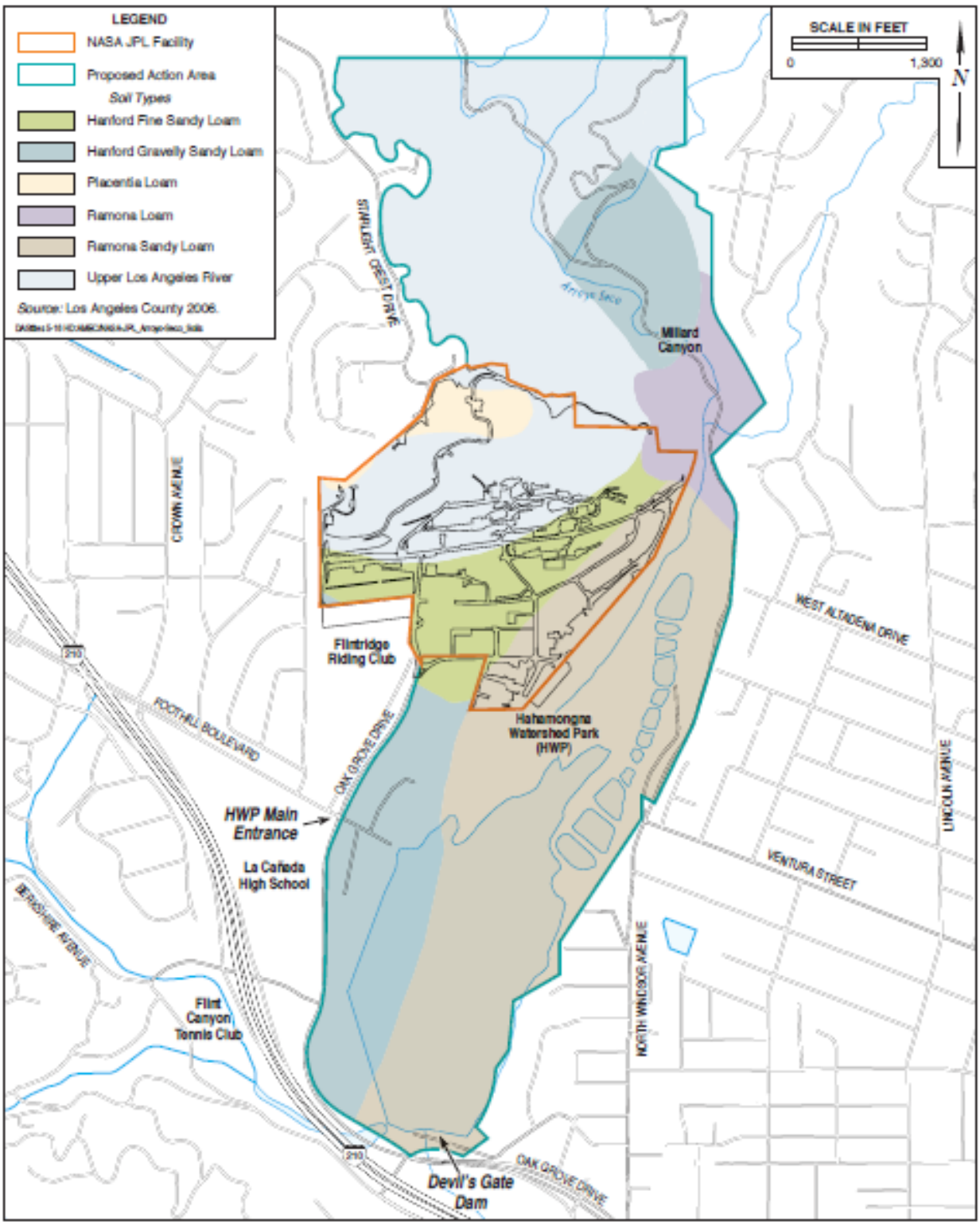
the Quaternary Pacoima Formation, composed of conglomeratic arkosic sandstones of stream channel and fanglomeratic origin (NASA 2012a).

The Arroyo Seco, located southeast and adjacent to the NASA JPL facility, is characterized as an incised channel with alluvial deposits from years of sediment accumulation behind Devil's Gate Dam. Older alluvial fans (terrace deposits) consist of consolidated cemented sand, silt, and gravelly sand. Alluvium overlying the bedrock in the channel consists of a gravel-coarse sand mixture with minor silt and finer sand, which in turn is overlain by artificial (i.e., man-made) fill consisting of similar materials (U.S. Army Corps of Engineers [ACOE] 2011).

3.4.3.2 Soils

Soils at the NASA JPL facility consist primarily of 20 to 30 inches of a fine sandy loam layer (Hanford Series; see Figure 3-1). Soils are mapped as Balder family-Xerorthents complex, 5 to 60 percent slopes. The Balder family soils are well drained gravelly sandy loam derived from residuum weathered from granodiorite. Xerorthents soils are somewhat excessively drained gravelly sandy loam derived from residuum weathered from granodiorite and/or residuum weathered from metamorphic rock. These soils are underlain by a granitic rock basement. This crystalline basement is composed of rocks ranging from Precambrian to Tertiary, and includes various types of diorites, granites, monzonites, and granodorites with a history of intrusion and metamorphism (NASA 2012a).

Within the Arroyo Seco, the near surface soils consist primarily of Ramona Series soils, including Ramona Sandy Loam. These soils reflect the underlying parent material and include a near surface fine to coarse sandy loam, underlain by sands and silty to clayey sands with gravel and cobbles. These soil types have moderate to high foundation-bearing capacity and low to moderate expansion potential. Corrosion potential of these soils range from slight to moderate (NASA 2015d).



EA

Soil Types on the NASA JPL Facility and Proposed Action Area

FIGURE 3-1

No warranty is made by NASA as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document," in that it is intended to change as new data become available and are incorporated into the GIS database.

3.4.3.3 Topography

Periodic tectonic uplift of the mountains has occurred during the past 1 to 2 million years producing the present area topography. Most of this uplift occurred along north to northeast dipping reverse and thrust faults located along the southwestern edges of the mountains (NASA 2012a). The NASA JPL facility is located near the southwestern base of the San Gabriel Mountains. The northern portion of the facility is mountainous and steep and topped by a narrow ridge. The remainder of the facility slopes moderately and has been graded extensively throughout its development. The NASA JPL facility terrain varies in elevation from 458 feet to 1,075 feet above mean sea level.

The Arroyo Seco has incised through the alluvium on the southeast side of NASA JPL. However, within the Arroyo Seco, sediment deposition raised the ground surface in the reservoir area to its current elevation, sloping from approximately 1,100 feet (335 meters) at the NASA JPL Bridge to a downstream elevation of approximately 986 feet (300 meters) at the dam face (City of Pasadena 2003).

3.4.3.4 Seismicity

NASA JPL and the surrounding vicinity including the Arroyo Seco is located in a seismically active area as is most of Southern California. Active faults in the vicinity of the NASA JPL facility and the Arroyo Seco include the San Andreas fault located approximately 24 miles to the northeast, the Newport-Inglewood fault zone located approximately 17.5 miles to the southwest, the Whittier-Elsinore fault located approximately 17 miles to the south/southeast, and the Raymond fault located approximately 3.5 miles to the south. The active Sierra Madre fault zone trends east-west along the base of the San Gabriel Mountains, crossing through the NASA JPL facility. The Sierra Madre fault zone includes multiple segments of reverse thrust faults that dip steeply to the north. It is considered to be more active along the western end of the fault zone with decreasing activity in the central and eastern portions. The NASA JPL facility and the Arroyo Seco are located within the central portion of the Sierra Madre fault zone. This segment represents the easternmost part of this fault zone. The fault zone is considered active and capable of producing moderate to large

earthquakes and ground rupture. Historic earthquakes along related fault zones include the 1971 San Fernando Earthquake and the 1991 Sierra Madre Earthquake. Current U.S. Geological Survey (USGS) data indicate that the Sierra Madre fault zone is capable of producing a magnitude 7.0 earthquake. Although recent geologic studies of the Sierra Madre fault system near the NASA JPL facility indicate Holocene fault movement, the Sierra Madre fault zone on site is not currently zoned as an APEFZ by the CGS.

The Sierra Madre Fault Zone crosses the Arroyo Seco at the NASA JPL Bridge. As a result, portions of the NASA JPL facility near the Arroyo Seco may be subject to seismically induced liquefaction. Soil liquefaction may occur where loose sandy soils and shallow groundwater exist, and can result in soil settlement and lateral earth spreading (NASA 2015d). Younger alluvium within the area where groundwater historically has been less than 40 feet from the surface are included as a liquefaction zone. These factors must be evaluated on a site-specific basis to assess the potential for ground failure at any given project site (ACOE 2011). Seismically induced landslides in the steep granitic rock terrain within the northern portions of the NASA JPL facility would likely be comprised of shallow rock falls or debris slides, where loose material is present on steep slopes (NASA 2015d).

3.4.4 Approach to Analysis

Determination of the significance of potential impacts to geological and soil resources is based on 1) the importance of the resource (i.e., commercial, ecological, and/or scientific); 2) the proportion of the resource that would be affected relative to its occurrence in the region; and 3) the susceptibility for deleterious effects on the resource due to a proposed action. Impacts to geological and soil resources are significant if the physical structure, chemical composition, or visual aesthetic character are adversely affected over a relatively large area.

3.4.5 Environmental Impacts

3.4.5.1 Alternative A

Under this alternative on-site testing activities within the NASA JPL facility would have a limited potential to impact topography or otherwise affect geological resources on-site. All activities would be conducted indoors, on paved surfaces, or with designated outdoor testing areas (e.g., Mars Yard and Robotics Arena). Off-site testing activities in the Arroyo Seco, including the operation of wheeled vehicles and other stationary equipment, could result in the potential for negligible, localized erosion and compaction of soils within the HWP and Upper Arroyo Seco. As described in Section 3.4.3, *Existing Conditions* the HWP and Upper Arroyo is comprised of existing paved and unpaved roads, vegetated open spaces, and/or rocky and gravelly soils. However, due to the relatively low number of testing operations, the potential for impacts associated with operation of wheeled vehicles or other equipment is low. Testing operations would not require grading and the large majority of testing operations would not require vegetation removal or other activities that could mobilize sediments. Previously permitted and approved testing activities in the Arroyo Seco have not resulted in measurable impacts on geological resources. Consequently, this alternative would have less than significant short-term and/or long-term related impacts on affected soils, geologic resources, and topography within the project area.

3.4.5.2 No Action Alternative

Under the No Action Alternative there would be no change in the approval process for on-site and off-site testing activities. Similar to previously permitted and approved activities, there would be no substantial disturbance to geology, soils, or topography as a result of testing activities, including activities within the HWP and Upper Arroyo Seco. However, under the No Action Alternative, if approval for testing operations in the Arroyo Seco cannot be obtained, NASA JPL may be required to pursue more remote outdoor testing areas located at a much greater distance from the facility, which could result in potential minor impacts to off-site geological resources.

3.5 WATER RESOURCES

3.5.1 Definition of Resources

Water resources analyzed in this study encompass surface water, groundwater, floodplains, and wetlands. Surface water resources include lakes, rivers, and streams and are important for a variety of reasons including ecological, economic, recreational, aesthetic, and human health. Groundwater comprises subsurface water resources and is an essential resource in many areas as it is used for potable water, agricultural irrigation, and industrial applications. Floodplains are belts of low, level ground present on one or both sides of a stream channel and are subject to either periodic or infrequent inundation by floodwater.

The CWA defines wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (40 CFR 230.3[t]).

3.5.2 Existing Conditions

3.5.2.1 Surface Water and Drainage

Surface water from the hillsides above the NASA JPL facility is transmitted via an underground storm drain system located throughout the developed regions of the site. The storm drain outlets flow into the Arroyo Seco within the HWP located directly east of the facility border. The Arroyo Seco is a 22-mile long tributary of the Los Angeles River draining an area of 47 square miles. The Arroyo Seco begins in the San Gabriel Mountains within the Angeles National Forest (ANF) and proceeds through Pasadena, South Pasadena, and northeast Los Angeles to join the Los Angeles River. The upper watershed is in the front range of the San Gabriel Mountains, also referred to as the Sierra Madre Mountains, immediately north of Pasadena, northwest of Altadena and northeast of La Cañada Flintridge. Thirty-two square miles (i.e., 67 percent) of the watershed is steep, erosion-prone terrain that drains directly into the HWP located behind Devil's Gate Dam (ACOE 2011). Natural flow in the Arroyo Seco

is dependent on rainfall and is dry during periods of little or no rainfall. The average monthly discharge for the Arroyo Seco upstream of the NASA JPL facility is approximately 10 cubic feet per second (USGS 2010), with storm drains from local municipalities comprising the majority of direct drainage to the Arroyo Seco. The City of Pasadena Department of Parks and Recreation initiated a multi-use project in the Arroyo Seco, known as the *Hahamongna Watershed Park Master Plan* in September 2003 (City of Pasadena 2003). The project was designed to enhance water resources, improve flood control, restore native habitat, and improve recreation and infrastructure for use by the local community.

Discharges to the Arroyo Seco from the NASA JPL facility are permitted by a U.S. National Pollution Discharge Elimination System (NPDES) Storm Water General Permit. The permit requires NASA JPL to develop and maintain a Stormwater Pollution Prevention Plan (SWPPP) to prevent storm water pollution. The site SWPPP identifies best management practices (BMPs) for industrial activities that are exposed to precipitation. NASA JPL also holds a Stormwater Discharge Permit for the discharge of groundwater from an artesian well behind Building 150. Construction Stormwater Permits are required for onsite construction activities (NASA 2012a). On-site drainage from the NASA JPL facility is north to south. Runoff in the steep northern areas of the site is intercepted with debris basins to control the velocity of runoff and to capture debris from the mountains. Surface runoff from the northern areas is transmitted by an underground storm drain system, located throughout the developed lower portion of NASA JPL to one of nine outlet points in the Arroyo Seco.

3.5.2.2 Groundwater

The NASA JPL facility is situated over part of the Monk Hill Basin, which is an unconfined groundwater aquifer. The Pasadena Subarea, the Santa Anita Subarea, and the Monk Hill Basin make up the unconfined aquifer called the Raymond Basin. The Raymond Basin is bounded to the north by the San Gabriel Mountains, to the south and east by the San Gabriel Valley, and the west by the San Rafael Hills. The Basin provides part of the potable water supply for Pasadena, La Cañada Flintridge, San Marino, Sierra Madre, Altadena, Alhambra, and Arcadia.

The greater Raymond Basin is replenished by both natural rainfall and artificial recharge from several spreading basins on the eastern side of the Arroyo Seco, within the HWP. These spreading basins are operated by the City of Pasadena. The alluvial aquifer below the Arroyo Seco is predominantly characterized by relatively coarse sediment, which makes the Arroyo extremely permeable.

Surface water percolates into the groundwater fairly quickly, and groundwater flow rates are relatively high. The City of Pasadena obtains approximately 40 to 50 percent of its municipal water supply from groundwater wells. The groundwater table below the facility is located at approximately 200 feet below ground surface (bgs). The groundwater table and groundwater flow patterns are significantly influenced by Pasadena production wells located to the southeast of the facility. Groundwater moves from the northwest to the southeast towards the NASA JPL facility, then towards these water supply wells. The groundwater contains various chemicals, including some historically used at the NASA JPL facility. In 1992, NASA JPL was placed on the National Priority List (NPL) of sites subject to regulation under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). All CERCLA documentation associated with NASA JPL can be found in the Information Repository section of the NASA CERCLA website. As part of the CERCLA cleanup, NASA divided the facility into three separate areas referred to as Operating Units (OUs). Of these three OUs, two are on-facility groundwater and off-facility groundwater, which are described further in the Master Plan Updates PEA. The local water purveyors constantly monitor the water served to the public and take the necessary actions, including blending and treatment, to assure this water meets all applicable drinking water quality standards (NASA 2012a).

3.5.2.3 Floodplains

NASA JPL Facility and Surrounding Areas

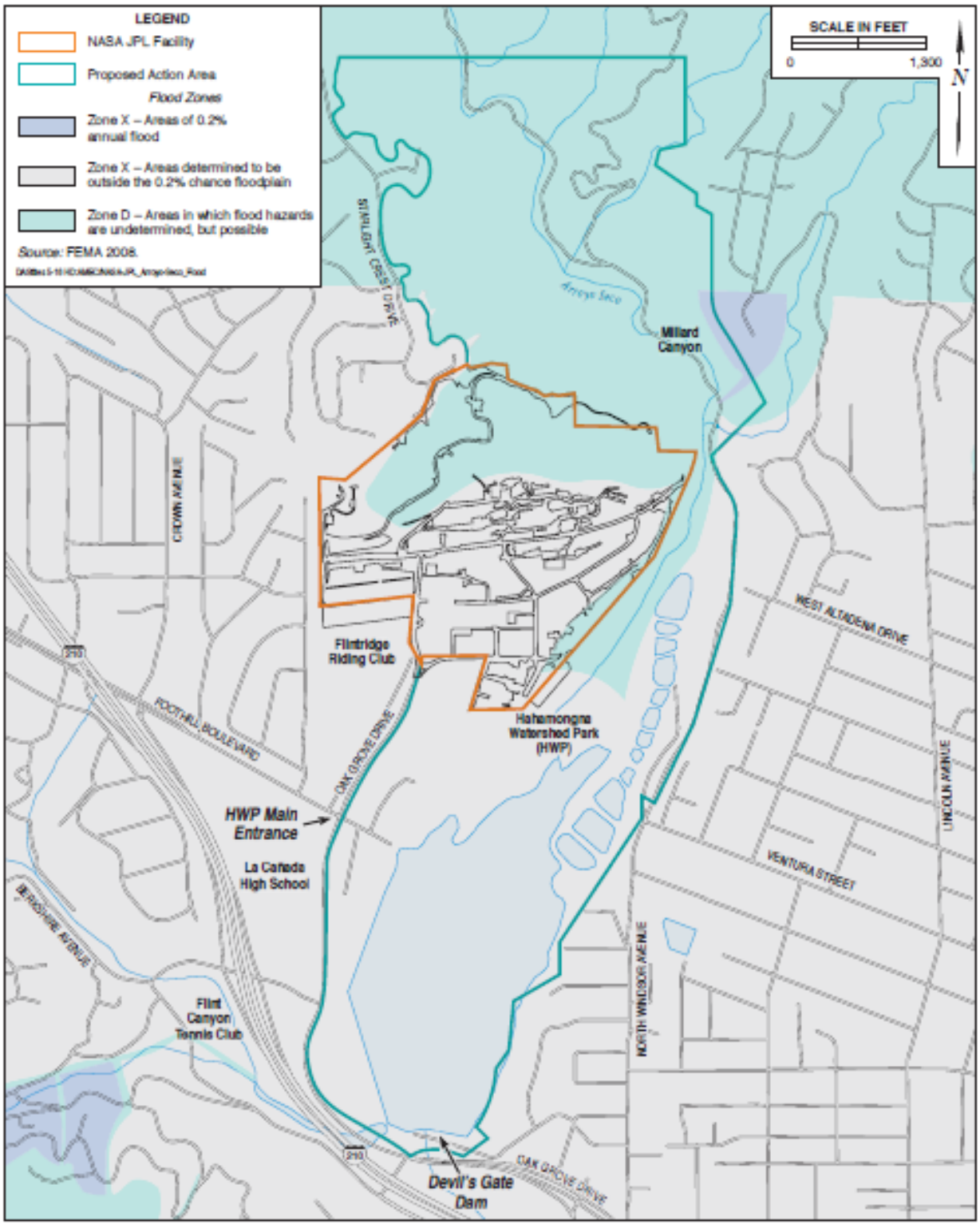
The NASA JPL facility is included in the U.S. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Number 06037C1375F dated September 26, 2008. According to the map, the majority of the NASA JPL facility is located within Flood Zone X; defined as "areas determined to be outside the 0.002 percent, or 500-year annual chance floodplain" (FEMA 2008). A portion of

the steep northern section of the facility is located within Flood Zone D; "areas in which flood hazards are undetermined, but possible" (FEMA 2008). Although the FIRM Number 06037C1375F does not measure the 100 year flood boundaries, it has been determined that portions of the west Arroyo parking lot would become inundated with a 100-year flood event as surface water elevations would reach 1,075 feet (328 meters) above mean sea level (NASA 2015d). The residential areas to the west and southwest are within Zone X (see Figure 3-2).

Hahamongna Watershed Park

As a result of the historic flooding in the early 1900s, the Los Angeles Department of Public Works (LACDPW) was formed with a mandate to provide flood protection. The LACDPW initiated construction of multiple dams in the San Gabriel Mountains with the Devil's Gate Dam being the first. The dam was completed in 1920 with the dual purposes of providing flood risk management and water recharge to the Raymond Basin aquifer. However, due to years of sedimentation following dam construction, the dam no longer has sufficient storage capacity to significantly affect the magnitude of peak flood flows and the outlet gates and tunnels are now operated to maximize sediment pass-through the dam and minimize sediment accumulation in the dam basin (NASA 2015d). As a result, future flood capacity within the HWP is contingent on sediment deposition, transport and pass through within the HWP and Devil's Gate Dam.

According to the FIRM Number 06037C1375F, these areas directly east and south of the NASA JPL facility, within the HWP are located within both Zone X and D.



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Flood Zones in the Vicinity of NASA JPL Facility and Proposed Action Area

FIGURE 3-2

No warranty is made by NASA as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document," in that it is intended to change as new data become available and are incorporated into the GIS database.

3.5.2.4 Wetlands

The HWP, located directly east of the NASA JPL facility, includes an intermittent riverine streambed and seasonally flooded wetlands dominated by shrubs and emergents that have been modified by a man-made barrier or dam that influences water flow. According to the U.S. Fish and Wildlife Service (USFWS) Natural Wetlands Inventory (NWI), based on the analysis of aerial imagery, a total of 102.19 acres of wetlands were located within the HWP. Of these wetlands, the Natural Wetlands Inventory classifies 7.13 acres as Riverine wetlands, 44.35 acres as Freshwater Forested/Scrub wetlands, 33.73 acres as Freshwater Emergent wetlands and 16.98 acres as Freshwater Ponds. It is noted that the 13.54 acres of the Freshwater Ponds are otherwise known as the spreading grounds located on the eastern portion of the HWP, which are used for groundwater recharge. No other classified wetlands are located within the vicinity of the NASA JPL facility (USFWS 2016a).

3.5.3 Approach to Analysis

Significant impacts to water resources would occur if Federal or state water quality regulations or standards for surface water or groundwater are violated, if existing water resources are directly or indirectly impacted from water extraction activities due to increased demand, if activities were located in a regulatory floodplain without an appropriate flood study, if activities fail to adequately address upstream drainage as it is conveyed through the project area, or if activities change historic drainage flows and/or patterns, potentially impacting downstream areas (NASA 2012a).

3.5.4 Environmental Impacts

3.5.4.1 Alternative A

As described in Section 3.4, *Geological Resources*, under this alternative there would be a minor increase in the potential for sedimentation due to soils disturbed during maneuvering associated with testing activities in the HWP and Upper Arroyo Seco. However, the frequency, duration, and footprint of testing would be limited, and would not require grading or, for the large majority of testing, vegetation removal. Consequently, as with other previously permitted

and approved testing activities, impacts to surface water would be negligible. Additionally, some vehicles and other equipment proposed for testing are designed for interplanetary/extraterrestrial use. As such, they have been designed with state-of-the-art containment, conservation, sustainability, and sealant systems which are intended to contain any fuel used and waste generated within the vehicle system. Fueling and maintenance would occur in previously designated/approved/permitted facilities within NASA JPL. Consequently, there would be limited potential for impacts to surface water quality as a result of unintentional spills hydrology and/or water quality from sediment and stormwater runoff to the Arroyo Seco watershed and the surrounding environment.

There would be no anticipated impacts to groundwater. Given the estimated depth to groundwater of approximately 200 feet bgs, and the shallow depth of planned surface grading, it would be unlikely that groundwater would be encountered (NASA 2012a).

Testing activities under this alternative would occur within a floodplain; however, no construction, permanent development or paving, or any other topographical changes that would affect flow within existing floodplains are proposed under this alternative. Existing surface water flow patterns would not be substantially altered. Therefore, there would be no anticipated adverse impacts to water resources, including water quality, groundwater, and floodplains.

3.5.4.2 No Action Alternative

Under the No Action Alternative there would be no change in the approval process for on-site and off-site testing activities. Under the No Action Alternative there would be no change to existing surface water, groundwater, or floodplain function. However, under the No Action Alternative, if approval for testing operations in the Arroyo Seco cannot be obtained, NASA JPL may be required to pursue more remote outdoor testing areas located at a much greater distance from the facility, which could result in potential off-site impacts to surface water features if present.

3.6 BIOLOGICAL RESOURCES

3.6.1 Definition of Resource

Biological resources include native or naturalized plants and animals and the habitats in which they occur. Sensitive biological resources are defined as those plants and animal species listed as threatened or endangered, or proposed as such, by USFWS, the National Marine Fisheries Service (NMFS), and the California Department of Fish and Wildlife (CDFW).

3.6.2 Regulatory Setting

The Endangered Species Act (ESA) was created in order to protect and recover imperiled species and the ecosystems upon which they depend. The ESA grants USFWS primary responsibility for terrestrial and freshwater organisms and NMFS primary responsibility for marine wildlife.

The California Endangered Species Act (CESA) was created to parallel the ESA and allows the CDFW to designate species, including plants as threatened or endangered. Further, the CESA makes it illegal to import, export, take, possess, purchase, sell, or attempt to do any of those actions to species that are designated as threatened, endangered, or candidates for listing, unless permitted by CDFW (CDFW 2014).

The Migratory Bird Treaty Act (MBTA) makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. In addition, this act serves to protect environmental conditions for migratory birds from pollution or other ecosystem degradations.

3.6.3 Existing Conditions

3.6.3.1 NASA JPL Facility

NASA JPL is an industrial facility that is characterized by paved surfaces. Natural vegetation is very limited and primarily consists of native trees in close proximity to existing buildings. Native chaparral and coastal scrub communities are limited to the hillsides and canyons in the northern region of the facility.

Previous biological surveys of the NASA JPL facility did not find evidence of species listed as threatened or endangered by either the State of California or Federal government. No special-status plants were detected during surveys of

the facility. No critical habitat has been identified on the site. Historically, portions of the site were designated as critical habitat for the Southwestern Arroyo Toad; that designation was repealed by the USFWS in late 2002 (NASA 2012b).

3.6.3.2 Hahamongna Watershed Park

Vegetation

The vegetation of the adjacent HWP area is dominated by a mixture of California terrestrial natural plant communities or vegetation series that have been subject to varying levels of disturbance from sand and gravel mining, water conservation, flood control, and recreation activities. Throughout the majority of the HWP, riparian scrub habitats and weedy non-native grasslands dominate the floor of the central portion of the drainage. Oak woodland and other types of scrub habitats occupy variable areas along the perimeter and/or banks of the drainage. Landscaped areas are populated with introduced, ornamental shrubs and trees and exotic, ruderal (associated with disturbed ground) weedy species of grasses and forbs (NASA 2012a).

Within the HWP, the wide alluvial plain upstream of Devil's Gate Dam is very dynamic and its topographical features can change significantly during high flow events. Therefore, much of the vegetation in the active floodplain is young, although some mature riparian vegetation, aquatic emergent habitat along the active stream channel, and seasonal wetland habitat have been identified (ACOE 2011).

Five native vegetation communities are found in the HWP and include coast live oak forest and woodland, southern willow scrub, coastal scrub, Riversidean alluvial fan sage scrub, mulefat scrub, and southern sycamore-alder riverine woodland (ACOE 2011).

Wildlife

The mixed habitats found in the Arroyo Seco watershed represent a remnant of the rich biotic community that was once dominant within the Los Angeles basin. However, despite the disturbed nature of the landscape and limited connectivity throughout the watershed, many wildlife species can still be found in the area. Because the least amount of urbanization is present above Devil's Gate Dam in

the HWP, it hosts the most natural assemblage of wildlife habitat in the watershed (ACOE 2011).

Mammals common throughout the watershed include coyote (*Canis latrans*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), California ground squirrel (*Spermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), and Audubon cottontail (*Sylvilagus audubonii*). Non-native species such as feral cats and dogs are also common. Evidence observed in the HWP suggests that dusky-footed woodrat (*Neotoma fuscipes*), gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), mule deer (*Odocoileus hemionus californicus*), cougar (*Puma concolor*) and bobcat (*Lynx rufus*) utilize the upper watershed. Bat species are also present, using many habitats in the watershed for roosting, breeding, or foraging (ACOE 2011).

Over 180 native bird species have been documented in the Arroyo Seco watershed for breeding, wintering, or are residents (ACOE 2011). Typical species observed in native habitats include western scrub jay (*Aphelocoma californica*), California towhee (*Pipilo crissalis*), spotted towhee (*P. maculatus*), wren-tit (*Chamaea fasciata*), red-tailed hawk (*Buteo jamaicensis*), oak titmouse (*Baeolophus inornatus*), acorn woodpecker (*Melanerpes formicivorus*), band-tailed pigeon (*Patagioenas fasciata*), Bewick's wren (*Thryomanes bewickii*), and others (NASA 2015d).

Threatened and Endangered Species

Initial review of the USFWS Information, Planning, and Conservation System as well as the California Natural Diversity Database to document observance or potential of occurrence for special-status wildlife species within the Proposed Action area. Federally and state endangered and threatened species are listed below and in Table 3-4.

Federally Listed. Six federally endangered species and one federally threatened species have the potential to occur within the HWP. They include two flowering plant species, two amphibians and three bird species; the endangered species are: Nevin's barberry (*Berberis nevinii*), Braunton's Milk-vetch (*Astragalus brauntonii*), arroyo toad (*Anaxyrus californicus*), red-legged frog (*Rana daytronii*), California condor (*Gymnogyps californicus*), and least Bell's vireo (*Vireo bellii pusillus*). The coastal California gnatcatcher (*Polioptila californica californica)* is federally threatened. There are no federally designated critical habitats listed in the Proposed Action area for these respective species (USFWS 2016b).

Table 3-4. Federal and State Special Status Species with Potential to Occur in the Proposed Action area

Common Name	Scientific Name	Federal Status	State Status
Amphibians			
Red-legged Frog	*Rana daytronii*	E	E
Arroyo Toad	*Anaxyrus californicus*	E	E
Birds			
California Condor	*Gymnogyps californicus*	E	E
Coastal California Gnatcatcher	*Polioptila californica californica*	T	-
Least Bell's Vireo	*Vireo bellii pusillus*	E	E
Plants			
Nevin's barberry	*Berberis nevinii*	E	E
Braunton's Milk-vetch	*Astragalus brauntonii*	E	E

Notes:
E= Endangered
T = Threatened
Sources: ACOE 2011; USFWS 2016b; CDFW 2016

3.6.4 Approach to Analysis

Determination of the significance of potential impacts to biological resources is based on 1) the importance (i.e., legal, commercial, recreation, ecological, or scientific) of the resource; 2) the proportion of the resource that would be affected relative to its occurrence in the region; 3) the sensitivity of the resource to proposed activities; and 4) the duration of ecological ramifications.

Impacts to biological resources are significant if species or habitats of concern are adversely affected over relatively large areas, or if disturbances cause reductions in population size or distribution. Potential physical impacts such as habitat loss, noise, and impacts to water quality were evaluated to assess potential impacts to biological resources resulting from the proposed alternatives.

3.6.5 Environmental Impacts

3.6.5.1 Alternative A

Migratory birds may traverse, forage, and/or nest within NASA JPL; however, no federally or state listed threatened or endangered species, or federally designated critical habitat for any threatened or endangered species, is known to occur within the facility. Six federally and/or state listed species have the potential to occur within the HWP and Upper Arroyo Seco. However, noise generated from operation of testing equipment, including sUASs in the wooded areas to the north of the NASA JPL Bridge is expected to be consistent with background noise levels in the vicinity and therefore not expected to disturb species that may occur within the project area. Operation of testing equipment including wheeled vehicles and camera or radar setups would not require vegetation removal; however, operation of wheeled equipment has a limited potential to crush existing vegetation and compact soils. However, vegetation crushed by vehicle operation is expected to be minimal and would be expected to regrow. Testing activities would occur in heavily trafficked or otherwise disturbed areas of the HWP and Upper Arroyo Seco and therefore would not be expected to impact federally and/or state listed plant species, or potential habitat for these species. There is a small risk of transporting weeds from use of travel routes and open areas within the project area. However, vehicles would be cleaned before and after all testing activities, which would limit the potential for invasive species transport. Additionally, increased use of the existing roadway network (e.g., for transport of testing equipment) and use within open areas has the potential to result in harassment, injury, or mortality to individuals of ground-dwelling species (e.g., snakes, lizards, salamanders, etc.) by crushing them or unearthing them or their nests or eggs during motorized vehicle use activities. The intensity of effects would be variable based on population density and frequency of road and/or off road use.

No irrevocable loss of habitat, ongoing takes, or direct mortality of threatened or endangered species would occur as a result of this alternative. Minimal, if any, temporary loss of vegetation or habitat for species would be anticipated. Therefore, implementation of this alternative would result in less than significant impacts to biological resources.

3.6.5.2 No Action Alternative

Under the No Action Alternative, there would be no change in the approval process for testing activities. Similar to previously permitted and approved testing activities, there would be no measureable disturbance to the existing environment and as a result there would be no impacts to biological resources. However, under the No Action Alternative, if approval for testing operations in the Arroyo Seco cannot be obtained, NASA JPL may be required to pursue more remote outdoor testing areas located at a much greater distance from the facility, which could result in potential off-site indirect impacts to sensitive biological resources (e.g., noise impacts), if present.

3.7 LAND USE

3.7.1 Definition of Resource

Land use is comprised of natural conditions or human-modified activities occurring at a particular location. Human-modified land use categories include residential, commercial, industrial, transportation, communications and utilities, agricultural, institutional, recreational, and other developed use areas.

Management plans and zoning regulations determine the type and extent of land use allowable in specific areas and are often intended to protect specially designated or environmentally sensitive areas.

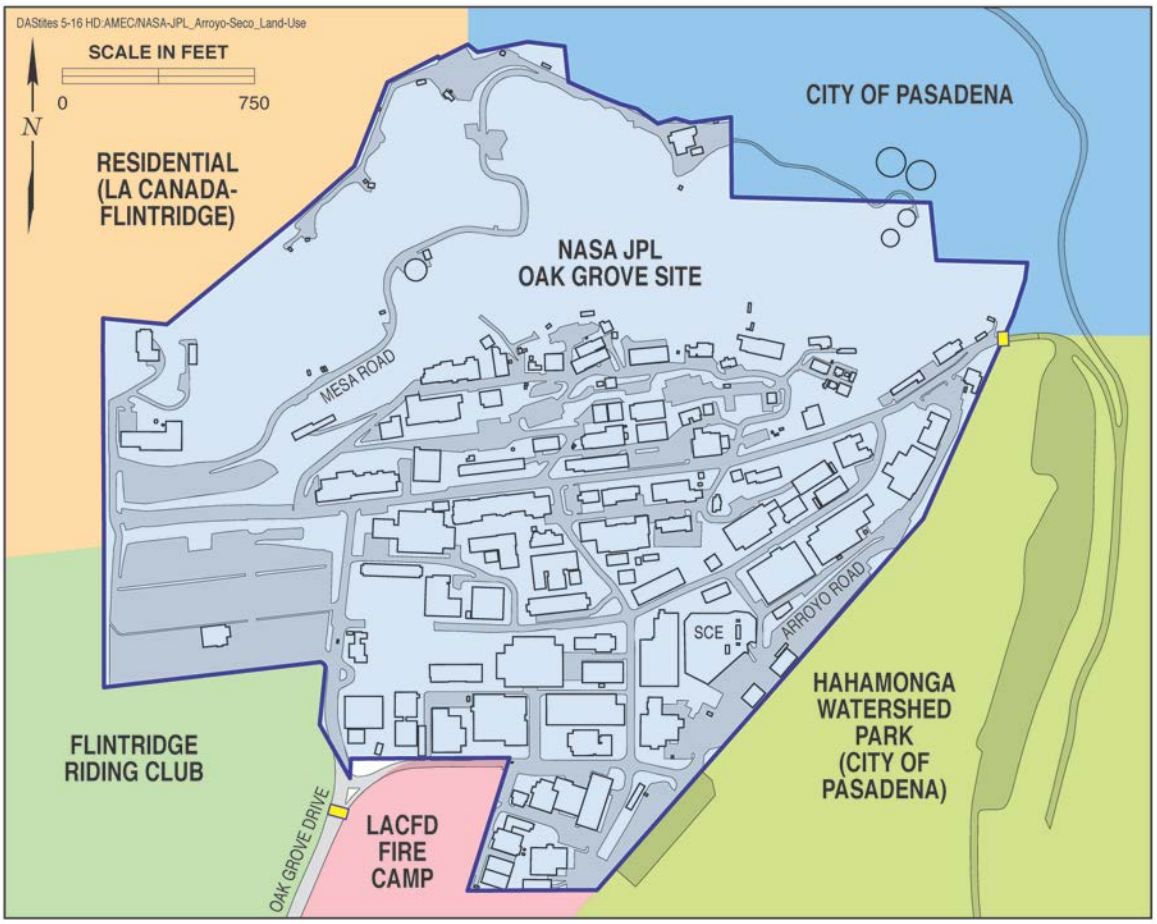
3.7.2 Existing Conditions

The primary land use near NASA JPL is residential along with undeveloped areas of the ANF to the north. The communities of La Cañada Flintridge, Pasadena, and Altadena surrounding NASA JPL to the west, south, and east, respectively, are predominantly low density, single family residences. The ANF is largely undeveloped and improved with hiking/equestrian trails and service roads. No state forests or parks exist in the surrounding area.

Land use within the NASA JPL facility is guided by the NASA JPL Master Plan, which directs facilities modernization and recapitalization planning at the facility through 2032. NASA JPL primarily includes administrative, office, and laboratory (industrial) uses. The facility is comprised of 138 buildings totaling

over 2.7 million gross square feet. The areas surrounding the facility include residential and recreational use, as well as the natural floodplain included in the HWP to the east. The LACFD training camp is located along the southwest boundary of the NASA JPL facility. Figure 3-3 shows land use at the facility, as well as within the surrounding area (NASA 2012a).

Land use planning within the Arroyo Seco is guided by the Arroyo Seco Master Plans, a set of documents defining the community vision for the Arroyo Seco Natural Park (refer to Section 2.2.1.2, *Arroyo Seco and Hahamongna Watershed Park*). Additionally, the Arroyo Seco Design Guidelines (City of Pasadena 2003), which are also included in the four separate Arroyo Seco Master Plans, were developed by the City of Pasadena to protect the natural and cultural integrity of the Arroyo Seco, while acknowledging that it is a regional recreational facility. The HWP, which is included in the HMP, is located adjacent to NASA JPL. This area, which serves as a flood control reservoir, is currently used for groundwater spreading basins and recreational facilities, including a hiking and horseback riding trail network adjacent to NASA JPL. The lower eastern portion of the HWP area is comprised of a sediment plain located upstream of the Devil's Gate Dam. It also contains Johnson Field, which is used for softball games, group picnics, and related activities. The western portion of the HWP area contains HWP (formerly Oak Grove Park). This area is dominated by passive recreation uses, water conservation, and flood control activities. Other specialized land uses included in the HWP include equestrian riding clubs, and a LACFD facility. The entire basin is designated as *Open Space* in the Land Use Element of the City of Pasadena Comprehensive General Plan with the exception of two parcels zoned as *Planned Development Districts* (NASA 2012a).



EA

NASA JPL and Surrounding Land Use

FIGURE 3-3

3.7.3 Approach to Analysis

Significance of potential land use impacts is based on the level of land use sensitivity in areas affected by a proposed action. In general, land use impacts would be significant if they would: 1) be inconsistent or noncompliant with applicable land use plans or policies; 2) preclude the viability of existing land use; 3) preclude continued use or occupation of an area; or 4) be incompatible with adjacent or vicinity land use to the extent that public health or safety is threatened.

3.7.4 Environmental Impacts

3.7.4.1 Alternative A

The implementation of this alternative is compatible and consistent with long-term NASA JPL land use and planning objectives, including the NASA JPL Master Plan. The testing activities under this alternative are essential to accomplishing NASA JPL's scientific and technology demonstration missions. On-site and off-site testing activities under this alternative would be similar to previously permitted and approved activities and would also not conflict with the Arroyo Seco Master Plans, including the HMP, which is described in Section 2.2.1.3, *Arroyo Seco and Hahamongna Watershed Park*. Testing activities, including the use of sUASs, would not result in closure of the HWP or preclude existing uses (e.g., hiking activities). This alternative would not conflict with or be affected by any existing land use designations, plans, or zoning. Consequently, implementation of this alternative would result in no adverse impacts to land use.

3.7.4.2 No Action Alternative

Under the No Action Alternative there would be no change in the approval process for on-site and off-site testing conducted at the NASA JPL facility or within the Arroyo Seco. Consequently, there would be no changes to land use within the affected environment; however, individual permitting and planning process would continue to limit the ability of NASA JPL to implement testing on short-notice or unscheduled conditions. The existing approval processes would restrict NASA JPL's ability to expeditiously conduct outdoor testing and calibration activities and may, in some circumstances, require NASA JPL to pursue other less suitable outdoor testing areas, which could result in the potential for off-site land use conflicts.

3.8 TRAFFIC AND TRANSPORTATION

3.8.1 Definition of Resource

Traffic and transportation refers to the movement of vehicles throughout a road or highway network. Primary roads include principal arterials, such as major interstates, designed to move traffic and not necessarily to provide access to all adjacent areas. Secondary roads include arterials, such as rural routes and major

surface streets, which provide access to residential and commercial areas, hospitals, and schools.

3.8.2 Existing Conditions

3.8.2.1 Existing Roadway Network

Regional Access

Interstate 210 (I-210, Foothill Freeway) is a limited-access east-west freeway, which provides regional access to the NASA JPL facility as well as the HWP and Upper Arroyo Seco from the San Fernando Valley to the northwest and the San Gabriel Valley and Inland Empire to the east. In the vicinity of the NASA JPL facility, I-210 has four mixed-flow travel lanes in each direction. State Route (SR) 134 (Ventura Freeway) is an east-west freeway that connects Pasadena with the southern San Fernando Valley to the west. The Ventura Freeway is located to the south of the NASA JPL facility as well as the HWP and Upper Arroyo Seco. Additional regional access is provided via SR 2 (Glendale Freeway) located west of the NASA JPL facility.

Local Access

The principal arterial road providing access to the main entrance of the NASA JPL facility is Oak Grove Drive along the western limits of the facility. Oak Grove Drive also serves as the main western access for the adjacent HWP. Oak Grove Drive has a total average weekday traffic count of approximately 9,308 vehicles per day (vpd) near the West Gate (Main Gate). It is a four-lane road with no parking and limited pedestrian improvements (e.g., sidewalks). The primary arterial feeders to Oak Grove Drive are Foothill Boulevard, the Foothill Freeway eastbound and westbound ramps, and Berkshire Place (NASA 2012c).

Immediate access to the Upper Arroyo Seco Master Plan area is provided via Foothill Boulevard, Oak Grove Drive, and Windsor Avenue. Foothill Boulevard provides access to and from the Upper Arroyo Seco area at Oak Grove Drive at the entrance to the HWP (City of Pasadena 2002). One through travel lane is provided in each direction along Foothill Boulevard between Oak Grove Drive and the Foothill Freeway ramps. Two lanes are provided in each direction along

Foothill Boulevard west of the Foothill Freeway ramps and are generally separated by a raised median from the freeway ramps to Gould Avenue. Parking is not permitted on either side of Foothill Boulevard from Oak Grove Drive to the Foothill Freeway ramps. Windsor Avenue is a north-south roadway located east of the Upper Arroyo Seco. Windsor Avenue provides one through travel lane in each direction. Sidewalks are generally not provided along Windsor Avenue, except for a few small segments (City of Pasadena 2002).[6]

Traffic counts have been collected at vicinity intersections as a part of the Arroyo Seco Master Plan EIR (City of Pasadena 2002) as well as the Hahamongna Watershed Park Master Plan Addendum Initial Study (City of Pasadena 2009). In 2009 the existing LOS is the surrounding vicinity was Level of Service (LOS) C or better, indicating acceptable service consistent with the Pasadena Department of Transportation guidelines (City of Pasadena 2009).

Bicycle Facilities

Within the immediate vicinity of NASA JPL and the HWP, a bikeway runs from South Pasadena to the HWP and connects to bicycle lanes on Oak Grove Drive. On-street bicycle lanes are provided north of Foothill Boulevard and south of Berkshire Place (NASA 2012b, 2012c). A large number of NASA JPL employees commute to the facility via bicycle along Road B, immediately east of Explorer Road at the East Gate. Road B connects the JPL bridge/East Gate with the Gabrielino Trail (part of the Altadena Crest Trail Complex), which is a paved gently sloping multi-use trail that is signed for bicycles and meets Windsor Road at the Windsor Gate. The East Gate is open on work days from 5:30 am to 8:00 pm and City of Pasadena personnel open the "Pasadena Gate" (located at the intersection of Road B and Explorer Road) at 5:30 am and close it at midnight on the same days as the East Gate. Road B is used by cyclists accessing the facility through the East Gate. Large "Share The Road" signs are located at the merge of Road B with Explorer Road and bicycle *sharrows* (or on-asphalt road markings

[6] Portions of Windsor Avenue north of the Foothill Freeway are located within the City of Altadena.

designating shared access between vehicles and cyclists) are located on the NASA JPL Bridge. Explorer Road (between the former East Lot and Windsor Road) is not suitable for bicycles and presents safety issues as it is a narrow two-lane road without striped bicycle lanes (NASA 2016).

3.8.2.2 Hahamongna Watershed Park

The following two surface parking lots provide access to the HWP, totaling 98 surface parking spaces:

- **Echo Sunset Prieto Trail Loop Lot**: This lot is accessed from Windsor Avenue located on the east side of the HWP, near to cross streets of Windsor Avenue and Ventura Street. It contains 23 surface parking spaces and is used for passive recreational uses within the HWP.

- **Oak Grove Recreational Field Lot:** This lot is within the western portion of the HWP directly across from La Cañada Flintridge High School and directly adjacent to the Oak Grove recreation fields. It is accessed via Oak Grove Drive and provides approximately 75 surface parking spaces for public access and use of the HWP. Additional overflow parking is located nearby in a dirt field where parking spaces are unmarked.

Additional parking in the vicinity include a small lot along Windsor Avenue, at its intersection with Explorer Road, which provides an additional 24 parking spaces at an overlook of and trailhead to HWP.

3.8.3 Approach to Analysis

A significant transportation impact would be considered one that resulted in a substantial increase in traffic generation, a substantial increase in the use of connecting street systems or mass transit, or if on-site parking demand would not be met by projected parking space supply.

3.8.4 Environmental Impacts

3.8.4.1 Alternative A

No additional personnel would be required to conduct on-site testing activities within the Mars Yard or Robotics Arena or off-site testing activities within the

Arroyo Seco. Vehicles and/or equipment to be used in off-site testing under this alternative are located at the NASA JPL facility and would be transported from the facility to the testing area via existing roadways. NASA JPL personnel conducting small-scale testing activities within the Arroyo Seco would access testing areas via the East Gate during standard operating hours. Alternative A would result in no change to traffic flow patterns, circulation, or parking both on-site and in the immediate surrounding vicinity, including pedestrian and/or bicycle facilities; therefore, implementation of Alternative A would not result in significant impacts to traffic.

3.8.4.2 No Action Alternative

Under the No Action Alternative there would be no change to existing circulation or traffic flow patterns within the affected environment. On-site testing activities and off-site testing activities within the Arroyo Seco would be permitted and approved individually with consideration to existing transportation and circulation conditions at NASA JPL and within the HWP. However, under the No Action Alternative if approval for testing operations in the Arroyo Seco cannot be obtained, NASA JPL may be required to pursue more remote outdoor testing areas located at a much greater distance from the facility, which would result in additional vehicle trips associated with transportation of assets and equipment. This would limit the ability of NASA JPL to accomplish the goals set out by Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade* as well as NASA Policy Directive (NPD) 8500.1C, and NASA Sustainability Performance Plan (SPP).

3.9 CULTURAL RESOURCES

3.9.1 Definition of Resources

Cultural resources are "cultural items", as defined by NAGPRA and "historic properties" as defined by the NHPA, and represent and document activities, accomplishments, and traditions of previous civilizations and link current and former inhabitants of an area. Depending on their conditions and historic uses, these resources may provide insight to living conditions in previous civilizations and may retain cultural and religious significance to modern groups.

Archaeological resources, as defined by the Archaeological Resources Environmental Protection Act (ARPA), comprise areas where prehistoric or historic activity measurably altered the earth or deposits of physical remains (e.g., arrowheads, bottles). Cultural resources also include "sacred sites" as defined by EO 13007 to which access is afforded under the American Indian Religious Freedom Act (AIRFA), and collections and associated records as defined by 36 CFR 79. Architectural resources include standing buildings, districts, bridges, dams, and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for inclusion in the National Register of Historic Places (NRHP), an inventory of culturally significant resources identified in the U.S.; however, more recent structures, such as Cold War-era resources, may warrant protection if they have the potential to gain significance in the future. Traditional cultural resources can include archaeological resources, structures, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that Native Americans or other groups consider essential for the persistence of traditional culture.

3.9.2 Regulatory Setting

Several Federal laws and regulations have been established to manage cultural resources, including the National Historic Preservation Act (NHPA) (1966), the Archaeological and Historic Preservation Act (1974), and the Archaeological Resource Protection Act (1979). In order for a cultural resource to be considered significant, it must meet one or more of the following criteria for inclusion on the NRHP:

"The quality of significance in American history, architecture, archaeology, 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: (a) that 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 or 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 and distinguishable entity whose components may lack

individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history" (CFR, Title 36, Part 60:4; 2004).

The California State Office of Historic Preservation (OHP) is responsible for administering federally and state-mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources under the direction of the State Historic Preservation Officer (SHPO), a gubernatorial appointee, and the State Historical Resources Commission. OHP reviews and comments on federally sponsored projects pursuant to Section 106 of the NHPA and state projects pursuant to Sections 5025 and 5024.5 of the Public Resources Code and the California Environmental Quality Act (CEQA) (OHP 2014).

3.9.3 Existing Conditions

3.9.3.1 Archaeology

A comprehensive survey of the NASA JPL facility in 2014 did not identify any archaeological resources within the facility boundaries; however, several sites are located in the vicinity. NASA JPL is well developed with few undisturbed areas available for archaeological inspection. The only undisturbed area, the hillside to the north, is considered too steep to be inhabitable or archaeologically sensitive. The area adjacent to the Arroyo Seco, however, can be considered potentially sensitive because of the occurrence of archaeological sites within the vicinity to the north and south of the NASA JPL facility (NASA 2012b).

The majority of the HWP area has not been surveyed by archaeologists for cultural resources (ACOE 2011). However, several large habitation sites, possibly of the Hahamongna peoples have been identified in the vicinity; these include the following:

- CA-LAN-26 (California-Los Angeles), situated along the Arroyo Seco (about 2.4 km [1.5 mi] south of the NASA JPL facility), is described as a prehistoric village and cemetery complex of undetermined age. This site was reportedly destroyed by bulldozing prior to 1962.

- CA-LAN-342, situated in Millard Canyon, approximately 1 mile northeast of NASA JPL. This site was a Middle Horizon Village site (circa 1500 B.C. to A.D. 500) characterized by numerous grinding implements and other prehistoric stone artifacts (NASA 2012a).

Historical documents identify this Hahamongna prehistoric community as occupying the upper reaches of Arroyo Seco, Verdugo Wash, and the San Rafael Hills (NASA 2012a). Mission register data indicate that the Hahamongna were a large community that undoubtedly helped construct the mission at San Gabriel where 70 Hahamongna baptisms were recorded between 1707 and 1805 (NASA 2012a). Semiautonomous communities like and including the Hahamongna occupied sites in the vicinity but disappeared soon after the arrival of the Spanish (NASA 2012a).

3.9.3.2 Architectural Resources

NASA JPL prepared a *Historic Resources Study Gate to Gate, NASA Jet Propulsion Laboratory, Pasadena, CA* in 2010 (Page & Turnbull 2010). The study was completed to assist NASA JPL in meeting its obligations under Sections 106 and 110 of the NHPA and concluded that 7 buildings are eligible for listing on the NRHP. These buildings, with their date of construction, include:

- Building 11, Space Sciences Laboratory, 1942;
- Building 18, Structural Test Laboratory, 1945;
- Building 82, High Vacuum Laboratory, 1948;
- Building 90, Pyrotechnics Laboratory, 1948;
- Building 103, Electronic Fabrication Shop, 1947;
- Building 125, Combined Engineering Support, 1954; and
- Building 179, Spacecraft Assembly Facility, 1961.

Additionally, two structures, Building 230 (Space Flight Operations) and Building 150 (25-foot Space Simulator), are currently listed on the NRHP as a result of the *Man in Space Theme Study* performed by the National Park Service in 1984. These properties were formally designated by the Secretary of the Interior on October 3, 1985 (NASA 2012a).

3.9.4 Approach to Analysis

Cultural resources are subject to review under both Federal and state laws and regulations. Section 106 of the NHPA requires the Federal agency to consider the impacts of its actions on historic properties, which are defined as cultural resources that meet specific criteria for eligibility for listing on the National Register of Historic Places (NRHP).

Analysis of potential impacts to cultural resources considers both direct and indirect impacts. Direct impacts may occur by 1) physically altering, damaging, or destroying all or part of a resource; 2) altering the characteristics of the surrounding environment that contribute to resource significance; 3) introducing visual, audible, or atmospheric elements that are out of character with the property or alter its setting; or 4) neglecting the resource to the extent that it is deteriorated or destroyed.

Identifying the locations of proposed actions and determining the exact locations of cultural resources that could be affected can assess direct impacts. Indirect impacts primarily result from the effects of project-induced population increases and the resultant need to develop new housing areas, utilities services, and other support functions necessary to accommodate population growth. These activities and the subsequent use of the facilities can disturb or destroy cultural resources.

3.9.5 Environmental Impacts

3.9.5.1 Alternative A

On-site testing activities at NASA JPL under implementation of this alternative would be limited to designated testing areas and would not impact historic structures at the facility. Archaeological resources have not been encountered within the boundaries of the NASA JPL during past archaeological surveys; however, several sites are located in the area and there is potential for buried deposits indicative of either prehistoric or historic activities within NASA JPL (McKenna et al. 1993). Potential sites may include habitation sites of the Hahamongna peoples occupying the upper reaches of Arroyo Seco, Verdugo Wash, and the San Rafael Hills. Additionally, HWP has the potential to contain buried archaeological deposits.

Activities proposed would not require any disturbance of subsurface material (i.e., no grading, excavation, or related construction activity is proposed). Use of instruments, radar, tripods, and sUASs is non-intrusive and no effect to cultural resources is anticipated as a result of testing using these resources. Use of vehicles on existing roads, trails, and other open spaces within the HWP is not anticipated to have an effect on buried cultural resources. It is unlikely any cultural resources remain at the surface as this area is a publically accessible park. If surface resources are identified during testing NASA JPL would follow the Protocol for the Inadvertent Discovery of Cultural Artifacts (NASA JPL Rule Doc ID 72132) (NASA 2012b). Proposed activities under this alternative are not anticipated to result in any irrevocable loss of historic or cultural resources. No short-term or long-term impacts on historic or cultural resources would be expected as a result of the implementation of this alternative.

3.9.5.2 No Action Alternative

Under the No Action Alternative, there would be no change to the approval process for on-site and off-site testing activities. None of the activities would be anticipated to impact any potential archaeological, historic, or cultural resources at the NASA JPL facility or in the immediate vicinity within the HWP. However, under the No Action Alternative, if approval for testing operations on-site or in the Arroyo Seco cannot be obtained, NASA JPL may be required to pursue more remote outdoor testing areas located at a much greater distance from the facility, which could result in potential off-site impacts to sensitive cultural resources, if present.

3.10 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

3.10.1 Definition of Resource

Socioeconomics are defined as the basic attributes and resources associated with the human environment, particularly population and economic activity. Human population is affected by regional birth and death rates as well as net in- or outmigration. Economic activity typically comprises employment, personal income, and industrial growth. Impacts on these fundamental socioeconomic

indicators can also influence other components such as housing availability and public services provision.

3.10.2 Regulatory Setting

In 1994, Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, was issued to focus attention of Federal agencies on human health and environmental conditions in minority and low income communities. EO 12898 requires that all Federal agencies address the effects of policies on minority and low-income populations and communities as well as ensure that disproportionately high and adverse human health or environmental effects on these communities are identified and addressed. The CEQ has oversight of the Federal agencies' compliance with EO 12898 and NEPA. CEQ, in consultation with USEPA and other affected agencies, developed Environmental Justice Guidance Under the National Environmental Policy Act (CEQ 1997) to further assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed.

3.10.3 Existing Conditions

The NASA JPL facility and HWP are located in the City of La Cañada Flintridge and the City of Pasadena, respectively. Both cities are located within Los Angeles County. Socioeconomic data was gathered from the U.S. Census Bureau 2010 American Fact Finder dataset as well as the *Nasa JPL Environmental Justice Plan* (NASA 2015e) prepared in September 2015.

County of Los Angeles. As of 2010 the county of Los Angeles included a total population of 9,818,605. The estimated population for 2014 was 10,116,705, which represents a 3-percent increase since 2010.

Pasadena. In 2014, the population of the City of Pasadena was 140,881 people. As recorded in 2010 census, the largest demographic is Non-Latino/White persons (39 percent), followed by people of Hispanic or Latino origin (34 percent), Asian origin (14 percent), Black or African American persons (11 percent), persons of Native American Indians or Alaska Native persons (less than 1 percent).

La Cañada Flintridge. The City of La Cañada Flintridge had a population of 20,662 people in 2014. As recorded in 2010 census, the largest demographic is Non-Latino/White (68.9 percent of the total population). The second largest demographic is Asian, which represents 25.8 percent of the population.

Table 3-5 below shows the general demographic characteristics for Pasadena and La Cañada Flintridge based on 2010 Census data. La Cañada Flintridge includes a relatively small population with a high median income level and low poverty rate, compared to Pasadena.

Table 3-5. Socioeconomic Data for the Cities of Pasadena and La Cañada Flintridge

Demographic Statistics	City of Pasadena	City of La Cañada Flintridge
Age		
Median Age	37.2	45.9
Race (percent of total population)		
One race	95.1	96.6
Two or more races	4.9	3.4
Black of African American	10.7	0.5
White	55.8	68.9
American Indian and Alaska Native	0.6	0.1
Asian	14.3	25.8
Native Hawaiian or Pacific Islander	0.1	0.0
Hispanic or Latino	33.7	6.3
Housing		
Total Housing Units	59,551	7,089
Total Households	55,270	6,849
Economic Data		
Labor Force Population	77,114	9,389
Unemployment Rate	9.8%	5.8%
Median Household Income	$68,310	$154,947
Percent of Population Below the Poverty Rate	12.9%	2.1%

Source: U.S Census Bureau 2010.

As described in the NASA JPL Environmental Justice Plan data obtained from EJView (2015) summarizes the demographic profile of the area surrounding and

potentially influenced by activities at NASA JPL independent of geographic boundaries (i.e., using a 3-mile radius from NASA JPL in lieu of political boundaries). According to the mapping program, the total population of the area within a 3-mile radius of NASA JPL is 84,998 people; of this total, 55,910 (or 66 percent) are defined as *minority*. No community within 3- miles of NASA JPL is mapped as *low-income* (i.e., supporting low-income populations greater than 50 percent of the total) (NASA JPL 2015e).

3.10.4 Approach to Analysis

Significance of population and economic activity are assessed in terms of their direct effects on the local economy and related effects on other socioeconomic resources (e.g., housing). The magnitude of potential impacts varies depending on the location of a proposed action; for example, an action that creates 20 employment positions may be unnoticed in an urban area, but may have significant impacts in a more rural region. If potential socioeconomic impacts would result in substantial shifts in population trends, or adversely affect regional spending and earning patterns, they would be significant.

In order to comply with EO 12898, and ethnicity and poverty status in the vicinity of the Proposed Action area have been examined and compared to county, state, and national data to determine if any minority or low-income communities could potentially be disproportionately affected by implementation of the Proposed Action or alternatives. Data have been collected from previously published documents issued by Federal, state, and local agencies and from state and national databases (e.g., U.S. Bureau of Economic Analysis Regional Economic Information System).

The CEQ guidance states that "minority populations should be identified" where either: a) the minority population of the affected area exceeds 50 percent; or b) the population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis." (CEQ 1997). Only census tracts in Altadena and Pasadena meet the definition of a minority population; none are located in the community of La Cañada Flintridge (NASA 2012a). Further, CEQ (1997) guidelines do not specifically state the percentage considered meaningful in the

case of low-income populations; however, while low income individuals do reside within the surrounding community, the percentages in the potentially affected census tracts are well below the 50 percent required to be considered a "low-income population" as defined by Housing and Urban Development guidelines (NASA 2012a).

3.10.5 Environmental Impacts

3.10.5.1 Alternative A

Under this alternative, there would be no change in employment associated with on-site or off-site testing activities or the total number of personnel at NASA JPL. Further, as described in more detail within Section 3.7, *Land Use* and Section 3.12, *Hazardous Materials and Wastes* there would be no impacts to safety at NASA JPL or recreational uses or safety within the HWP under this alternative. Further, no effect (including those related to noise or air emissions) on housing or community facilities is anticipated in the vicinity of NASA JPL. No anticipated short-term or long-term impacts to socioeconomic resources, low-income populations, or minority populations would be anticipated.

3.10.5.2 No Action Alternative

Under the No Action Alternative, there would be no change to the approval process for on-site and off-site testing activities. Similar to previously permitted and approved testing activities, there would be no impacts to regional or local socioeconomics or Environmental Justice communities. NASA JPL would continue to implement mitigation for all construction, field activities, and contracts as described in the Environmental Justice Plan Update.

3.11 VISUAL RESOURCES

3.11.1 Definition of Resource

Visual resources are defined as the natural and manufactured features that comprise the aesthetic qualities of an area. These features form the overall impressions that an observer receives of an area or its landscape character. Landforms, water surfaces, vegetation, and manufactured features are considered characteristic of an area if they are inherent to the structure and function of a landscape.

3.11.2 Existing Conditions

The visual environment within the NASA JPL facility is representative of a developed laboratory (industrial) area. The main natural visual resources within the NASA JPL property include the foothills of the San Gabriel Mountains within the northern portion of the property. The NASA JPL facility consists of 138 buildings and other minor ancillary structures, totaling over 2.7 million gross square feet in the area. The primary land use near NASA JPL is residential, along with undeveloped areas of the ANF to the north. The ANF is largely undeveloped and improved with hiking/equestrian trails and service roads. No state forests or parks exist in the surrounding area (NASA 2012b).

To the east of the NASA JPL facility, located on the south-facing slopes of the San Gabriel Mountains, lies the HWP within the Arroyo Seco. The HWP basin floor consists of a broad sediment plain of erosional deposits that have accumulated behind the Devil's Gate Dam. The park gently slopes from an upstream to downstream with steep walls around its perimeter. Past excavation and mining activities as well as erosion have contributed to irregularities in the park's terrain characterized by shallow ridgecrests and alluvial fan slopes, interspersed with fairly level ground. Vegetation in the central portion of the site consists of a mix of primarily riparian scrub habitats and nonnative grasslands. Nighttime lighting in this area is primarily associated with outdoor lighting for the structures around the perimeter of the site as well as street lighting. Some glare is generated by light reflecting off the NASA JPL buildings (ACOE 2011).

Views of the HWP are available primarily from the surrounding roadways, residences, and the NASA JPL facility. Spreading grounds used for groundwater recharge extend south along the eastern portion of the site until roughly West Kent Street. Views of the south/southwestern portion of the site consist of somewhat patchy vegetated areas, sedimentary materials, small water-filled depressions and partially-excavated areas in front of the Devil's Gate Dam. A series of sparsely-vegetated trails and meandering stream courses dominate views of the central portion of the site (ACOE 2011).

Due to the size of the HWP and its position below the level of surrounding development, views through the site are unobstructed. Views of the San Gabriel Mountains are available looking in a northerly direction from the site while views of the San Raphael Hills are available looking in a southeasterly direction. The NASA JPL facility structures are notable features in the visual landscape

looking north/northwest through the site. As the Devil's Gate Dam is located down slope and farther below street level with intervening trees and shrubs, views are limited especially from surrounding uses to the north and east (ACOE 2011).

The Arroyo Seco North of the HWP starting at the NASA JPL Bridge gradually ascends into the San Gabriel Mountains with steep hillsides to the west and east. Available views of this portion of the Arroyo Seco are accessible from the NASA JPL facility and residences on the adjacent western and eastern ridgelines. The visual environment within this portion of the Arroyo Seco is unobstructed, characterized by the riparian scrub habitats, and surrounding views of the San Gabriel Mountains.

3.11.3 Approach to Analysis

Determination of the significance of impacts to visual resources is based on the level of visual sensitivity in the area. Visual sensitivity is defined as the degree of public interest in a visual resource and concern over adverse changes in the quality of that resource. In general, an impact to a visual resource is significant if implementation of a proposed action would result in substantial alterations to an existing sensitive visual setting.

3.11.4 Environmental Impacts

3.11.4.1 Alternative A

No construction activities or substantial impacts to visual resources are proposed under this alternative. All on-site testing activities would occur within existing facilities, including the Mars Yard, Robotics Arena, and other areas within the facility. During testing of sUASs within the Arroyo Seco, recreational users within the HWP or in the vicinity may see them in flight; however, the sUASs are relatively small and would not permanently change the viewshed. Further, the frequency and duration of use would be small, consequently, the opportunity to see the sUASs in flight within the HWP would be limited. Other testing activities within the Arroyo Seco, including operation of wheeled vehicles as well as camera imaging and radar set ups, would be short-term and would have no long-term impacts on the visual resources within the Upper Arroyo Seco. No change to visual and aesthetic resources within NASA JPL or adjacent HWP would be expected to occur during proposed activities under this alternative.

3.11.4.2 No Action Alternative

Under the No Action Alternative, there would be no change to the approval process for on-site and off-site testing activities. As with previously permitted and approved testing activities, testing activities would be short-term and temporary and no long-term impacts to visual and aesthetic resources would be anticipated.

3.12 HAZARDOUS MATERIALS AND WASTES

3.12.1 Definition of Resource

Solid Materials are defined as substances that do not have strong physical properties of ignitability, corrosivity, reactivity, or toxicity. Solid Wastes are defined as solid waste that does not pose a substantial present or potential hazard to human health or to the environment.

Hazardous materials are defined as substances with strong physical properties of ignitability, corrosivity, reactivity, or toxicity, which may cause an increase in mortality, serious irreversible illness, incapacitating reversible illness, or pose a substantial threat to human health or to the environment. *Hazardous wastes* are defined as any solid, liquid, contained gaseous, or semisolid waste, or any combination of wastes that pose a substantial present or potential hazard to human health or to the environment.

Issues associated with hazardous materials and wastes typically center on underground storage tanks, aboveground storage tanks, and the storage, transport, and use of pesticides and fuel. When such resources are improperly used, they can threaten the health and well-being of wildlife species, botanical habitats, soil systems, water resources, and people.

3.12.2 Regulatory Setting

Federal laws and regulations pertaining to hazardous materials and waste include the CERCLA, the Superfund Amendments and Reauthorization Act (SARA), the Toxic Substances Controls Act (TSCA), and the Resource and Conservation Recovery Act (RCRA).

Solid and hazardous waste streams in the State of California are regulated at the state and local level. Since January 2010, the California Department of Resources Recycling and Recovery (CalRecycle) has been the regulatory agency responsible for regulating solid waste in the State of California. CalRecycle exists as an entity within the California Natural Resources Agency and has enforcement authority over waste disposal programs under California Code of Regulations (CCR) Title 27, and nonhazardous waste management under CCR Title 14.

Hazardous and universal waste streams are regulated by the California Department of Toxic Substances Control (CalDTSC). The Hazardous Waste Control Law (1972) pertains to the management of hazardous waste streams and represents a State of California regulation similar to RCRA. Finally, the Southern California Association of Governments (SCAG) is responsible for preparing the Southern California Hazardous Waste Management Plan pursuant to the California Health and Safety Code. SCAG's decision makers adopt regional policies for both solid waste and hazardous wastes that will enable the region to support state waste goals while growing in accordance with SCAG's adopted plans, such as the Regional Transportation Plan, Compass Growth Vision, and Regional Comprehensive Plan and Guide (NASA 2012a).

3.12.3 Existing Conditions

Management of hazardous materials and wastes at the NASA JPL facility focuses on evaluation of the storage, handling, and transportation capabilities for a site. Evaluation extends to the generation and disposal of hazardous wastes, and includes fuels, solvents, acids and bases, and petroleum oil and lubricants. In addition to being a threat to humans, the improper release of hazardous materials and wastes can threatened the health and well-being of wildlife species and habitats, soil systems, and water resources. A description of hazardous materials and wastes at the NASA JPL facility is provided below.

3.12.3.1 NASA JPL Hazardous Waste Generation and Handling

NASA JPL generates 1,000 kilograms or more hazardous wastes per year and it therefore classified as a large quantity generator. Research and development activities generate different types of laboratory chemical wastes that include

common chemicals that have either exceeded their shelf life, are excess after project completion, or are spent after being used in a given project. Hazardous wastes are moved from the point of generation to an on-site hazardous waste storage facility for consolidation prior to transport for recycling/disposal off-site (NASA 2012a).

3.12.3.2 Pollution Prevention and Waste Minimization

NASA JPL has an established strategy to provide a systematic approach to pollution prevention as presented in its Pollution Prevention Plan. Plan objectives are to develop a program for preventing, reducing, reusing, and recycling waste and emissions. The plan builds on existing programs and activities that currently meet compliance requirements, as well as identifying additional activities, while trying to reduce costs associated with pollution prevention programs. The plan also encourages pollution prevention concepts to be implemented in daily business processes to aid the on-site workforce in understanding pollution prevention and environmentally related activities.

3.12.3.3 Non-Hazardous wastes

Non-hazardous waste (i.e., garbage and recycling) generated at the NASA JPL facility is collected in containers/barrels and disposed of daily by a contractor. A large construction materials container is also provided and removed as needed. Non-hazardous waste materials such as scrap metal, metal drums, scrap paper, pallets, and toner cartridges are periodically recovered and recycled. NASA JPL has an aggressive recycling program with recycling bins distributed throughout the facility for white paper, toner cartridges, and cardboard. Additionally, newspaper recycling bins are located in all cafeterias.

3.12.3.4 Toxic Substances

Excluding laboratory chemicals, other toxic or hazardous substances that are or were historically present at the NASA JPL facility include polychlorinated biphenyls (PCBs), asbestos, pesticides, and radiation sources. The status of these, as well as information regarding chemical safety and reporting requirements, is discussed below.

PCBs

Through the 1980s up to 1993, NASA JPL conducted a lab-wide program to identify and remove all PCB transformers and capacitors from the facility. As part of the program, PCB transformers were either removed from the facility and disposed of or had the PCB's removed and then reclassified as non-PCB transformers.

Asbestos

Asbestos at NASA JPL is found in spray-applied fireproofing and piping insulation. Non-friable asbestos may be contained in flooring tile and adhesive. Asbestos removal or abatement at the NASA JPL facility is dictated by the renovation or remodeling needs of the facility. Asbestos is removed by a licensed contractor in accordance with the asbestos standard of Occupational Safety and Health Administration, 29 CFR, 1926-58. Asbestos-containing materials (ACM) are handled and disposed of off-site consistent with TSCA.

Pesticides

A range of pesticides are used at the NASA JPL facility for rodent control and grounds maintenance, and are applied by licensed contractors, who are overseen by certified advisors and applicators. NASA JPL reduces potential environmental impacts of pesticides in use by controlled applications, inventory inspection, and monitoring. All insecticides, fungicides, herbicides, and rodenticides are handled, applied, and disposed of consistent with applicable Federal and state requirements.

Radiation

Radiation sources at the NASA JPL facility include ionizing (e.g., x-rays, gamma rays, alpha and beta particles, neutrons, protons, high-speed electrons) and non-ionizing emitters (e.g., lasers and radio frequency radiation). Large ionizing radiation sources are few and fixed in location, but small sources are used in varying locations throughout the site. Non-ionizing radiation sources include visible and near-visible infrared lasers, electromagnetic radiation (microwave

and radio frequency transmitters) and ultraviolet radiation from ultraviolet lamps. Source controls include occupational safety evaluations of new sources and checks for correct operation and adherence to safety procedures. Storage and disposal is consistent with NASA JPL's radioactive material license conditions.

3.12.3.5 Chemical Safety and Reporting Requirements

NASA JPL complies with EPCRA and the more strict State of California community right-to-know requirements. NASA JPL is in compliance with Title 19 of the CCR and California Business Plan requirements, and provides a California Business Plan annually to the LACFD.

As part of the plan, NASA JPL submits a facility inventory of hazardous materials that contains reportable quantities of materials. All acutely hazardous materials stored at the NASA JPL facility are below threshold quantities for Accidental Release Prevention (November 2007). Accidental releases are unanticipated emissions of a regulated substance or other extremely hazardous substance into the ambient air from a stationary source.

3.12.3.6 NASA CERCLA Cleanup

During historical operations at the NASA JPL site, various chemicals and other materials were used. In the 1940s and 1950s, liquid wastes from materials used at NASA JPL, such as solvents, solid and liquid rocket propellants, cooling tower chemicals, and analytical laboratory chemicals, were disposed of into seepage pits, a disposal practice common at that time. By 1958, a sanitary sewage system was installed to handle sewage and wastewater, and the use of seepage pits for sanitary and chemical wastes was discontinued. Some of these chemicals, including perchlorate and chlorinated solvents, eventually reached the groundwater hundreds of feet beneath NASA JPL and were subsequently carried by groundwater flow to areas adjacent to the facility. In 1992, NASA JPL was placed on the NPL by the USEPA. As the responsible agency, NASA has conducted number of detailed investigations and studies on the facility and adjacent areas since the early 1990s. Please refer to Section 3.1.13 the Master Plan Updates PEA for further discussion.

3.12.3.7 Hahamongna Watershed Park

A Phase I Environmental Site Assessment of the Arroyo Seco was conducted as a part of the Arroyo Seco Master Plans Environmental Impact Report (EIR) to ascertain whether the project site is currently affected by or could be affected by on-site or off-site unauthorized releases of hazardous materials. No on-site hazardous material sites reporting unauthorized releases of hazardous materials were identified in the Upper Arroyo Seco. The only identified hazardous waste issue was the NASA JPL Superfund site to the northwest. However, the Hahamongna Watershed Park Management Plan Addendum Initial Study (IS) also concluded that park restroom and maintenance structures constructed in the 1950s, can reasonably be assumed to contain asbestos-containing building materials (ACMs). Additionally, the surfaces of these facilities may have been treated with lead-based paint (LBP) (City of Pasadena 2009).

3.12.4 Approach to Analysis

Federal, state, and local laws regulate the storage, handling, disposal, and transportation of hazardous materials and wastes; the primary purpose of these laws is to protect human health and the environment. The significance of potential impacts associated with hazardous substances is based on their toxicity, reactivity, ignitability, and corrosivity. Impacts associated with hazardous materials and wastes would be significant if the storage, use, transportation, or disposal of hazardous substances substantially increased the human health risk or environmental exposure.

3.12.5 Environmental Impacts

3.12.5.1 Alternative A

Solid Waste

No solid waste would be generated as a result of on-site or off-site testing under this alternative. Consequently no additional short-term or long-term sources of solid waste would be anticipated as a result of implementation of this alternative.

Hazardous Wastes

Potentially hazardous materials are used to maintain equipment used for testing and in vehicles used to transport testing equipment to and from testing locations. As described in Section 3.5, *Water Resources* equipment/vehicles proposed for testing are designed for interplanetary/extraterrestrial use. As such, they have been designed with state-of-the-art containment, conservation, sustainability, and sealant systems which are intended to contain any fuel used and waste generated within the vehicle system. Fueling and maintenance would occur in previously designated/approved/permitted facilities within NASA JPL. The potential of petroleum or hazardous material release would be possible from vehicles accessing the testing locations. To minimize this hazard, all applicable Federal and state regulations relating to hazardous materials handling, use and transportation would be followed to ensure that hazardous material release to the affected environment would be minimized and contained. For example, vehicles and equipment would be regularly inspected for leaks and performance and maintained accordingly. As a result, vehicle-related impacts associated with hazardous materials and waste would be short-term and less than significant.

Based on the minimal level of disturbance under implementation of this alternative, impacts related to hazardous waste would not be anticipated to be significant.

3.12.5.2 No Action Alternative

Under the No Action Alternative, there would be no change in the approval process for on-site and off-site testing activities. Existing conditions would remain unchanged, and there would be no additional hazardous materials used and no additional solid or hazardous wastes generated in the Arroyo Seco. However, under the No Action Alternative, if approval for testing operations in the Arroyo Seco cannot be obtained, NASA JPL may be required to pursue more remote outdoor testing areas located at a much greater distance from the facility, which could result in potential introduction of additional hazardous materials in these areas. Regardless, due to the design and construction of the NASA JPL testing equipment (e.g., designed for interplanetary/extraterrestrial use) as well as NASA JPL testing protocol (e.g., fueling off-site, following all applicable

Federal, state, and local regulations regarding hazardous materials), as described for the Proposed Action (Alternative A), impacts related to hazardous waste would not be anticipated to be significant.

3.13 CUMULATIVE IMPACTS

Cumulative impacts on environmental resources result from incremental impacts of a proposed action that, when combined with other past, present, and reasonably foreseeable future projects in an affected area, may collectively cause more substantial adverse impacts. Cumulative impacts can result from minor, but collectively substantial, actions undertaken over a period of time by various agencies (Federal, state, or local) or persons. In accordance with NEPA and the CEQ memorandum of "Guidance on the Consideration of Past Actions in Cumulative Effects Analysis," a discussion of cumulative impacts resulting from projects which are proposed, under construction, recently completed, or anticipated to be implemented in the near future is required.

3.13.1 Past Actions

NASA JPL was developed beginning in the late 1930s and continues to be updated and developed based on needed technologies and use. NASA JPL was previously undeveloped open fields. NASA JPL first used these fields for experimentation in propulsion, which led to the construction of a few small shacks and some buried bunkers used to test propellants and other fuels. In 1940, the facility was acquired by the U.S. Army and construction of permanent/semi-permanent buildings began. The first permanent structure, described as an engineering building was added to the facility in 1942 with the start of activities supporting World War II efforts. At least 97 additional buildings/structures were constructed during the remainder of the 1940s. Some of the earlier, temporary buildings or inadequate facilities were replaced at this time with more permanent structures (NASA 2012b).

During the 1950s, another 60 buildings/structures were completed as either new construction or to replace outdated facilities. During the 1960s, 78 buildings/structures were constructed. Some of these replaced older, outdated structures. During the period from 1970 to 1980, 51 additional

buildings/structures were constructed at the facility as either new construction or to replace outdated facilities. In the 1980s, ten buildings were added to the facility (NASA 2012b).

From 1990 to 2010, an additional 49 buildings/structures were constructed. A significant number of these structures were temporary trailer offices. Over the life of NASA JPL, more than 325 facilities have been constructed on site. Of these, 222 buildings/structures are still standing (NASA 2012b).

In 2014, a new on-site parking structure was completed in order to provide parking for facility workers who used the former East Arroyo Lot, which was returned to the City of Pasadena in order to implement natural groundwater recharge basins in the area (NASA 2012b).

From a cumulative perspective, past development of NASA JPL from its initial appearance as open fields to the urban setting that exists at the current time has been a major impact. However, the existing footprint of the facility has been in place for approximately 50 years. Proposed testing is consistent with current uses of the facility.

3.13.2 Planned or Reasonably Foreseeable Projects

3.13.2.1 Onsite Projects

The *NASA JPL Master Plan Update* proposes and describes several recapitalization projects over a 20-year horizon through 2032 (NASA JPL 2012a). The plan addresses the comprehensive set of facilities-related goals that NASA JPL have set in order to insure that the facility can meet its Solar System and space exploration missions. The Master Plan provides general planning framework, based upon an overall concept plan and a land use plan, as well as more specific development plan components, including a circulation and parking plan, landscape concept plan, sustainability plan and major utility plans. Major recapitalization projects included in the Master Plan over the near-term include Flight Electronics Facility (85,000 square feet) and Advanced Robotics Facility (50,000 square feet). Longer-term recapitalization projects include the Mechanical Development Facility (100,000 square feet) in 2018-2022, the Research and Technology Development Facility in 2023-2027 (approximately (100,000 square

feet) and Systems Assembly and Test Facility in 2028-2032 (approximately 50,000 square feet).

Additionally, over the near term NASA JPL proposes security and parking enhancements at the facility, including the West, South, and East gates. This project is intended to remedy security inadequacies cand improve vehicular circulation issues at each of the three security gates, through development of security infrastructure and reconfiguration of vehicular parking and circulation in discrete areas of the NASA JPL facility consistent with NASA Procedural Requirement (NPR) 1620.3, *Physical Security Requirements for NASA Facilities and Property*, which specifically requires that designated vehicle inspection areas not interfere with the vehicular traffic or pedestrian flow on- and off-center to ensure the safety of the NASA JPL workforce and the General Public, and NASA assets. This action was evaluated in the *Environmental Assessment for Fortification of Security Gates at the Jet Propulsion Laboratory* (NASA 2016).

Less than significant impacts are expected as a result of implementation of Alternative A. Further, the proposed project is not expected to result in any cumulative impacts associated with near-term projects as NASA JPL or long-term recapitalization projects under the Master Plan. Any cumulative impacts were determined to be less than significant (NASA 2012b, 2016).

3.13.2.2 Offsite Projects

The following major public infrastructure projects are planned by the City of Pasadena and the City of La Cañada Flintridge:

- Flintridge Sacred Heart Academy Specific Plan
- La Cañada Flintridge Citywide Catch Basin Maintenance Plan
- La Cañada Flintridge Citywide Street Resurfacing
- La Cañada Flintridge 2016 miscellaneous concrete repair
- Hahamongna Watershed Park Master Plan
- Devil's Gate Sediment Removal Project

- Arroyo Seco Canyon Water Resources, Habitat Restoration and Recreation Project
- Street Lighting and Electric System Undergrounding
- La Loma Bridge Project
- Master Sewer Plan
- Preventive Maintenance
- I-210 Sound wall
- Street lighting Improvements

None of the proposed projects would result in a significant cumulative impact in conjunction with Alternative A since the proposed off-site projects would include short-term construction-related impacts, and long-term socioeconomic benefits through improved public safety and health, improved natural environmental and habitat function, floodplain management, increased recreational opportunities and community aesthetics (City of Pasadena 2014; City of La Cañada Flintridge 2014).

4.0 CONSULTATION AND COORDINATION

(To be Provided)

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