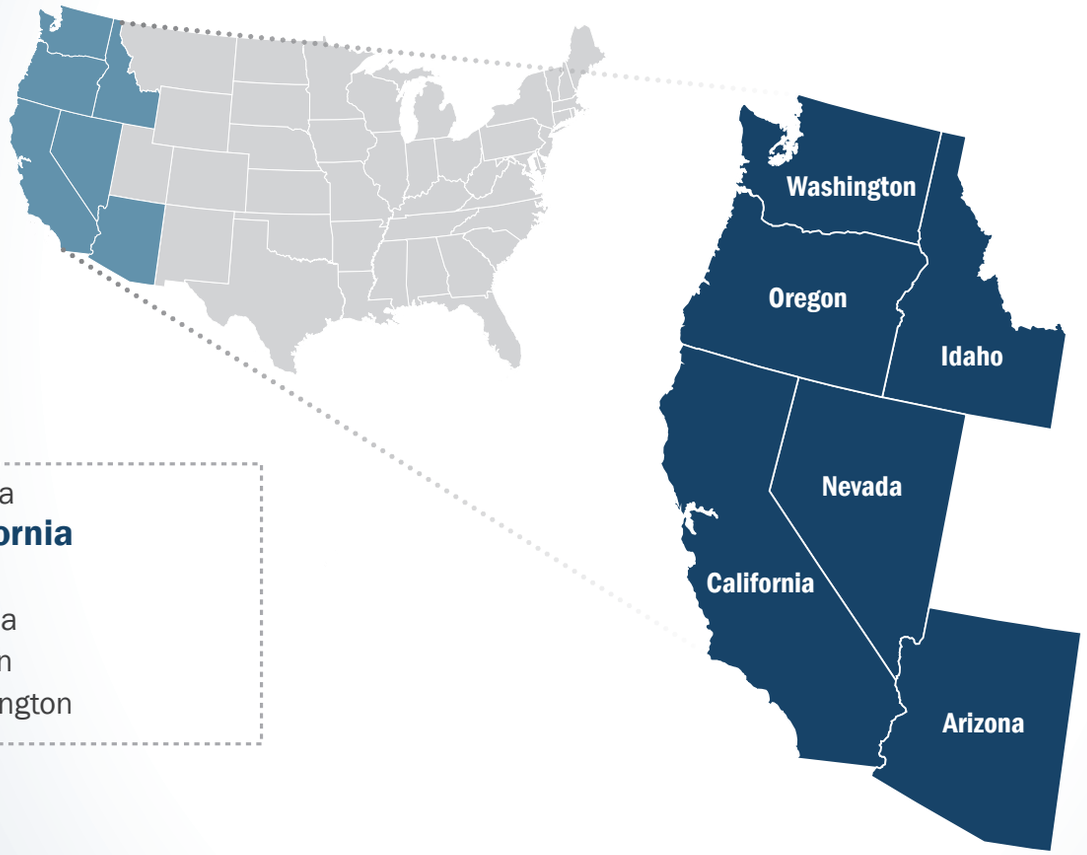
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Western United States

VOLUME 2 - CHAPTER 4



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First Responder Network Authority

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Western United States

VOLUME 2 - CHAPTER 4

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Federal Communications Commission
General Services Administration
U.S. Department of Agriculture—Rural Utilities Service
U.S. Department of Agriculture—U.S. Forest Service
U.S. Department of Agriculture—Natural Resource Conservation Service
U.S. Department of Defense—Department of the Air Force
U.S. Department of Energy
U.S. Department of Homeland Security

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Contents

4 California 4-7
4.1 Affected Environment 4-8
4.1.1 Infrastructure 4-8
4.1.2 Soils 4-40
4.1.3 Geology 4-55
4.1.4 Water Resources 4-74
4.1.5 Wetlands 4-89
4.1.6 Biological Resources 4-98
4.1.7 Land Use, Recreation, and Airspace 4-303
4.1.8 Visual Resources 4-338
4.1.9 Socioeconomics 4-357
4.1.10 Environmental Justice 4-374
4.1.11 Cultural Resources 4-380
4.1.12 Air Quality 4-399
4.1.13 Noise 4-493
4.1.14 Climate Change 4-498
4.1.15 Human Health and Safety 4-508
4.2 Environmental Consequences 4-523
4.2.1 Infrastructure 4-523
4.2.2 Soils 4-535
4.2.3 Geology 4-542
4.2.4 Water Resources 4-554
4.2.5 Wetlands 4-567
4.2.6 Biological Resources 4-578
4.2.7 Land Use, Recreation, and Airspace 4-630
4.2.8 Visual Resources 4-644
4.2.9 Socioeconomics 4-651
4.2.10 Environmental Justice 4-664
4.2.11 Cultural Resources 4-671
4.2.12 Air Quality 4-680
4.2.13 Noise 4-686
4.2.14 Climate Change 4-694
4.2.15 Human Health and Safety 4-710
CA Appendix A – Water Resources 4-725
CA Appendix B – Communities of Concern 4-728
Acronyms 4-739
References 4-745
GIS References 4-829

List of Tables

Table 4.1.1-1: Relevant California Infrastructure Laws and Regulations 4-9
Table 4.1.1-2: California Interstates 4-10
Table 4.1.1-3: Amtrak Train Routes Serving California 4-12
Table 4.1.1-4: Key California Indicators 4-16
Table 4.1.1-5: Public Safety Infrastructure in California by Type 4-16
Table 4.1.1-6: First Responder Personnel in California by Type 4-17
Table 4.1.1-7: California Public Safety P25 Networks 4-21
Table 4.1.1-8: Telecommunications Access Providers and Coverage in California as of December 31, 2013. 4-23
Table 4.1.1-9: Wireless Telecommunications Coverage by Providers in California 4-23
Table 4.1.1-10: Number of Commercial Towers in California by Type 4-30
Table 4.1.1-11: Fiber Provider Coverage 4-33
Table 4.1.2-1: Relevant California Soils Laws and Regulations 4-41
Table 4.1.2-2: Characteristics of Major Land Resource Areas in California 4-44
Table 4.1.2-3: Major Characteristics of Soil Suborders Found in California, as depicted in Figure 4.1.2-2 4-48
Table 4.1.3-1: Relevant California Geology Laws and Regulations 4-56
Table 4.1.4-1: Relevant California Water Laws and Regulations 4-74
Table 4.1.4-2: Section 403(d) Impaired Waters of California, 2012 4-82
Table 4.1.4-3: Description of California's Principal Aquifers 4-86
Table 4.1.5-1: Relevant California Wetland Laws and Regulations 4-89
Table 4.1.5-2: California Wetland Types, Descriptions, Location, and Amount, 2014 4-91
Table 4.1.6-1: Relevant California Biological Laws and Regulations 4-98
Table 4.1.6-2. USEPA Level III Ecoregions of California 4-102
Table 4.1.6-3. State and/or Federally Regulated Aquatic Invasive Animals and Plants 4-125
Table 4.1.6-4: Popular Sportfish Species in California 4-128
Table 4.1.6-5. Habitat Areas of Particular Concern for California 4-131
Table 4.1.6-6: Federally Listed Mammal Species of California 4-136
Table 4.1.6-7: Federally Listed Bird Species of California 4-154
Table 4.1.6-8: Federally Listed Fish Species of California 4-162
Table 4.1.6-9: Federally Listed Amphibian Species of California 4-175
Table 4.1.6-10: Federally Listed Reptile Species of California 4-181
Table 4.1.6-11: Federally Listed Invertebrate Species of California 4-186
Table 4.1.6-12: Federally Listed Plant Species of California 4-204
Table 4.1.7-1: Major Land Use in California by Coverage Type 4-304
Table 4.1.7-2: Top Five Developed Metropolitan Areas 4-306
Table 4.1.7-3: Federal Land in California 4-308
Table 4.1.7-4: State Land in California[a] 4-309
Table 4.1.7-5: Indian Reservations and Other Land Holdings in California 4-311
Table 4.1.7-6: SUA Designations 4-320
Table 4.1.7-7: Type and Number of California Airports/Facilities 4-324
Table 4.1.8-1: Relevant California Visual Resources Laws and Regulations 4-338
Table 4.1.8-2: National Park Service Lands and Scenic Values 4-347
Table 4.1.9-1: Land Area, Population, and Population Density of California 4-359
Table 4.1.9-2: Recent Population Growth of California 4-360

Table 4.1.9-3: Projected Population Growth of California 4-360
Table 4.1.9-4: Population of the 10 Largest Population Concentrations in California 4-361
Table 4.1.9-5: Selected Economic Indicators for California 4-365
Table 4.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in California, 2009–2013 4-369
Table 4.1.9-7: Employment by Class of Worker and by Industry, 2013 4-369
Table 4.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in California, 2009–2013 4-370
Table 4.1.9-9: Selected Housing Indicators for California, 2013 4-371
Table 4.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in California, 2009–2013 4-371
Table 4.1.9-11: Residential Property Values in California, 2013 4-372
Table 4.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in California, 2009–2013 4-372
Table 4.1.9-13: State and Local Government Revenues, Selected Sources, 2012 4-373
Table 4.1.10-1: Population by Race and Hispanic Status, 2013 4-377
Table 4.1.10-2: Percentage of Population (Individuals) in Poverty, 2013 4-377
Table 4.1.11-1: Relevant California Cultural Resources Laws and Regulations 4-381
Table 4.1.11-2: NRHP Listed Archaeological Sites in California 4-389
Table 4.1.12-1: California Air Districts 4-399
Table 4.1.12-2: California Ambient Air Quality Standards (CAAQS) 4-402
Table 4.1.12-3: Major Air Pollutant Source Thresholds 4-404
Table 4.1.12-4: *De Minimis* Levels 4-405
Table 4.1.12-5: Amador County APCD Major Air Pollutant Source Thresholds 4-407
Table 4.1.12-6: Antelope Valley AQMD Major Air Pollutant Source Thresholds 4-409
Table 4.1.12-7: Bay Area AQMD Major Air Pollutant Source Thresholds 4-410
Table 4.1.12-8: Butte County AQMD Major Air Pollutant Source Thresholds 4-413
Table 4.1.12-9: Eastern Kern APCD Major Air Pollutant Source Thresholds 4-419
Table 4.1.12-10: El Dorado County AQMD Major Air Pollutant Source Thresholds 4-422
Table 4.1.12-11: Feather River AQMD Major Air Pollutant Source Thresholds 4-425
Table 4.1.12-12: Great Basin Unified APCD Major Air Pollutant Source Thresholds 4-429
Table 4.1.12-13: Imperial County APCD Major Air Pollutant Source Thresholds 4-431
Table 4.1.12-14: Lake County AQMD Major Air Pollutant Source Thresholds 4-433
Table 4.1.12-15: Mendocino County AQMD Major Air Pollutant Source Thresholds 4-439
Table 4.1.12-16: Mojave Desert AQMD Major Air Pollutant Source Thresholds 4-443
Table 4.1.12-17: Monterey Bay Unified AQMD Major Air Pollutant Source Thresholds 4-445
Table 4.1.12-18: North Coast Unified AQMD Major Air Pollutant Source Thresholds 4-447
Table 4.1.12-19: Northern Sierra AQMD Major Air Pollutant Source Thresholds 4-450
Table 4.1.12-20: Northern Sonoma APCD Major Air Pollutant Source Thresholds 4-452
Table 4.1.12-21: Placer County APCD Major Air Pollutant Source Thresholds 4-454
Table 4.1.12-22: Sacramento Metropolitan AQMD Major Air Pollutant Source Thresholds 4-456
Table 4.1.12-23: San Diego County APCD Major Air Pollutant Source Thresholds 4-458
Table 4.1.12-24: San Joaquin Valley APCD Major Air Pollutant Source Thresholds 4-460
Table 4.1.12-25: Shasta County AQMD Major Air Pollutant Source Thresholds 4-469
Table 4.1.12-26: Siskiyou County AQMD Air Contaminant Significance Levels Thresholds….. 4-473

Table 4.1.12-27: South Coast AQMD Major Air Pollutant Source Thresholds During Phase Two 4-475
Table 4.1.12-28: Tehama County APCD Major Air Pollutant Source Thresholds 4-476
Table 4.1.12-29: Tuolumne County APCD Major Air Pollutant Source Thresholds 4-479
Table 4.1.12-30: Yolo-Solano AQMD Major Air Pollutant Source Thresholds 4-483
Table 4.1.12-31: California Nonattainment and Maintenance Areas by Pollutant Standard and County 4-487
Table 4.1.12-32: Relevant Federal Class I Areas 4-491
Table 4.1.13-1: Relevant California Noise Laws and Regulations 4-496
Table 4.1.14-1: Relevant California Climate Change Laws and Regulations 4-499
Table 4.1.14-2: California CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013 4-501
Table 4.2.1-1: Impact Significance Rating Criteria for Infrastructure 4-525
Table 4.2.2-1: Impact Significance Rating Criteria for Soils 4-536
Table 4.2.3-1: Impact Significance Rating Criteria for Geology 4-544
Table 4.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats 4-579
Table 4.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species 4-614
Table 4.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace. 4-631
Table 4.2.8-1: Impact Significance Rating Criteria for Visual Resources 4-645
Table 4.2.9-1: Impact Significance Rating Criteria for Socioeconomics 4-652
Table 4.2.10-1: Impact Significance Rating Criteria for Environmental Justice 4-665
Table 4.2.11-1: Impact Significance Rating Criteria for Cultural Resources 4-673
Table 4.2.12-1: Impact Significance Rating Criteria for California 4-681
Table 4.2.13-1: Impact Significance Rating Criteria for Noise 4-688
Table 4.2.14-1: Impact Significance Rating Criteria for Climate Change 4-695
Table 4.2.15-1: Impact Significance Rating Criteria for Human Health and Safety 4-712

List of Figures

Figure 4.1.1-1: California Transportation Networks 4-11
Figure 4.1.1-2: Wireless Network Configuration 4-18
Figure 4.1.1-3: California Public Safety Microwave Network Interconnections Map 4-20
Figure 4.1.1-4: Top Wireless Providers Availability in California 4-24
Figure 4.1.1-5: Sprint and T-Mobile Wireless Availability in California 4-25
Figure 4.1.1-6: MetroPCS and Digital Path Inc. Wireless Availability in California 4-26
Figure 4.1.1-7: U.S. Cellular and unWired Broadband Inc. Wireless Availability in California 4-27
Figure 4.1.1-8: Other Providers Wireless Availability in California 4-28
Figure 4.1.1-9: Types of Towers 4-29
Figure 4.1.1-10: FCC Tower Structure Locations in California 4-31
Figure 4.1.1-11: Typical Fiber Optic Network in California 4-32
Figure 4.1.1-12: Fiber Availability in California for AT&T and Verizon 4-34
Figure 4.1.1-13: Comcast and Time Warner Cable's Fiber Availability in California 4-35
Figure 4.1.1-14: MegaPath's Fiber Availability in California 4-36
Figure 4.1.1-15: Other Providers' Fiber Availability in California 4-37
Figure 4.1.2-1: Locations of Major Land Resource Areas in California 4-43

Figure 4.1.2-2: California Soil Taxonomy Suborders 4-47
Figure 4.1.3-1: Physiographic Regions and Provinces of California 4-58
Figure 4.1.3-2: Generalized Surface Geology for California 4-62
Figure 4.1.3-3: Generalized Bedrock Geology for California 4-64
Figure 4.1.3-4: California 2014 Seismic Hazard Map 4-69
Figure 4.1.3-5: California Landslide Incidence and Susceptibility Hazard Map 4-71
Figure 4.1.3-6: Areas Susceptible to Subsidence due to Karst Topography in California 4-73
Figure 4.1.4-1: Major California Watersheds and Surface Waterbodies 4-77
Figure 4.1.4-2: California's Estuaries and Critical Resource Waters 4-80
Figure 4.1.4-3: Section 403(d) Impaired Waters of California, 2014 4-84
Figure 4.1.4-4: Principal and Sole Source Aquifers of California 4-88
Figure 4.1.5-1: Wetlands by Type, Northern California, 2014 4-94
Figure 4.1.5-2: Wetlands by Type, Southern California, 2014 4-95
Figure 4.1.6-1: USEPA Level III Ecoregions in California 4-101
Figure 4.1.6-2: Important Bird Areas (IBA) of California 4-118
Figure 4.1.6-3: Federally Designated Critical Habitat in Northern California 4-134
Figure 4.1.6-4: Federally Designated Critical Habitat in Southern California 4-135
Figure 4.1.7-1: Major Land Use Distribution by Coverage Type 4-307
Figure 4.1.7-2: Major Land Ownership Distribution 4-310
Figure 4.1.7-3: California Recreation Resources 4-315
Figure 4.1.7-4: National Air Space Classification Profile 4-319
Figure 4.1.7-5: Composite of California Airports/Facilities 4-325
Figure 4.1.7-6: Public California Airports/Facilities 4-326
Figure 4.1.7-7: Private California Airports/Facilities 4-327
Figure 4.1.7-8: SUAs in California 4-336
Figure 4.1.7-9: MTRs in California 4-337
Figure 4.1.8-1: Representative Sample of Some Historic and Cultural Areas that May Be Visually Sensitive 4-342
Figure 4.1.8-2: Donner Memorial State Park near Donner Camp Sites National Historic Landmark, Sierra Nevada Mountains 4-343
Figure 4.1.8-3: View of the Historic Mojave Road along the Old Spanish National Historic Trail within the Mojave National Preserve 4-344
Figure 4.1.8-4: Natural Areas that May be Visually Significant 4-346
Figure 4.1.8-5: Half Dome, Yosemite National Park and World Heritage Site 4-347
Figure 4.1.8-6: Devils Postpile, one of the many scenic views from the Pacific Crest Trail 4-351
Figure 4.1.8-7: Mono Lake Tufa State Natural Reserve 4-352
Figure 4.1.8-8: Farallon National Wildlife Refuge 4-354
Figure 4.1.8-9: Wildflowers and Oak Woodland along the Route 1-San Luis Obispo North Coast Byway 4-357
Figure 4.1.9-1: Population Distribution in California, 2009–2013 4-363
Figure 4.1.9-2: Median Household Income in California, by County, 2013 4-367
Figure 4.1.9-3: Unemployment Rates in California, by County, 2014 4-368
Figure 4.1.10-1: Potential for Environmental Justice Populations in California, 2009–2013 4-379
Figure 4.1.11-1: Timeline of Prehistoric Human Occupation 4-382
Figure 4.1.11-2: Federally Recognized Tribes in California 4-388
Figure 4.1.11-3: National Register of Historic Places (NRHP) Sites in California 4-396

Figure 4.1.11-4: Representative Architectural Styles of California 4-398
Figure 4.1.12-1: AQMDs and APCDs in California..... 4-401
Figure 4.1.12-2: Nonattainment and Maintenance Counties in California..... 4-486
Figure 4.1.12-3: Federal Class I Areas With Implications for California 4-492
Figure 4.1.13-1: Sound Levels of Typical Sounds 4-494
Figure 4.1.14-1: California CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013 4-500
Figure 4.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties 4-503
Figure 4.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014 4-512
Figure 4.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in California (2013) 4-516
Figure 4.1.15-3: Inventoried Abandoned Mine Land Features in California (2012)..... 4-519
Figure 4.2.14-1: California Low Emission Scenario Projected Temperature Change 4-697
Figure 4.2.14-2: California High Emission Scenario Projected Temperature Change..... 4-698
Figure 4.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario 4-700
Figure 4.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario 4-701
Figure 4.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050 4-703
Figure 4.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050..... 4-703

4 CALIFORNIA

American Indian tribes with a rich cultural history lived in what is now the state of California for centuries before the 1800s. California existed for a few brief weeks in 1846 as the Republic of California, after a series of skirmishes between a small group of American settlers and the Mexican Army led the settlers to declare independence from Mexico. After the United States (U.S.) won the Mexican-American War in 1847, the U.S. gained possession of California and made it a state in 1850 (California Department of Parks and Recreation, 2009). California is bordered by Oregon to the north, Nevada and Arizona to the east, Mexico to the south, and the Pacific Ocean to the west. This chapter provides details about the existing environment of California as it relates to the Proposed Action.

General facts about California are provided below:

- **State Nickname:** The Golden State
- **Area:** 163,695 square miles; **U.S. Rank:** 3 (U.S. Census Bureau, 2010)
- **Capital:** Sacramento
- **Counties:** 58 (U.S. Census Bureau, 2015w)
- **2014 Estimated Population:** 38,802,500 people; **U.S. Rank:** 1 (U.S. Census Bureau, 2016)
- **Most Populated Cites:** Los Angeles, San Diego, San Jose, and San Francisco (U.S. Census Bureau, 2015w)
- **Main Rivers:** San Joaquin River, Sacramento River and Colorado River
- **Bordering Waterbodies:** Pacific Ocean and Colorado River
- **Mountain Ranges:** Klamath Mountains, Cascade Mountains, Coastal Mountains, and a portion of the Sierra Nevada Mountains
- **Highest Point:** Mount Whitney (14,494 feet) (USGS, 2005)

4.1 AFFECTED ENVIRONMENT

4.1.1 Infrastructure

4.1.1.1 Definition of the Resource

This section provides information on key California infrastructure resources that could potentially be affected by FirstNet projects. Infrastructure consists of the systems and physical structures that enable a population in a specified area to function. Infrastructure is entirely manmade with a high correlation between the type and extent of infrastructure and the degree to which an area is characterized as "developed." Infrastructure includes a broad array of facilities such as utility systems, streets and highways, railroads, airports, buildings and structures, ports, harbors and other manmade facilities. Individuals, businesses, government entities, and virtually all relationships between these groups depend on infrastructure for their most basic needs, as well as for critical and advanced needs (e.g., emergency response, health care, and telecommunications).

Section 4.1.1.3 provides an overview of California's traffic and transportation infrastructure, including road and rail networks and waterway facilities. California's public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (Public Law [Pub. L.] No. 112-96, Title VI Stat. 156 (codified at 47 United States Code [U.S.C.] 1401 et seq.)) (the Act), including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by the Act. Public safety services in California are presented in more detail in Section 4.1.1.4. Section 4.1.1.5 describes California's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of California utilities, such as power, water, and sewer, is presented in Section 4.1.1.6.

4.1.1.2 Specific Regulatory Considerations

Multiple California laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 4.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state's applicable statutes and administrative rules referenced in column one. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

[1] The term "public safety entity" means an entity that provides public safety services (7 U.S. Code [U.S.C.] § 1401(26)).

Table 4.1.1-1: Relevant California Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
California Code of Regulations (CCR) Title 14, Natural Resources, and Title 27, Environmental Protection	Various state agencies	Implementing authority of numerous state agencies that potentially regulate public and private infrastructure actions in the state, including the Department of Fish and Game, Department of Fish and Game, Department of Forestry and Fire Protection, Department of Conservation Department of Parks and Recreation, Boating and Waterways, California Coastal Commission, State Coastal Conservancy, and Environmental Affairs Agency.
CCR Title 19, Public Safety	California Emergency Management Agency	Specifies emergency management functions of the state, including hazardous material release reporting, inventory, and response plans; fire equipment; disaster assistance; and Seismic Safety Commission.
CCR Title 20, Public Utilities and Energy	California Public Utilities Commission (CPUC)	Regulates all common carrier, toll bridge, pipeline, gas, electrical, telephone, telegraph, water, sewer system, and heat corporations within the state.
California Streets and Highways Code	California Department of Transportation (Caltrans)	Regulates transportation systems within the state.
California Environmental Quality Act (CEQA) (Public Resources Code Section 2011 et seq.)	State, Regional, and Local Planning Agencies (e.g., cities, counties, special districts)	Requires public agencies to analyze and publicly disclose the environmental impacts from projects they approve, and adopt feasible alternatives and mitigation measures to mitigate for the significant impacts they identify.
National Pollutant Discharge Elimination System (NPDES) Permit Program	California State Water Resources Control Board	Program authorized by the U.S. EPA under the Clean Water Act for California to issue permits for the discharge of wastewater into waters of the U.S.
Safe Drinking Water Act and California Health and Safety Code Section 11672.60	California Environmental Protection Agency (CalEPA)	Requires the CalEPA to develop and implement a program to protect sources of drinking water, and establish a source water assessment program and wellhead protection program.

4.1.1.3 Transportation

This section describes the traffic and transportation infrastructure in California, including specific information related to the road networks, airport facilities, rail networks, harbors (this PEIS defines "harbor" as a body of water deep enough to allow anchorage of a ship or boat), and ports. The movement of vehicles is commonly referred to as traffic, as well as the circulation along roads. Roadways in the state range from multilane road networks with asphalt surfaces, to unpaved gravel or private roads. The information regarding existing transportation systems in California are based on a review of maps, aerial photography, and federal and state data sources.

Caltrans has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state; local counties have jurisdiction for smaller streets and roads. The mission of the Caltrans is to "provide a safe, sustainable, integrated, and efficient transportation system to enhance California's economy and livability" (Caltrans, 2015a).

California has an extensive and complex transportation system across the state that includes:

- 174,989 miles of public roads (FHWA, 2014) and 25,406 bridges (FHWA, 2015a);
- 6,863 miles of rail network that includes passenger rail and freight (Caltrans, 2015b);
- 810 aviation facilities, including airstrips and heliports (Caltrans, 2016a);
- 121 harbors (U.S. Harbors, 2015); and
- 5 major intermodal ports (Caltrans, 2007).

Road Networks

California's road network is composed of interstate, state, county, and local roads. As illustrated in Figure 4.1.1-1, interstate highways connect the state's major urban centers of Redding-Red Bluff, San Jose-San Francisco-Oakland, Fresno-Madera, Visalia-Porterville-Hanford, Los Angeles-Long Beach, and San Diego-Carlsbad (U.S. Census Bureau, 2013). Table 4.1.1-2 lists the interstates and their start/end points in California. Per the national standard, even numbered interstates run from west to east with the lowest numbers beginning in the south; odd numbered interstates run from north to south with the lowest numbers beginning in the west (FHWA, 2015b).

Table 4.1.1-2: California Interstates

Interstate	Southern or western terminus in CA	Northern or eastern terminus in CA
I-5	Mexico line in San Ysidro	OR line near Hilt
I-8	Sunset Cliffs Blvd in San Diego	AZ line in Winterhaven
I-10	SR-1 in Santa Monica	AZ line in Blythe
I-15	I-8 in San Diego	NV line near Mountain Pass
I-40	I-15 in Barstow	AZ line in Needles
I-80	US-101 in San Francisco	NV line near Mystic

California has 7 National Scenic Byways (FHWA, 2015c) and 58 State Scenic Byways (Caltrans, 2015c).[2] National and State Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, or scenic qualities (FHWA, 2013). Some State Scenic Byways may be designated on portions of National Scenic Byways.

Figure 4.1.1-1 shows the state's National Scenic Byways.

- Route 110 – Arroyo Seco Historic Parkway: 9.5 miles in southwestern California.
- Death Valley Scenic Byway: 81.5 miles in eastern California.
- Ebbetts Pass Scenic Byway: 61 miles in east-central California.
- Route 1 – Big Sur Coast Highway: 72 miles in west-central California.
- Route 1 – San Luis Obispo North Coast Byway: 57 miles in west-central California.
- Tioga Road/Big Oak Flat Road: 64 miles in east-central California.
- Volcanic Legacy Scenic Byway: 500 miles in California and Oregon.

The aesthetic perspective of California's National and State Scenic Byways is discussed in Section 4.1.8, Visual Resources.

[2] The total number of State Scenic Byways may not include those segments of National Scenic Byways that are also designated as State Scenic.

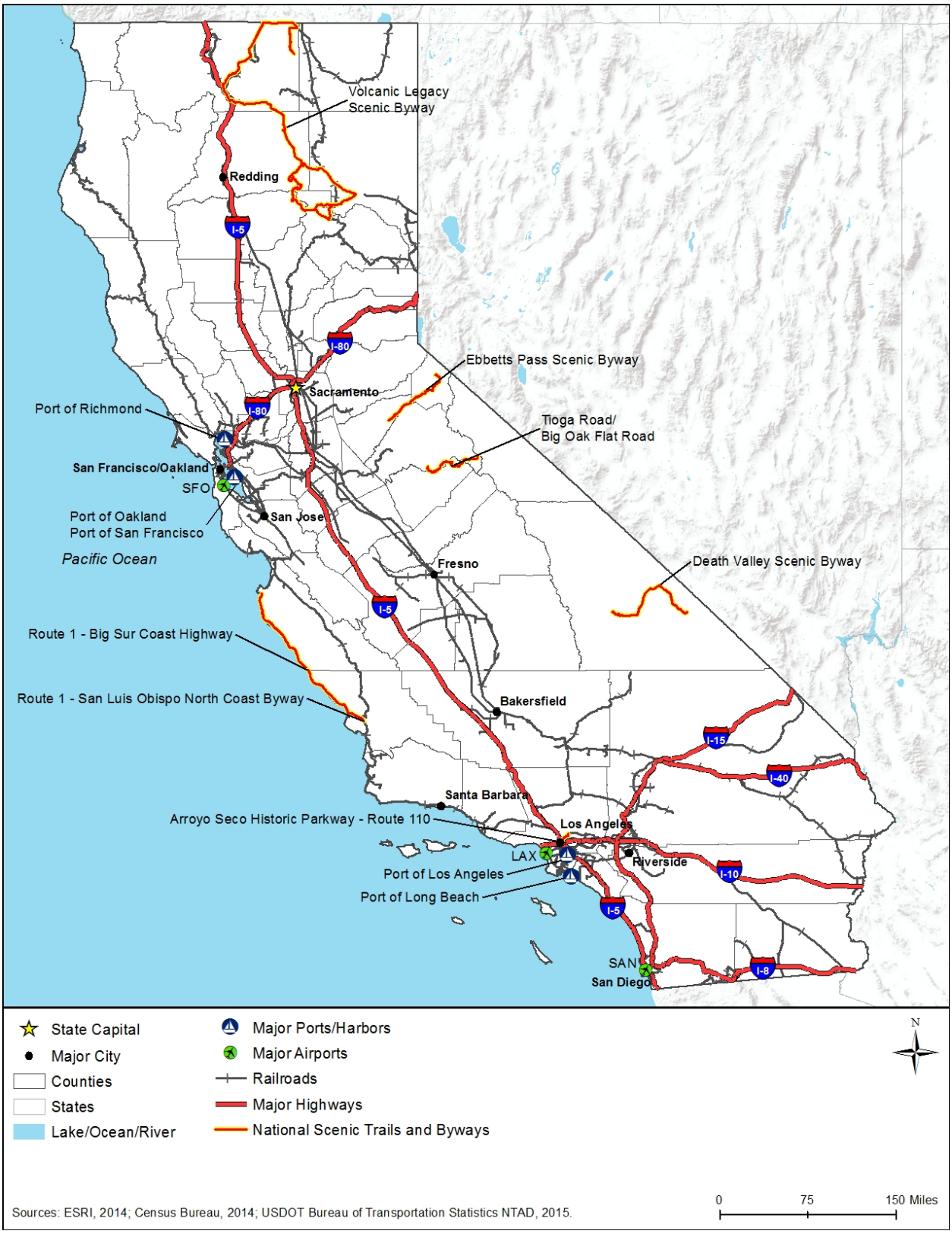


Figure 4.1.1-1: California Transportation Networks

Airports

California has three major international airports (Figure 4.1.1-1).

- Los Angeles International Airport (LAX) is 15 miles southwest of downtown Los Angeles. In 2014, LAX served 70,663,519 passengers (LAX, 2015a), facilitated 636,706 aircraft operations (LAX, 2015b), and moved 1,922,384 pounds of freight (LAX, 2015c). That same year, LAX was the second busiest airport in the nation in terms of the number of passengers served (FAA, 2015b) and the 7th busiest in the nation in terms of the amount of cargo moved (FAA, 2015c).
- San Francisco International Airport (SFO) is 13 miles south of downtown San Francisco. In 2014, SFO served 47,155,100 passengers, facilitated 431,633 aircraft operations, and moved 400,615 metric tons of cargo and U.S. mail (SFO, 2015). That same year, SFO was the 7th busiest airport in the nation in terms of the number of passengers served (FAA, 2015b) and the 21st busiest in the nation in terms of the amount of cargo moved (FAA, 2015c).
- San Diego International Airport (SAN) is three miles northwest of downtown San Diego. In 2014, SAN served 18,758,751 passengers, facilitated 191,761 aircraft operations, and moved 157,355.6 tons of cargo (SAN, 2015). That same year, SAN was the 28th busiest airport in the nation in terms of the number of passengers served (FAA, 2015b) and the 36th busiest in the nation in terms of the amount of cargo moved (FAA, 2015c).

Other large airports in California include Bob Hope Airport (BUR), Long Beach/Daugherty Field (LGB), Metropolitan Oakland International Airport (OAK), Ontario International Airport (ONT), Sacramento International Airport (SMF), Norman Y. Mineta San Jose International Airport (SJC), and John Wayne Airport-Orange County (SNA).

Rail Networks

California's rail network provides long-distance passenger service (Amtrak), public transportation (commuter rail), and freight transportation (Figure 4.1.1-1). Table 4.1.1-3 provides a complete list of Amtrak lines that run through California.

Table 4.1.1-3: Amtrak Train Routes Serving California

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in California
California Zephyr	Chicago, IL	Emeryville, CA	51 hours 20 minutes	Sacramento, Davis, Emeryville
Capitol Corridor	Auburn, CA	San Jose, CA	3 hours 15 minutes	Sacramento, Davis, Berkeley, Emeryville, Oakland, San Jose
Coast Starlight	Seattle, WA	Los Angeles, CA	35 hours	Sacramento, Davis, Emeryville, Oakland, San Jose, Santa Barbara, Los Angeles
Pacific Surfliner	San Luis Obispo, CA	San Diego, CA	5 hours 45 minutes	San Luis Obispo, Santa Barbara, Burbank, Los Angeles, Anaheim, San Diego

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in California
San Joaquin	Sacramento, CA	Bakersfield, CA	6 hours 15 minutes	Sacramento, Oakland, Emeryville, Fresno, Bakersfield
Southwest Chief	Chicago, IL	Los Angeles, CA	40+ hours	Riverside, Los Angeles
Sunset Limited	New Orleans, LA	Los Angeles, CA	48 hours	Palm Springs, Los Angeles
Texas Eagle	Chicago, IL	Los Angeles, CA	62 hours 20 minutes	Palm Springs, Los Angeles

Sources: (Amtrak, 2015a) (Amtrak, 2015b)

Four commuter railroads operate in California – two in northern California and two in southern California.

- Caltrain operates between San Francisco to San Jose and Gilroy on 77 miles of track, serving 29 stations in 18 different cities. In state fiscal year 2011-12, Caltrain served 14,134,117 passengers (Caltrans, 2013a).
- The Altamont Corridor Express (ACE) operates between Stockton to San Jose via Livermore and Fremont on 86 miles of track, serving 10 stations. In state fiscal year 2011-12, ACE served 786,947 passengers (Caltrans, 2013a).
- Metrolink operates seven separate rail lines that connect Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura Counties. Metrolink operates on 512 miles of track, serving 55 stations. In state fiscal year 2011-12, Metrolink served 11,977,540 passengers (Caltrans, 2013a).
- COASTER commuter trains run along the San Diego County coastline, from Oceanside to San Diego via Carlsbad, Encinitas, and Solana Beach. COASTER operates on 41 miles of track, serving 8 stations (COASTER, 2015). In state fiscal year 2011-12, COASTER served 1,624,211 passengers (Caltrans, 2013a).

Seven urban rail systems operate in California – two in the San Francisco metropolitan area, one in the Santa Clara metro area, one in Sacramento metro area, one in the Los Angeles metro area, one between Escondido and Oceanside, and one in San Diego.

- Bay Area Rapid Transit (BART) is a heavy-rail transit system operating in the San Francisco Bay Area. It consists of 5 lines across 104 miles of track and serves 44 stations (BART, 2015).
- Bay Area Rapid Transit (BART) is a heavy-rail transit system operating in the San Francisco Bay Area, with 5 lines on 104 miles of track serving 44 stations (BART, 2015).
- Muni provides multiple types of rail transit systems within the City of San Francisco. The Muni light rail transit system consists of six lines, the cable car system consists of three lines, and the historic streetcar system is one line (Muni, 2015).
- Santa Clara VTA Light Rail is a light rail transit system between Santa Clara, San Jose, and Mountain View, with 4 lines on 42.2 miles of track serving 62 stations (VTA, 2012).

- RT Light Rail is a light rail transit system operating in the Sacramento metro area, with 3 lines on 38.6 miles of track serving 50 stations (Regional Transit, 2015).
- Metro Rail is both a heavy-rail and a light rail transit system operating in the Los Angeles metro area, with 4 light rail lines and 2 subway lines on 87 miles serving 80 stations (Metro Rail, 2015).
- SPRINTER is a light rail system operating between Escondido and Oceanside, with 1 line on 22 miles of track serving 15 stations (SPRINTER, 2015).
- San Diego Trolley is a light rail transit system in San Diego, with 3 lines serving 53 stations (MTS, 2015).

Two Class I freight railroads operate in California: BNSF Railway owns 1,155 miles of track in the state and Union Pacific Railroad owns 2,773 miles of track in the state (Caltrans, 2013a). Eighteen short line railroads operate in California, as well as 8 switching and terminal railroads; combined, they operate on 823 miles of track (Caltrans, 2013a). In 2007, freight rail moved 176 million tons of cargo; of those tons, 99.3 million originated in California, and 58.3 terminated in the state (Caltrans, 2013a). In 2010, California ranked 8th in the nation in terms of the amount of freight rail originating in a state (Caltrans, 2013a).

Harbors and Ports

Many of California's major coastal cities were initially developed as ports with access to waterways and inland transportation infrastructure (Figure 4.1.1-1). Today, the major ports of Los Angeles, Long Beach, Oakland, Richmond, San Francisco, and San Diego are components of global transportation infrastructure that handle bulk commodities (e.g., coal, grain, and raw and refined petrochemical products) and manufactured products (usually transported in shipping containers). California ports also serve cruise lines, the U.S. Armed Forces, shipbuilding and repair facilities, and recreational boaters. Collectively, California ports are essential components of the regional and national economy (U.S. Census Bureau, 2015x).

The Port of Los Angeles occupies the western half of Terminal Island in the southeastern corner of the city, and serves commercial shipping and recreational marinas and beaches, as well as cruise operations (Port of LA, 2015a) (Port of LA, 2015b). The Port of Los Angeles' World Cruise Center is "the largest and busiest facility of its kind on the West Coast serving thousands of passengers a year" (Port of LA, 2015b). Commodities handled at the Port of Los Angeles include automobiles, furniture, paper, scrap metal, electronics, clothing, and auto parts (Port of LA, 2015c). Cargo terminals are served by Union Pacific Railroad through the Intermodal Container Transfer Facility. On dock rail services are provided by the companies leasing the space, such as Maersk or the Evergreen America Corp (Port of LA, 2015d). Highway access is provided by I-710 and I-110. In 2013, the Port of Los Angeles imported $244.5 billion worth of cargo, weighing 49.8 billion kg, and exported $40.9 billion weighing 19.2 billion kg (U.S. Census Bureau, 2015x).

The Port of Long Beach occupies the eastern half of Terminal Island and has facilities along a series of channels on the mainland opposite Terminal Island (POLB, 2015a); it is served by more

than 140 shipping lines with connections to 217 seaports worldwide" (POLB, 2015b). The Port of Long Beach handles a variety of cargo, including clothes, furniture, gypsum, petroleum coke, coal, oil, gasoline, lumber, and steel (POLB, 2015c). Export and import cargo is delivered to the port by I-710 and I-110, Union Pacific Railroad and BNSF Railroad. The Pacific Harbor Line regional railroad provides switching services (POLB, 2015d). Nearly $4 billion of improvement to the port are programmed over the next 10 years (POLB, 2015b). In 2013, the Port of Long Beach imported $69.7 billion worth of cargo, weighing 17 billion kg, and exported $439.5 billion, weighing 27.4 billion kg (U.S. Census Bureau, 2015x).

The Ports of Oakland, San Francisco, and Richmond are along the shores of San Francisco Bay.

- The Port of Oakland, on the eastern side of the Bay and southeast of the San Francisco-Oakland Bay Bridge has five container terminals, and two intermodal rail facilities served by I-880. (Port of Oakland, 2015a). The port specializes in moving intermodal container cargo and is home to five container terminals. It handles more than 99 percent of containerized cargo in northern California, and is the fifth busiest container port in the country (Port of Oakland, 2015b). It's most common cargo includes beverages, furniture, wood pulp, fruits and nuts, rubber, electrical machinery, seeds and grains, and plastics (Port of Oakland, 2015c). Rail services are provided by BNSF Railroad and Union Pacific Railway (Port of Oakland, 2015a). In 2013, the Port of Oakland imported $27.5 billion worth of cargo, weighing 5.4 billion kg, and exported $19.9 billion kg weighing 10.4 billion kg (U.S. Census Bureau, 2015x).
- The Port of San Francisco, across the bay from the Port of Oakland, occupies 7.5 miles of shoreline between the Hyde Street Pier and India Basin (SFPort, 2015a). Its facilities include shipping terminals, container handling facilities, ferry operations, and fishing wharfs, and is served by the Union Pacific Railroad, San Francisco Bay Railroad, and I-80 (SFPort, 2015a). The Port of San Francisco has five deep water berths and more than 550,000 square feet of covered storage facilities (SFPort, 2015b). Bulk cargo makes up the largest portion of the cargo shipped through the port, comprising about 99 percent of the total 1,616,671 tons handled by the port in 2014 (SFPort, 2015c). The Port of San Francisco is served by the San Francisco Bay Railroad, which carries goods from the port to interchanges with Union Pacific and BNSF (SFBayRail, 2015). The Port of San Francisco imported $3.7 billion in 2013, weighing 2.9 billion kg, and exported $1.7 billion weighing 3.3 billion kg (U.S. Census Bureau, 2015x).
- The Port of Richmond on the eastern side of the San Francisco Bay, north of the Port of Oakland occupies the area between Brooks Island and I-580, which allows access to the port. Most of the Port of Richmond's terminals line the banks of the Harbor Channel and Santa Fe Channel (Port of Richmond, 2015a). The Port of Richmond is "northern California's most diversified cargo handler" and is home to 5 terminals owned by the city, in addition to 10 privately owned terminals (Port of Richmond, 2015a) (Port of Richmond, 2015b). The Port is served by both BNSF Railroad and Union Pacific (Port of Richmond, 2015c). Some of its most important cargo includes petroleum and other bulk liquid cargos, although the port also handles dry bulk, breakbulk, and container cargo (Port of Richmond, 2015d). In 2013, the

Port of Richmond imported $8.4 billion in cargo weighing 8.9 billion kg; and exported $1.5 billion in cargo weighing 2.3 billion kg (U.S. Census Bureau, 2015x).

4.1.1.4 Public Safety Services

California public safety services are composed of public safety infrastructure and first responder personnel aligned with the demographics of the state. Table 4.1.1-4 presents California's key demographics including population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 4.1.9, Socioeconomics.

Table 4.1.1-4: Key California Indicators

California Indicators	
Estimated Population (2014)	38,802,500
Land Area (square miles) (2010)	163,695
Population Density (persons per sq. mile) (2010)	239.1
Municipal Governments (2013)	478

Sources: (U.S. Census Bureau, 2016) (National League of Cities, 2007)

Table 4.1.1-5 presents California's public safety infrastructure, including fire and police stations. Table 4.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and medical personnel in the state.

Table 4.1.1-5: Public Safety Infrastructure in California by Type

Infrastructure Type	Number
Fire and Rescue Stations [a]	3,740
Law Enforcement Agencies [b]	509
Fire Departments [c]	873

[a] Data collected by the U.S. Fire Administration in 2015.
[b] Number of state and local law enforcement agencies, which include: local police departments, sheriffs' offices, primary state law enforcement agencies, special jurisdictional agencies, and other miscellaneous agencies, collected by the U.S. Bureau of Justice Statistics in 2008.
[c] Data collected by the U.S. Fire Administration in 2015.

Sources: (U.S. Fire Administration, 2015) (U.S. Bureau of Justice Statistics, 2011)

Table 4.1.1-6: First Responder Personnel in California by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers [a]	7,170
Fire and Rescue Personnel [b]	51,269
Law Enforcement Personnel [c]	126,538
Emergency Medical Technicians and Paramedics [d e]	16,720

[a] BLS Occupation Code: 43-5031.
[b] BLS Occupation Codes: 33-2011 (Firefighters), 33-2021 (Fire Inspectors and Investigators), 33-1021 (First-Line Supervisors of Fire Fighting and Prevention Workers), and 53-3011 (Ambulance Drivers and Attendants, Except Emergency Medical Technicians). Volunteer firefighters reported by the U.S. Fire Administration.
[c] Full-time employees from state and local law enforcement agencies which include: local police departments, sheriffs' offices, primary state law enforcement agencies, special jurisdictional agencies, and other miscellaneous agencies, collected by the U.S. Bureau of Justice Statistics in 2008.
[d] BLS Occupation Code: 29-2041.
[e] All BLS data collected in 2015.

Sources: (U.S. Fire Administration, 2015) (U.S. Bureau of Justice Statistics, 2011) (BLS, 2015d)

4.1.1.5 Telecommunications Resources

There is no central repository of information for public safety communications infrastructure and commercial telecommunications infrastructure in California; therefore, the following information and data are combined from a variety of sources, as referenced. Communications throughout California are based on a variety of publicly- and commercially-owned technologies, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems providing voice, data, and video services (BLS, 2016). Figure 4.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including a Long Term Evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).

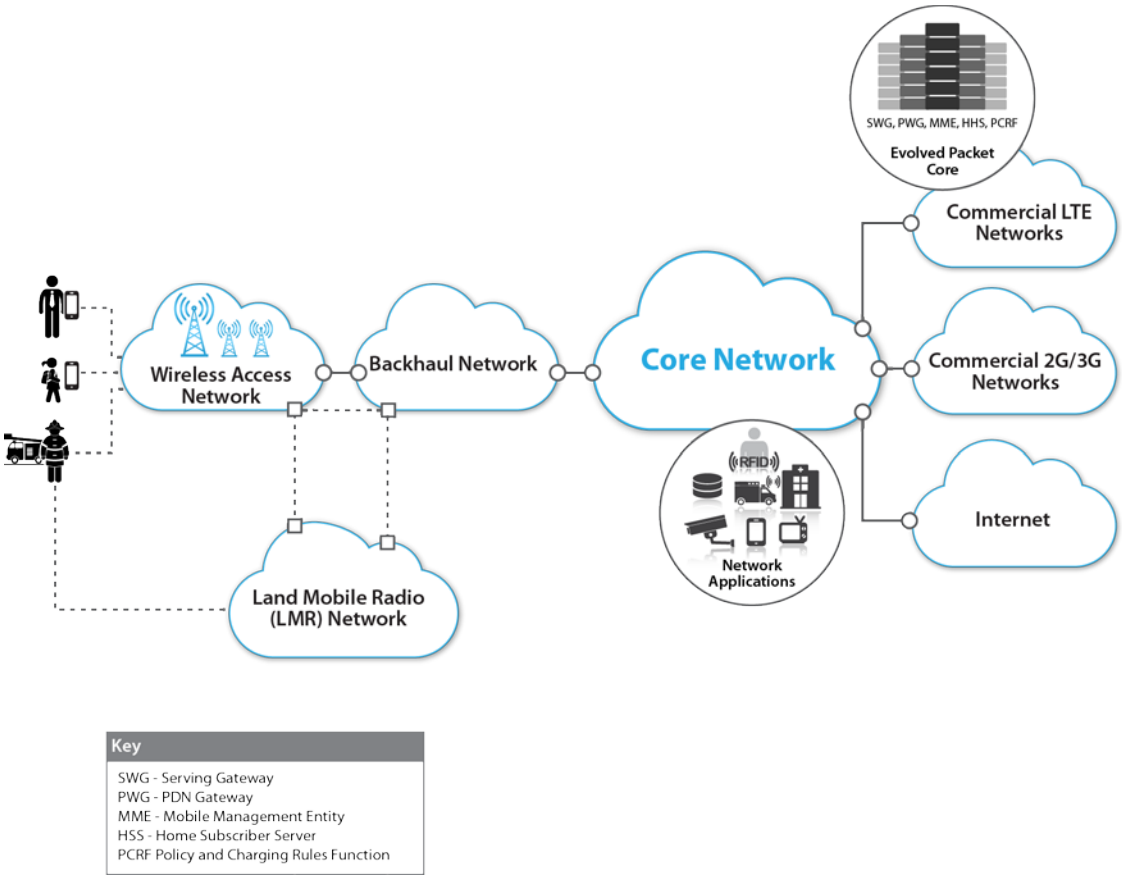


Figure 4.1.1-2: Wireless Network Configuration

Prepared by: Booz Allen Hamilton

Public Safety Communications

To protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as LTE (see Section 2.1.1), has the potential to provide users with better coverage, while offering additional capacity and enabling the use of new applications that would make their work safer and more efficient. Designing such a network presents several challenges due to the uniqueness of the deployment, the requirements, and the scale, which is national (NIST, 2015). Historically, there have been many challenges and impediments to timely and effective sharing of information. Chief factors impacting information sharing are: network coverage gaps, land mobile radio system infrastructure diversity, insufficient budgets, and diverse radio frequencies.

Communication interoperability has also been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the U.S., including California.

There are five key reasons why public safety agencies often cannot connect through existing communications (NTFI, 2005):

- Limited and fragmented funding,
- Limited and fragmented planning,
- A lack of coordination and cooperation, and
- Limited and fragmented radio spectrum.

To help enable the public safety community to incorporate disparate Land Mobile Radio (LMR) networks with a nationwide public safety LTE broadband network, the U.S. Department of Commerce Public Safety Communications Research (PSCR) – Boulder Laboratories, in 2015, prepared a locations-based services (LBS) R&D roadmap to examine the current state of location-based technologies, forecast the evolution of LBS capabilities and gaps, and identify potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years to better inform investment decisions (PSCR, 2015).

California is currently upgrading its LMR network infrastructure to increase communication interoperability across the many types of regional and local systems and frequency bands presently used in the state. Like many other large land-mass states with diverse and diffused community types, California has implemented a regional "system of systems" strategy for the management and operations of its public safety LMR networks. California summarizes its LMR and interoperability approach in its Statewide Communication Interoperability Plan (SCIP) as follows, "California relies on a system-of-systems approach across 12 major shared statewide or state-orientated systems and numerous regional and local systems of varying capabilities. Local agencies use frequency bands ranging from 2 megahertz (MHz) to 800 MHz, whereas most state agencies use Very High Frequency (VHF),[3] Ultra High Frequency (UHF),[4] and 800 MHz. The only spectrum state and local agencies have for systems expansions falls within the 700 MHz band" (California Office of Emergency Services, 2013).

California is an "early builder" broadband public safety LTE 700 MHz project (Bratcher, 2015). The Los Angeles Regional Interoperable Communications System (LA-RICS) has deployed 79 usable tower sites in support of LTE data and enhanced services (LA-RICS, 2015).

The Public Safety Radio Strategic Planning Committee (PSRSPC) functions as the lead entity in California responsible for the development and implementation of integrated public safety LMR systems in the state (California Office of Emergency Services, 2013).

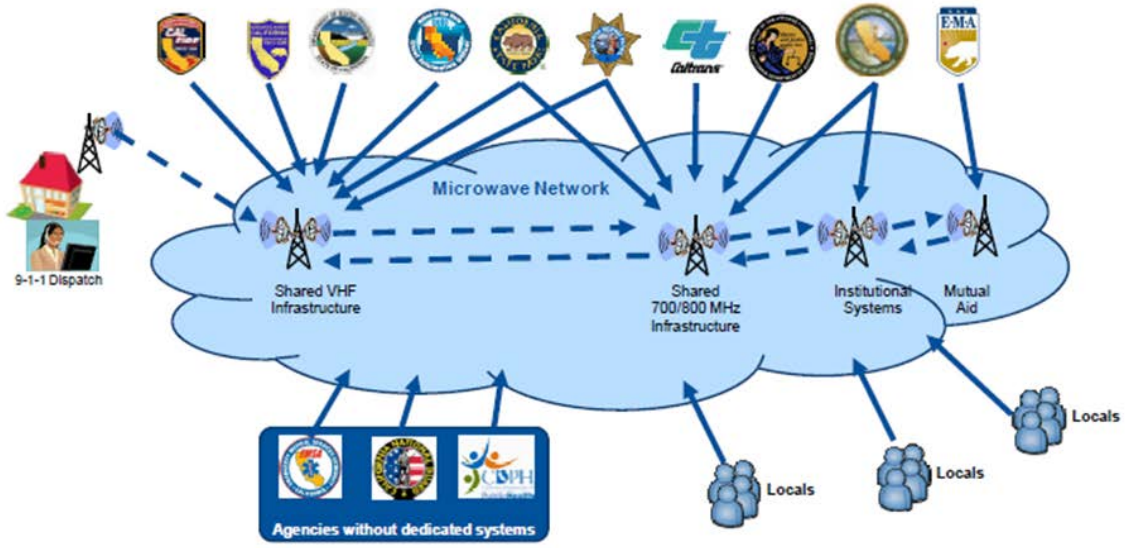
Statewide/Multi-County Public Safety Networks

Because of California's very large land mass, diversity in county community types (from urban through rural), presence of multiple large metropolitan areas, and the large number of diverse legacy LMR networks and systems; the state governs its LMR public safety networks and

[3] VHF band covers frequencies ranging from 30 MHz to 300 MHz (NTIA, 2005).
[4] UHF band covers frequencies ranging from 300 MHz to 3000 MHz (NTIA, 2005).

interoperability planning, through the organization of four major regions (Northern California, Capital-Bay, Central California, and Southern California). These boundaries reflect both geography as well as LMR system coverage (California Office of Emergency Services, 2013).

To support the public safety LMR network tower-to-tower and traffic aggregation needs, California leverages its statewide microwave network, the California Microwave Public Safety Network (CAPSNET), which supports public safety LMR services as well as 9-1-1 dispatch. Figure 4.1.1-3 below provides an overview of the CAPSNET architecture and interconnection with its public safety LMR and state agency stakeholder entities (California Technology Agency, 2011).



Source: (California Technology Agency, 2011)

Figure 4.1.1-3: California Public Safety Microwave Network Interconnections Map

A key example of one of California's critical statewide networks is the California Law Enforcement Radio System (CLERS) LMR network supporting the California Highway Patrol (CHP).

Regional networks, especially 700 MHz/800MHz networks, are critically important to California in ensuring wide area LMR communications in the state, as well as providing multi-agency communications. Most of the digital Project-25 (P25)[5] regional and multicounty networks in California operate on these frequencies, as Table 4.1.1-7 indicates (Symons, 2014). Table 4.1.1-7 below lists the regional digital P25 networks in California which include the East Bay Regional 700 MHz/800 MHz network, the Sacramento Regional Radio Network, and the Interagency Communications Interoperability UHF Hi network (Symons, 2014).

[5] Project-25 (P25) is a suite of standards for digital radio communications for use by federal, state, and local public safety agencies in North America to enable them to communicate with other agencies and mutual aid response teams in emergencies.

County/City Public Safety Networks

As California's SCIP notes, county and local public safety systems in the state operate across a wide range of frequencies, including narrowband VHF, UHF, 700 MHz, and 800 MHz. There continues to be high diversity in the types and frequencies of LMR systems adopted by county and local public safety departments, and many of these LMR systems will likely co-exist into the future even as the state deploys new digital P25 and broadband 700 MHz systems.

Reflecting the commitment to a shared "system-of-systems" approach to address the state's LMR public safety and interoperability needs in California, is the large number of regional and multi-county digital P25 systems in the state; as Table 4.1.1-7 illustrates (California Office of Emergency Services, 2013). There are 26 public safety digital P25 systems operational in California and Table 4.1.1-7 below lists these LMR systems and their operating frequencies. The majority of these digital P25 systems operate on either 700 MHz or 800 MHz; California's future expansion licenses are all at 700 MHz as its SCIP indicates (Project 25.org, 2015).

Table 4.1.1-7: California Public Safety P25 Networks

California P25 Public Safety Systems	Frequency Band
Countywide Coordinated Communications System (CCCS) Orange County	800 MHz
East Bay Regional (EBRCS)	700 MHz/800 MHz
Eastern Riverside County Interoperable Communications Authority (ERICA)	800 MHz
Interagency Communications Interoperability P25	UHF Hi
Interagency Communications Interoperability System (ICIS)	UHF Hi
LA City (STRS)	800 MHz
LA County REACT	UHF Lo
Marin County P25 (MERA)	UHF Hi
Monterey County Public Safety	700 MHz
Oakland	800 MHz
Sacramento Regional Radio (SRRCS) P25	800MHz
San Bernardino County	700 MHz
San Diego City 700 MHz	700 MHz
San Diego City 800 MHz	800 MHz
San Diego County-Imperial County (RCS)	800 MHz
San Diego County 71	700 MHz
San Francisco County/City	700 MHz
San Manuel	UHF Lo
San Mateo County 700 MHz	700 MHz
San Mateo County UHF Hi	UHF Hi
Yuma Regional Communications System	700 MHz/800 MHz
LA Countywide Integrated radio System (CWIRS)	800 MHz
LA Regional Interoperable Communications System (LA-RICS)	700 MHz
Placer Countywide Interoperable Radio Network (CIRN)	VHF
Riverside County Public Safety Enterprise Communication P25 (PSEC)	700 MHz
Silicon Valley Regional Communications System (SVRCS)	700 MHz

Sources: (FCC, 2014a) (FCC, 2014b)

Public Safety Answering Points

According to the Federal Communication Commission's (FCC) Master PSAP registry, there are 650 PSAPs in California serving the state's 58 counties (FCC, 2015a).

Commercial Telecommunications Infrastructure

California's commercial telecommunications industry and infrastructure is robust with multiple service providers, offering products and services via the full spectrum of telecommunications technologies (FCC, 2014a) (FCC, 2014b). The following sub-sections present information on California's commercial telecommunications infrastructure, including information on the number of carriers and technologies deployed; geographic coverage; voice, Internet access, and wireless subscribers; and the quantity and location of telecommunications towers, fiber optic plant, and data centers.

Carriers, Coverage, and Subscribers

California's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems as well as cable submarine systems for international connectivity. Table 4.1.1-8 presents the number of providers of switched access[6] lines, Internet access,[7] and mobile wireless services including coverage.

[6] "A service connection between an end user and the local telephone company's switch; the basis of plain old telephone services (POTS)" (FCC, 2014a).

[7] Internet access includes Digital Subscriber Line (DSL), cable modem, fiber, satellite, and fixed wireless providers.

Table 4.1.1-8: Telecommunications Access Providers and Coverage in California as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access lines [a]	223	98% of households [b]
Internet access [c]	130	65% of households
Mobile Wireless [d]	7	94% of population

Sources: (FCC, 2014a) (FCC, 2014b) (NTIA, 2014) (FCC, 2013)

[a] Switched access lines are a service connection between an end user and the local telephone company's switch (the basis of older telephone services); this number of service providers was reported by the FCC as of December 31, 2013 in Table 17 as the total of ILEC and non-ILEC providers (FCC, 2014b).
[b] Household coverage data provided by the FCC in "Universal Service Monitoring Report" as a Voice Penetration percentage (percentage of household with a telephone in the unit) and is current as of 2013.
[c] Internet access providers are presented in Table 21 by technology provided; the number of service providers is calculated by subtracting the reported Mobile Wireless number from the total reported number of providers. Household coverage is provided in Table 13 (FCC, 2014a).
[d] Mobile wireless provider data was retrieved from the FCC National Broadband Map website (www.broadbandmap.gov/data-download). The process of the data collection is explained in the broadband footnote.

Table 4.1.1-9 shows the wireless providers in California and their geographic coverage.

Table 4.1.1-9: Wireless Telecommunications Coverage by Providers in California

Wireless Telecommunications Providers	Coverage
Verizon Wireless	43.34%
AT&T Mobility LLC	36.08%
T-Mobile	14.52%
MetroPCS	11.36%
Sprint	8.55%
Digital Path, Inc.	6.71%
U.S. Cellular	6.64%
unWired Broadband, Inc.	6.14%
Other[a]	26.21%

Source: (NTIA, 2014)

[a]Other: Provider with less than 5% coverage area. Providers include: Cricket Wireless; 101 Netlink; Internet Free Planet; Succeed.Net; Skyriver Communications Inc.; Velocity Communications, Inc.; Valley Internet; Central Valley Broadband; North Coast Internet; Golden State Cellular; Fire2Wire; OACYS Technology; USA Communications; Ruralnet Wireless LLC; Cal.net; Vista Broadband Networks, Inc.; Etheric Networks; Surfnet Communications; Volcano Internet Provider; California Broadband Services; Sebastian – Audeamus; Plumas-Sierra Wireless; CyberNet Communications Inc.; Cal-Ore Communications, Inc.; Digitaldune; Tsunami-Wireless; SmarterBroadband, Inc.; CalDSL; Winters Broadband LLC; KV Wireless; Frazier Mountain Internet Service, Inc.; CALAVERAS INTERNET; IWVISP; Pinnacles Telephone Co.; Mother Lode Internet LLC.

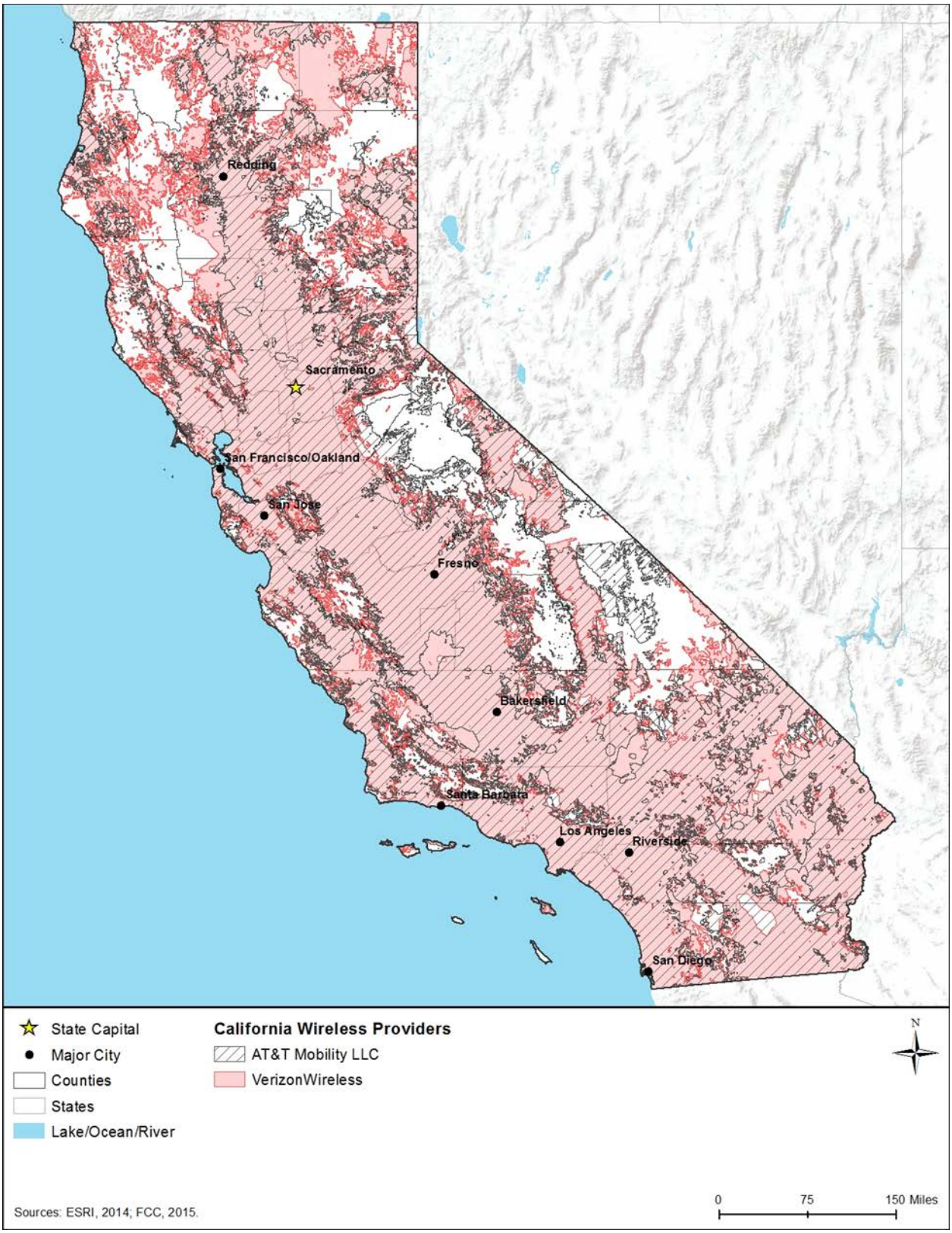


Figure 4.1.1-4: Top Wireless Providers Availability in California

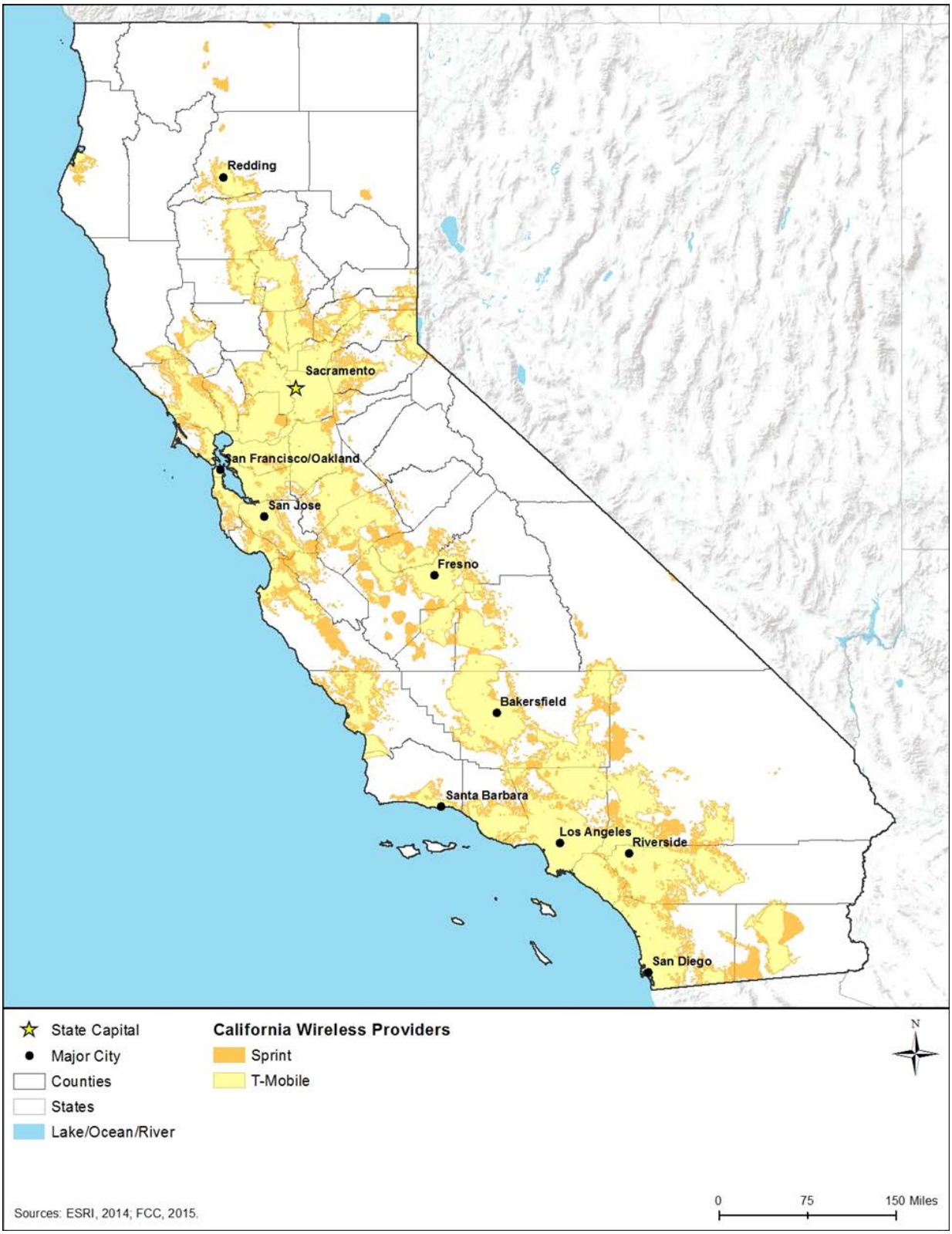


Figure 4.1.1-5: Sprint and T-Mobile Wireless Availability in California

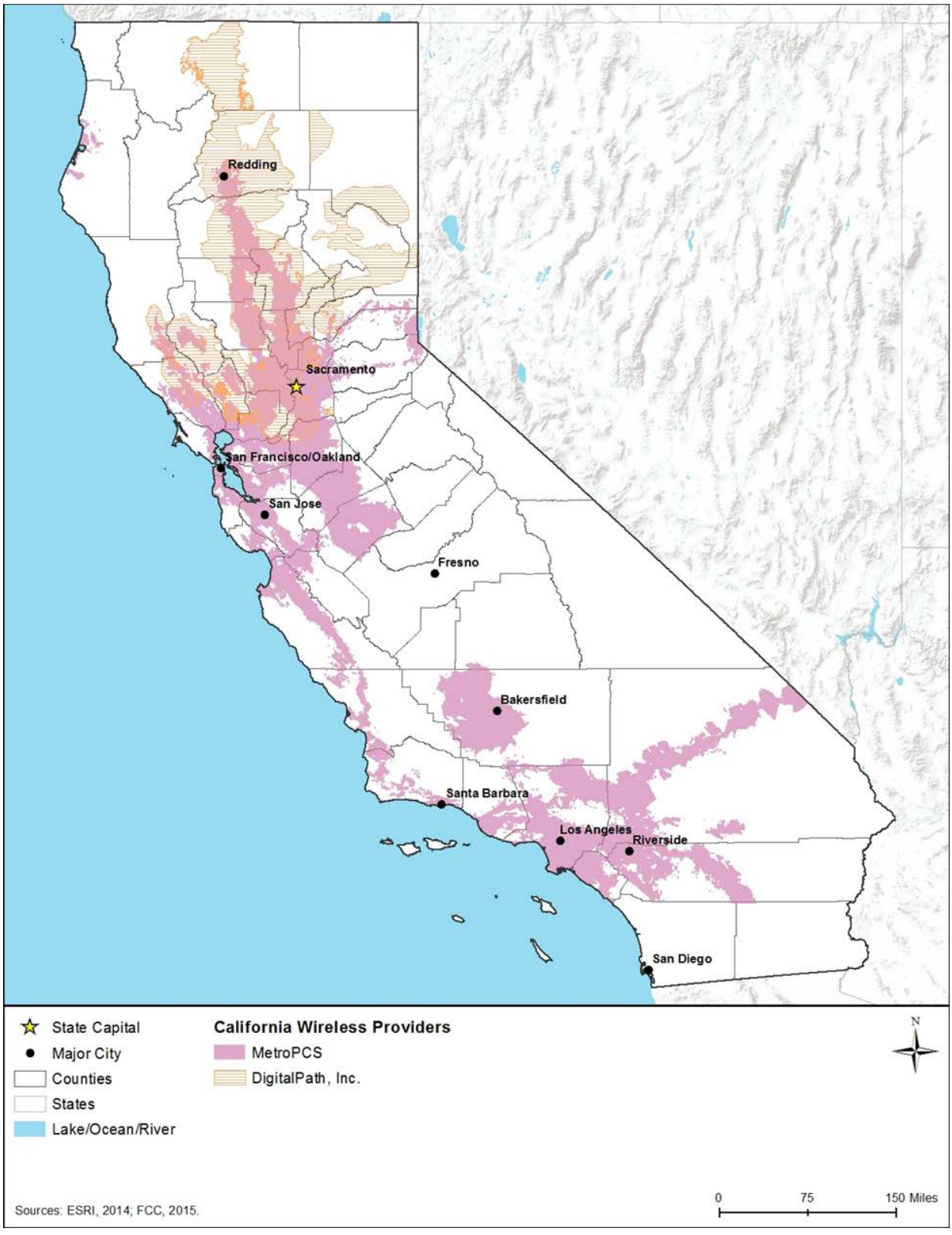


Figure 4.1.1-6: MetroPCS and Digital Path Inc. Wireless Availability in California

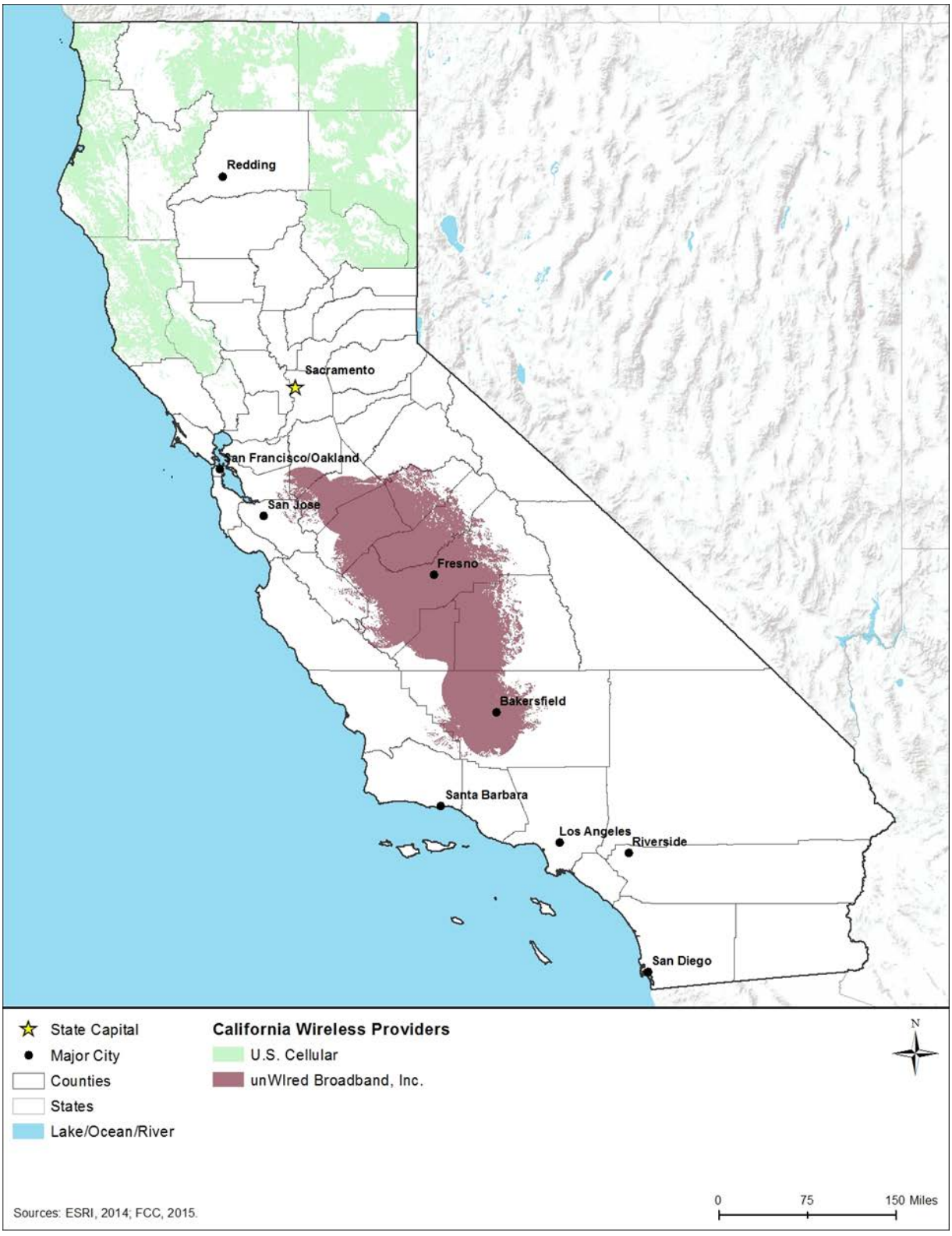


Figure 4.1.1-7: U.S. Cellular and unWired Broadband Inc. Wireless Availability in California

Figure 4.1.1-8: Other Providers Wireless Availability in California

Towers

There are many types of domestic towers employed today by the telecommunications industry, government agencies, and other owners. Towers are designed and used for a variety of purposes, and the height, location, and supporting structures and equipment are all designed, constructed, and operated according to the technical specifications of the spectrum used, the type of equipment mounted on the tower, geographic terrain, need for line-of-sight transmissions to other towers, radio frequency needs, and other technical specifications. There are three general categories of stand-alone towers: monopole, lattice, and guyed. Typically, monopole towers are the smallest, followed by lattice towers at a moderate height, and guyed towers at taller heights (with the guyed wires providing tension support for the taller heights) (CSC, 2007). In general, taller towers can provide communications coverage over larger geographic areas, but require more land for the actual tower site, whereas shorter towers provide less geographic coverage and require less land for the tower site. Figure 4.1.1-9 presents representative examples of each of these categories or types of towers.

Monopole
100 – 200 feet
Source:
http://laps.noaa.gov/birk/laps_intranet/site_photos/Monarch/tower.jpg

Lattice
200 – 400 feet
Source: Personal Picture

Guyed
200 – 2,000 feet
Source:
http://www.esrl.noaa.gov/gmd/ccgg/insitu/

Figure 4.1.1-9: Types of Towers

Prepared by: Booz Allen Hamilton

Telecommunications tower infrastructure proliferates throughout California, although tower infrastructure is concentrated in the higher and more densely populated areas of California; Redding, Sacramento, San Francisco, Oakland, San Jose, Fresno, Bakersfield, Santa Barbara, Los Angeles, Riverside, and San Diego. Owners of towers and some types of antennas are required to register those infrastructure assets with the Federal Communications Commission

(FCC) (FCC, 2016b).[8] Table 4.1.1-10 presents the number of towers (including broadcast towers) registered with the FCC in California, by tower types, and Figure 4.1.1-11 presents the location of those structures, as of June 2016.

Table 4.1.1-10: Number of Commercial Towers in California by Type

Constructed[a] Towers[b]		**Constructed Monopole Towers**	
100ft. and over	92	100ft.and over	0
75ft.–100ft	154	75ft.–100ft.	1
50ft.–75ft	345	50ft.–75ft.	1
25ft.–50ft	822	25ft.–50ft.	77
25ft.and below	1,328	25ft. and below	326
Subtotal	**2,741**	**Subtotal**	**405**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft. and over	22	100ft. and over	6
75ft.–100ft.	11	75ft.–100ft.	4
50ft.–75ft.	21	50ft.–75ft.	13
25ft.–50ft.	6	25ft.–50ft.	25
25ft. and below	9	25ft. and below	21
Subtotal	**69**	**Subtotal**	**69**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft. and over	6	100ft. and over	2
75ft.–100ft.	25	75ft.–100ft.	2
50ft.–75ft.	52	50ft.–75ft.	6
25ft.–50ft.	83	25ft.–50ft.	4
25ft. and below	46	25ft. and below	0
Subtotal	**212**	**Subtotal**	**14**
Constructed Tanks[d]			
Tanks	25		
Subtotal	**25**		
Total All Tower Structures		**3,535**	

Source: (FCC, 2015b)

[a] Planned construction or modification has been completed. Results will return only those antenna structures that the FCC has been notified are physically built or planned modifications/alterations to a structure have been completed (FCC, 2015b).

[b] Self-standing or guyed (anchored) structure used for communication purposes (FCC, 2012).

[c] Multiple constructed structures per antenna registration (FCC, 2016c).

[d] Any type of tank – water, gas, etc. with a constructed antenna (FCC, 2016c).

[8] An antenna structure must be registered with the FCC if it is taller than 200 feet above ground level or could interfere with the flight path of a nearby airport (FCC, 2016b).

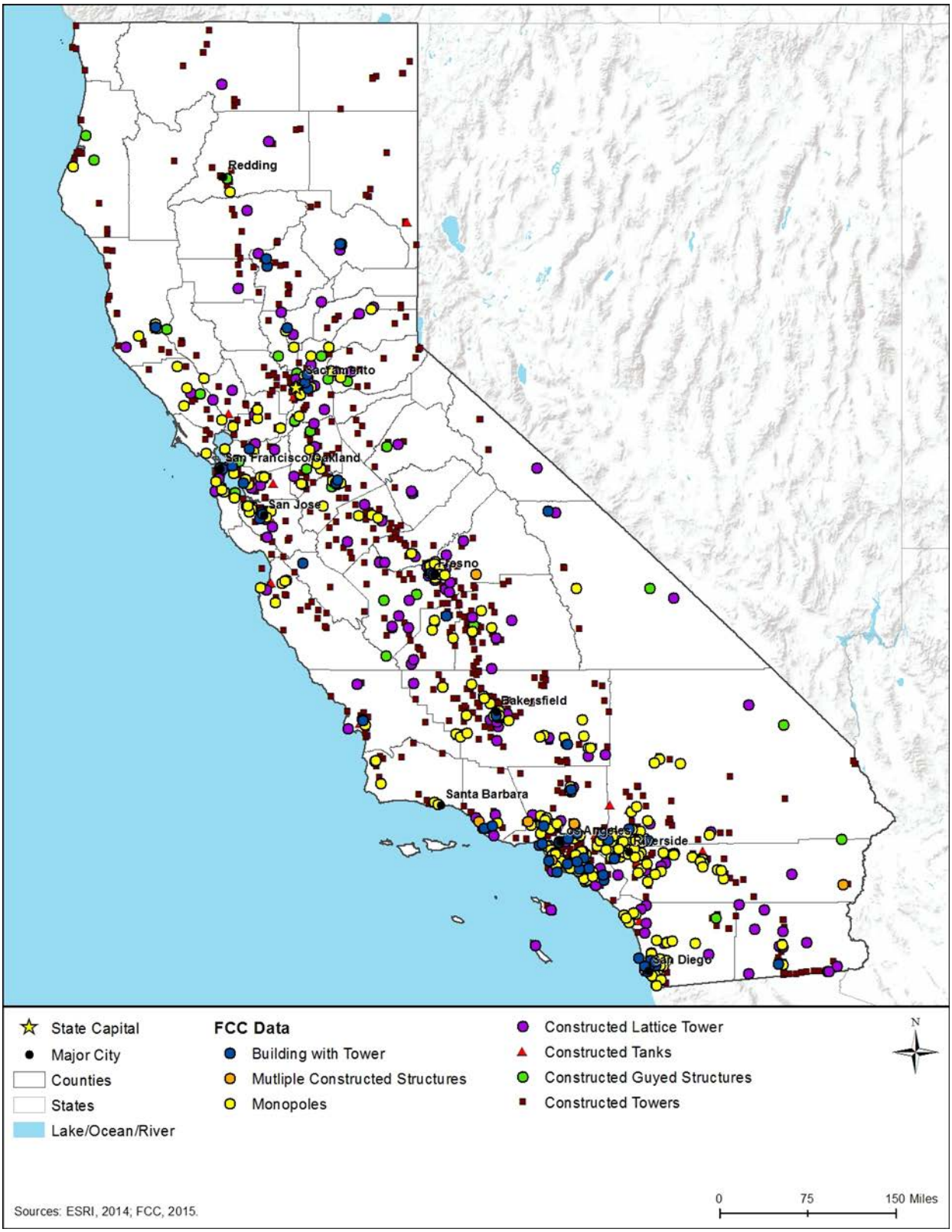


Figure 4.1.1-10: FCC Tower Structure Locations in California

Fiber Optic Plant (Cables)

Fiber optic plant, or cables, can be buried directly in the ground; pulled, blown, or floated into ducts, conduits, or innerduct (flexible plastic protective sleeves or tubes); placed under water; or installed aerially between poles, typically on utility rights-of-way (ROWs). A fiber optic network includes an access network consisting of a central office, distribution and feeder plant (cables of various sizes directly leaving a central office and splitting to connect users to the network), and a user location, as shown in Figure 4.1.1-11. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).

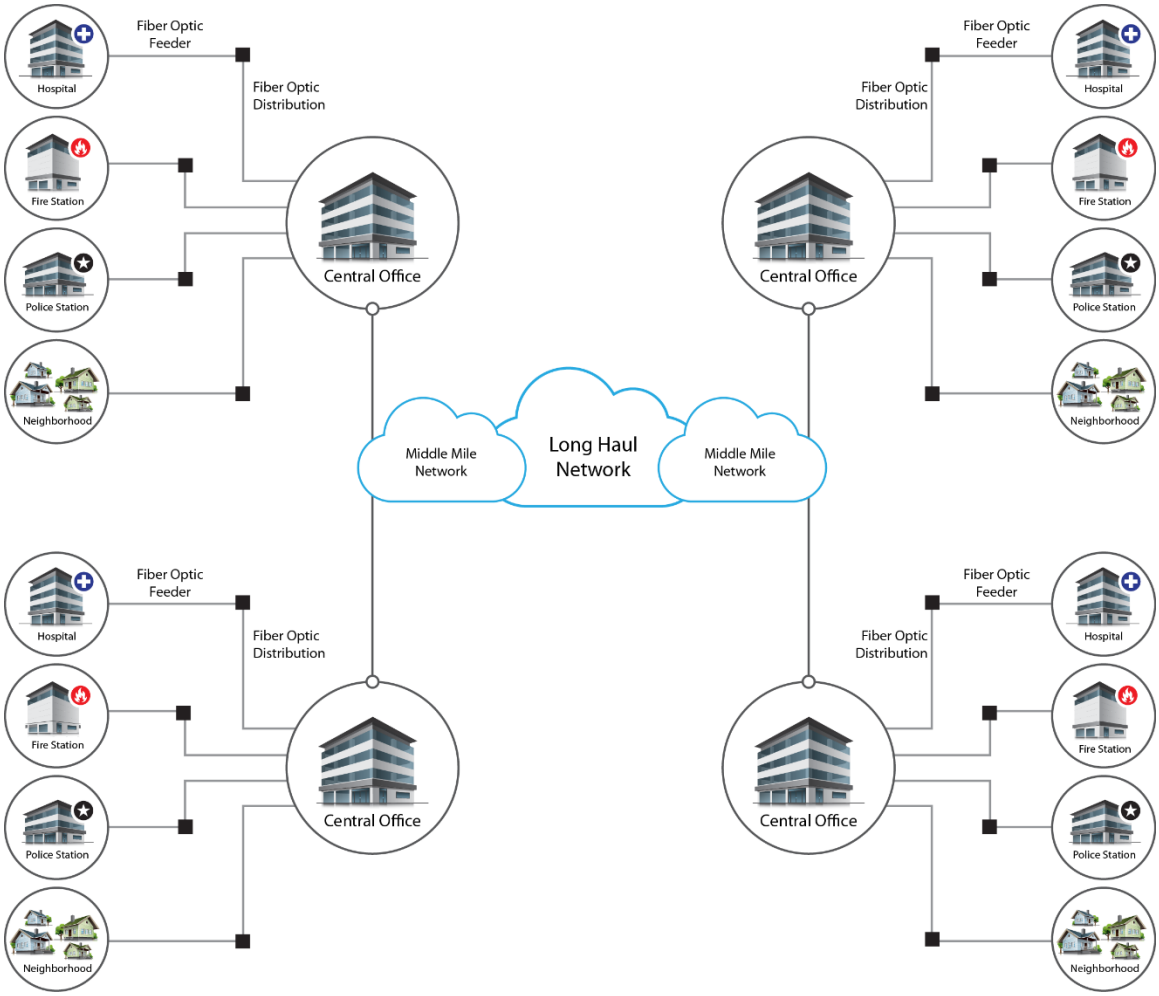


Figure 4.1.1-11: Typical Fiber Optic Network in California

Source: (ITU-T, 2012)

Prepared by: Booz Allen Hamilton

Last Mile Fiber Assets

In California, fiber access networks are concentrated in the highest population centers as shown in the figures below. There are 48 fiber providers that offer service in California, as listed in Table 4.1.1-11 shows coverage for AT&T California and Verizon, Figure 4.1.1-13 shows coverage for Comcast and Time Warner Cable, Figure 4.1.1-15 shows coverage for MegaPath, and Figure 4.1.1-16 shows coverage for all providers with less than 5 percent coverage area, respectively.[9]

Table 4.1.1-11: Fiber Provider Coverage

Fiber Provider	Coverage
AT&T California	4.42%
MegaPath	3.17%
Comcast	1.55%
Time Warner Cable	1.33%
Verizon	1.29%
Other[a]	4.84%

Source: (NTIA, 2014)

[a]Other: Providers with less than 5% coverage area are Charter Communications Inc.; Frontier Communications of California; Cox Communications; Sonic.net; Sierra Telephone Company, Inc.; Ponderosa Telephone Company; Mediacom California LLC; Suddenlink Communications; New Edge Networks; Bright House Networks; Consolidated Communications; Integra Telecom; TW Telecom; Sebastian – Kerman; The Siskiyou Telephone Company; Wave Broadband; Volcano Internet Provider; Cal-Ore Telephone Co.; Northland Cable TV; Level 3 Communications, LLC; Astound Broadband; TDS Telecom; Sebastian – Foresthill; PAETEC Communications, Inc.; Calaveras Internet; Central Valley Cable TV; Ducor Telephone Company; USA Communications; Sebastian – Audeamus; Calneva Broadband LLC; Horizon Cable TV, Inc.; Champion Broadband; RMA Broadband & Cable TV; Pinnacles Telephone Co.; Lone Pine Television Inc.; Fort Mojave Telecommunications Inc.; Zayo Group, LLC; Race Communications; Telscape Communications; San Bruno Cable TV; Cogent Communications; Catalina Broadband Solutions; Raw Bandwidth Telecom, Inc.

[9] The broadband map utilized data collected as part of the broadband American Recovery and Reinvestment Act initiative. The data was retrieved from the FCC National Broadband Map website (www.broadbandmap.gov/data-download). Each state's broadband data was downloaded accordingly. The data pertaining to broadband data/coverage for census blocks, streets, addresses, and wireless were used. Census blocks, roads, and addresses were merged into one file and dissolved by similar business and provider names. Square miles were calculated for each provider. The maps show all providers over 5% on separate maps; providers with areas under 5% were merged and mapped as "California Other Fiber Providers". All Wireless providers were mapped as well; those with areas under 5% were merged and mapped as "California Other Wireless Providers". Providers under 5% were denoted in their respective tables.

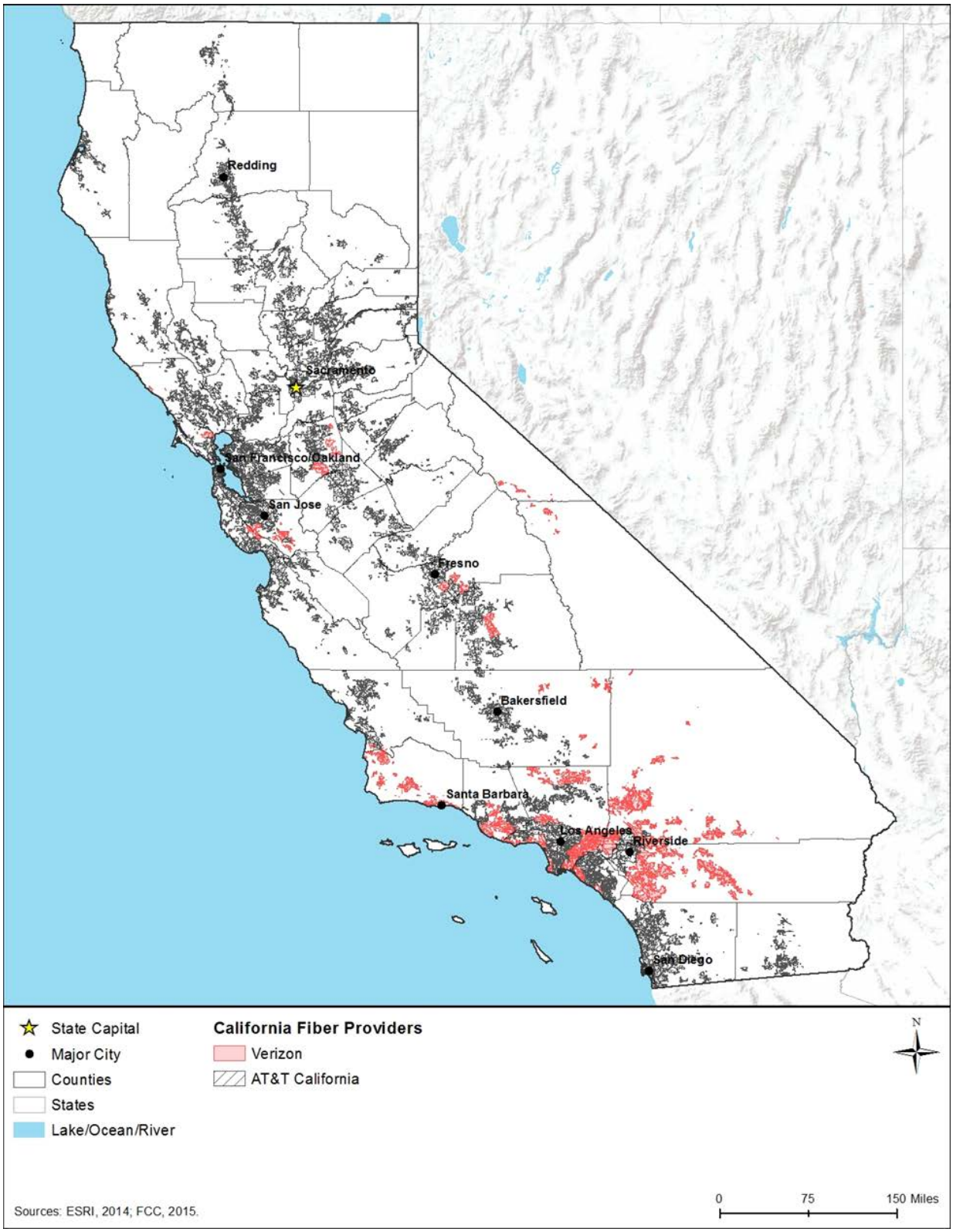


Figure 4.1.1-12: Fiber Availability in California for AT&T and Verizon

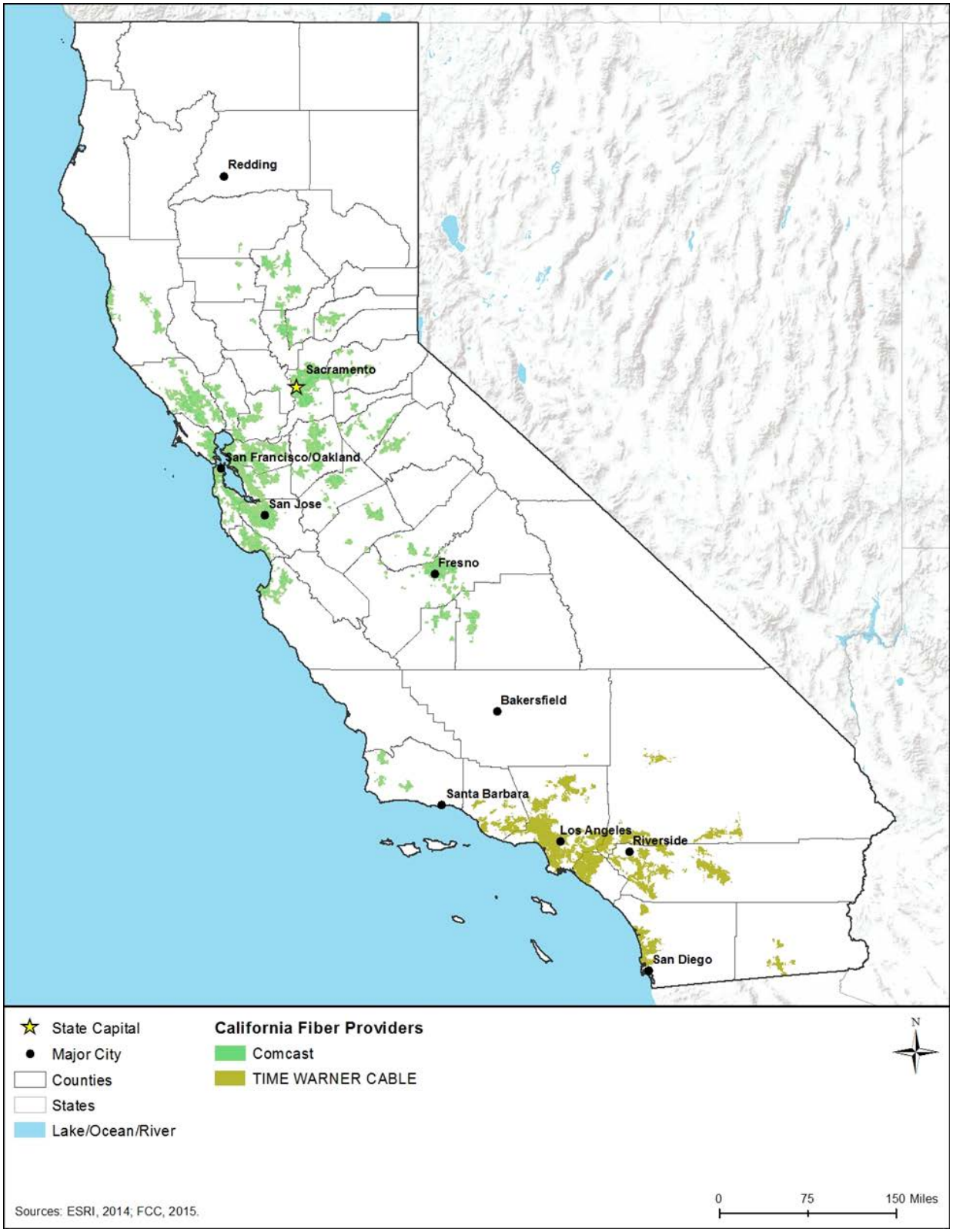


Figure 4.1.1-13: Comcast and Time Warner Cable's Fiber Availability in California

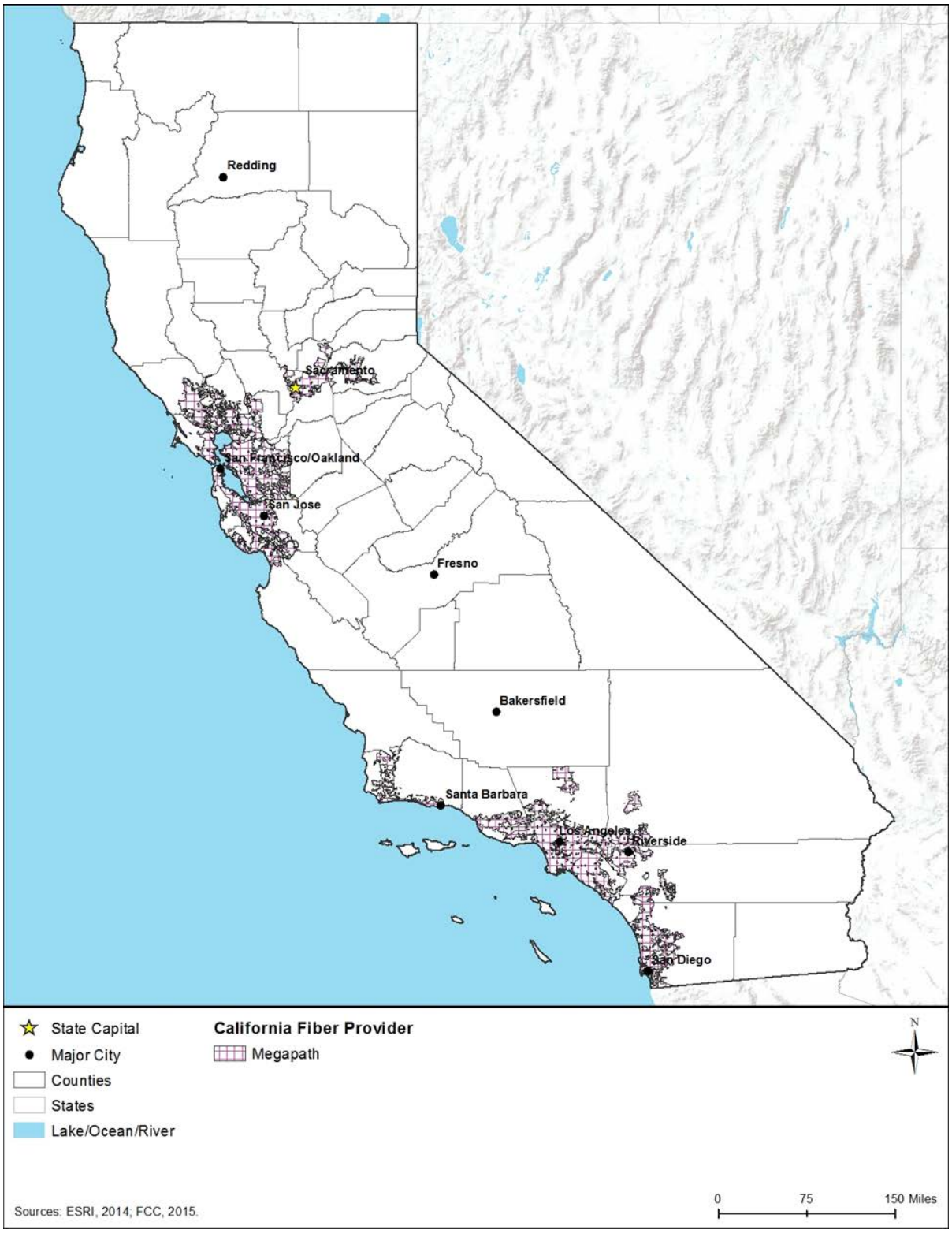


Figure 4.1.1-14: MegaPath's Fiber Availability in California

Figure 4.1.1-15: Other Providers' Fiber Availability in California

Data Centers

Data centers (also known as network access points, collocation facilities, hosting centers, carrier hotels, and Internet exchanges) are large telecommunications facilities that house routers, switches, servers, storage, and other telecommunications equipment. Data centers facilitate efficient network connectivity among and between telecommunications carriers and between carriers and their largest customers. These facilities also provide racks and cages for equipment, power and cooling, cabling, physical security, and 24x7 monitoring (CIO Council, 2015; GAO, 2013). Ownership of data centers may be public or private; comprehensive information regarding data centers may not be publicly available as some are related to secure facilities.

4.1.1.6 Utilities

Utilities are the essential systems that support daily operations in a community and cover a broad array of public services, such as electricity, water, wastewater, and solid waste. Section 9.1.4, Water Resources, describes the potable water sources in the state.

Electricity

Some aspects of the operation of California's investor owned electric utilities are overseen by the California Public Utilities Commission (CPUC), including the regulation of the rates charged to customers, as well as ensuring the reliability of service (CPUC, 2015). As of 2016, there are three large investor-owned electric utilities (Pacific Gas and Electric Company (PG&E), Southern California Edison, and San Diego Gas and Electric Company (SDGE)) and four small utilities (CPUC, 2016). Most electricity service in the state is provided by power generating facilities fueled by natural gas (EIA, 2015a). In 2014, California natural gas facilities produced 120,426,435 megawatthours[10] of electricity, 60.5 percent of the total 198,807,622 megawatthours generated in the state. Nuclear power provided 8.5 percent, hydroelectric power provided 8.3 percent, wind power 6.5 percent, and geothermal energy 6.1 percent. Facilities powered by solar power, biomass, and other gasses and coal all provided smaller amounts of electricity (EIA, 2015a). "In 2014, California ranked fourth in the nation in conventional hydroelectric generation, second in net electricity generation from other renewable energy resources, and first as a producer of electricity from both solar energy and geothermal energy" (EIA, 2015c). It is also worth noting that "Average site electricity consumption in California homes is among the lowest in the nation (6.9 megawatthours per year), according to EIA's Residential Energy Consumption Survey" (EIA, 2015c). The majority of the energy used in California is used in the transportation and industrials sectors. In 2013, transportation accounted for 37.8 percent and industry accounted for 23.6 percent of energy used. The residential and commercial sectors both consumed 19.3 percent of the state's energy (EIA, 2015c).

[10] One megawatthour is defined as one thousand kilowatt-hours or 1 million watt-hours; where one watthour is "the electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour." (EIA, 2016c)

Water

The CalEPA's State Water Resources Control Board has a Division of Drinking Water (DDW) within it. "The DDW regulates public water systems; oversees water recycling projects; permits water treatment devices; supports and promotes water system security; and performs a number of other functions" (CalEPA, 2015a). The public water systems (PWSs) regulated by the DDW are defined as systems "for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year" (CalEPA, 2015b). These systems are broken into three categories: community, transient non-community, and non-transient non-community. Community systems serve a minimum of 15 service connections for yearlong residents or regularly serve at least 25 yearlong residents. Non-transient non-community systems serve at least 25 of the same people at least six months each year. Transient non-community systems are those that do not fit these description, such as motels or rest stops (CalEPA, 2015b). California has 7,441 PWSs, of which 2,962 are community systems, 1,448 are non-transient non-community systems, and 3,031 are transient non-community systems.

The CalEPA operates a Drinking Water Source Assessment and Protection Program (DWSAP) to help identify and protect California drinking water sources. Part of the protection process are Source Water Assessments (SWAs), mandated by the federal Safe Drinking Water Act (SDWA) (CalEPA, 2015c). SWAs delineate areas used for source water, identify potential contaminants, and assess the risks of the contaminants affecting the water systems. Assessments have been performed for almost all of California's public water systems (CalEPA, 2015c). Consumer Confidence Reports (CCRs) are delivered annually to the users of the systems, as required by federal law (CalEPA, 2015d).

Wastewater

California regulates its wastewater through two main methods: the permitting of wastewater dischargers and the certification of wastewater facility operators (CalEPA, 2015e) (CalEPA, 2015f). The federal Clean Water Act requires that facilities that discharge wastewater into the waters of the U.S. must have a National Pollutant Discharge Elimination System (NPDES) Permit. The permitting program is ultimately overseen by the U.S. Environmental Protection Agency (USEPA) (USEPA, 2015a). Unlike some states, California has had authority over various parts of the permitting program since 1973, and has full authority over its wastewater permits since 1989 (USEPA, 2015b). In California, this NPDES permitting program is run by the "State Water Resources Control Board (State Water Board) and the nine Regional Water Quality Control Boards (Regional Water Boards), collectively Water Boards" and NPDES permits are known as waste discharge requirements (WDRs) (CalEPA, 2015e). Permits can be authorized for individual facilities with individual needs (CalEPA, 2015g). Most permits, however, are general permits used "to cover multiple facilities within a specific category. The use of general permits allows the Water Boards to allocate resources in a more efficient manner and provide timely permit coverage for large numbers of facilities in the same category" (CalEPA, 2015h). Wastewater facility operators must also be certified by the CalEPA. The CalEPA uses five levels of certification to differentiate levels of education and experience in the

management and discharge of wastewater, which helps to ensure that qualified employees operate the facilities in the interest of public health (CalEPA, 2015f).

Solid Waste Management

Solid waste management facilities in California are under the regulatory authority of the California Department of Resources Recycling and Recovery. California "leads the nation with an approximate 65 percent diversion rate for all materials, and today recycling supports more than 140,000 green jobs in California" (CalRecycle, 2015a). As of April 2016, California had 621 active and permitted solid waste facilities: 198 landfills, 406 transfer/process stations, and 175 composting facilities (CalRecycle, 2015b). In the 2014 Disposal-Facility-Based Characterization of Solid Waste in California, the Department of Resources, Recycling, and Recovery lists 30,864,279 tons of waste as having been disposed of in California during 2014, of which 37.4 percent was organic material, 17.4 percent was paper, 10.4 percent was plastic, and 19.9 percent was classified as inert or other. "Organic materials such as food scraps, yard waste, and lumber continue to be a large part of the waste disposed in California landfills" (CalRecycle, 2015c). The category of "inert" material contains substances like concrete and gypsum board. When compared with a similar study performed in 2008, the "largest change in the overall waste stream composition was a decrease from 29 percent to 20 percent in the Inerts and Other class" (CalRecycle, 2015c).

4.1.2 Soils

4.1.2.1 Definition of the Resource

The Soil Science Society of America defines soil as:

(i) "The unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants." (NRCS, 2015b)

(ii) "The unconsolidated mineral or organic matter on the surface of the Earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics." (NRCS, 2015b)

Five primary factors account for soil development patterns. A combination of the following variables contributes to the soil type in a particular area (University of Minnesota, 2001):

- *Parent Material*: The original geologic source material from the soil formed affects soil aspects, including color, texture, and ability to hold water.
- *Climate*: Chemical changes in parent material occur slowly in low temperatures. However, hot temperatures evaporate moisture, which also facilitates chemical reactions within soils. The highest degree of reaction within soils occurs in temperate, moist climates.

- *Topography*: Steeper slopes produce increased runoff, and, therefore, downslope movement of soils. Slope orientation also dictates the microclimate to which soils are exposed, because different slope faces receive more sunlight than others.
- *Biology*: The presence/absence of vegetation in soils affects the quantity of organic content of the soil.
- *Time*: Soil properties are dependent on the period over which other processes act on them.

4.1.2.2 Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. Applicable federal laws and regulations that apply to soils, such as the Farmland Protection Policy Act of 1981, are in Appendix C, Environmental Laws and Regulations. A list of applicable state laws and regulations is included in Table 4.1.2-1 below.

Table 4.1.2-1: Relevant California Soils Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
National Pollutant Discharge Elimination System (NPDES)	California State Water Resources Control Board	Soil and erosion controls are required as part of the state's Construction Storm water General Permit for sites that disturb 1 acre or more of land or as NPDES permits for other discharges to waters of the U.S.
California Coastal Act	California Coastal Commission	Erosion control plans are required under the Coastal Development Permit, required for any "development"[11] activity in the coastal zone.

4.1.2.3 Environmental Setting

California is composed of three Land Resource Region (LRR),[12] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006):

- California Subtropical Fruit, Truck, and Specialty Crop Region;
- Northwestern Forest, Forage, and Specialty Crop Region; and
- Western Range and Irrigated Region.

Within and among California's three LRRs are 19 Major Land Resource Areas (MLRA),[13] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming. The locations and characteristics of California's MLRAs are presented in Figure 4.1.2-1 and Table 4.1.2-2.

Soil characteristics are an important consideration for FirstNet insomuch as soil properties could influence the suitability of sites for network deployment. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, elevation, and position on the

[11] Development is broadly defined to include demolition, construction, replacement of structures, repair or maintenance activities that could result in environmental impacts, grading, removal of, or placement of rock, soil, or other materials, or land use changes (California Coastal Commission, 2014).
[12] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (NRCS, 2006).
[13] Major Land Resource Area: "A geographic area, usually several thousand acres in extent, that is characterized by a particular pattern of soils, climate, water resources, land uses, and type of farming" (NRCS, 2006).

landscape, biota[14] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[15] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky, & Rogers, 2004). Soils can also be affected by a variety of surface uses that loosen topsoil and damage or remove vegetation or other groundcover, which may result in accelerated erosion, compaction, and rutting[16] (discussed further in the subsections below).

[14] The flora and fauna of a region.
[15] Expansive soils are characterized by "the presence of swelling clay minerals" that absorb water molecules when wet and expand in size or shrink when dry leaving "voids in the soil" (Rogers, Olshansky, & Rogers, 2004).
[16] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009).

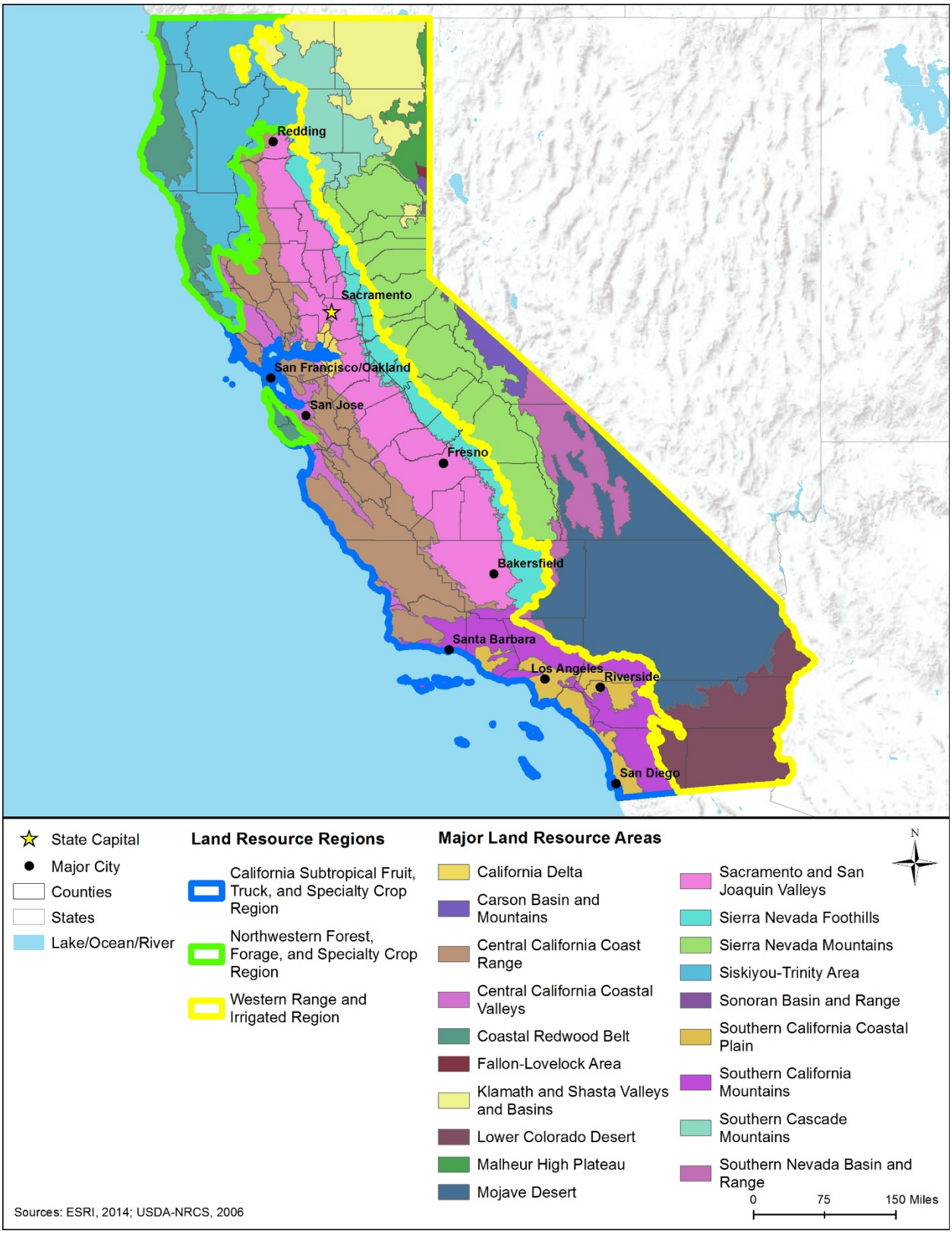


Figure 4.1.2-1: Locations of Major Land Resource Areas in California

Table 4.1.2-2: Characteristics of Major Land Resource Areas in California

MLRA Name	Region of State	Soil Characteristics
California Delta	Northern California	Entisols,[a] Histosols,[b] and Mollisols[c] are the dominant soil orders. These clayey and very deep soils are very poorly drained to poorly drained.
Carson Basin and Mountains	Northeastern California	Aridisols,[d] and Mollisols are the dominant soil orders. These well drained soils range from moderately deep to very shallow, and are clayey or loamy[e] and usually skeletal.
Central California Coast Range	Western California	Alfisols,[f] Entisols, Mollisols, and Vertisols[g] are the dominant soil orders. These clayey or loamy soils are well drained to excessively drained, and range from very shallow to deep.
Central California Coastal Valleys	Western California	Alfisols, Entisols, Mollisols, and Vertisols are the dominant soil orders. These clayey or loamy soils are very deep, and range from somewhat poorly drained to somewhat excessively drained.
Coastal Redwood Belt	Northwestern California	Alfisols, Entisols, Inceptisols,[h] and Ultisols,[i] are the dominant soil orders. These well drained soils are clayey or loamy, and are deep to very deep.
Fallon-Lovelock Area	Northeastern California	Aridisols and Entisols are the dominant soil orders. These soils range from shallow to very deep, and are typically well drained. They are loamy or sandy and often skeletal.
Klamath and Shasta Valleys and Basins	Northern California	Mollisols is the dominant soil order, with Histosols and Inceptisols less so. These loamy, sandy, or clayey soils range from very poorly drained to well drained, and range from shallow to very deep.
Lower Colorado Desert	Southern California	Aridisols and Entisols are the dominant soil orders. These very deep soils range from coarse to fine textured, and are well drained to excessively drained.
Malheur High Plateau	Northeastern California	Aridisols and Mollisols are the dominant soil orders. These very deep soils typically range from poorly drained to well drained, and are loamy or clayey.
Mojave Desert	Southern California	Aridisols and Entisols are the dominant soil orders. These soils range from shallow to very deep, and are well drained or excessively drained. They are loamy-skeletal or sandy-skeletal.
Sacramento and San Joaquin Valleys	Central California	Alfisols, Aridisols, Entisols, Mollisols, and Vertisols are the dominant soil orders. These clayey or loamy soils are very deep, and are moderately well drained to well drained.
Sierra Nevada Foothills	Central California	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These loamy soils range from very shallow to very deep, and are well drained or somewhat excessively drained.
Sierra Nevada Mountains	Northeastern California	Alfisols, Entisols, Inceptisols, Mollisols, and Ultisols are the dominant soil orders. These soils are loamy or sandy, and range from shallow to very deep. They are typically well drained or somewhat excessively drained.
Siskiyou-Trinity Area	Northwestern California	Alfisols, Inceptisols, and Ultisols are the dominant soil orders. These loamy and well drained soils are typically moderately deep to very deep.

MLRA Name	Region of State	Soil Characteristics
Sonoran Basin and Range	Southeastern California	Aridisols and Entisols are the dominant soil orders. These well drained to somewhat excessively drained soils range from very shallow to very deep.
Southern California Coastal Plain	Southwestern California	Alfisols, Entisols, and Mollisols are the dominant soil orders. These sandy or loamy soils are well drained or somewhat excessively drained, and are deep to very deep.
Southern California Mountains	Southwestern California	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These sandy or loamy soils are well drained or somewhat excessively drained, and range from very shallow to deep.
Southern Cascade Mountains	Northern California	Alfisols, Andisols,[j] Entisols, Inceptisols, and Mollisols are the dominant soil orders. These soils range from poorly drained to well drained, and are typically very deep.
Southern Nevada Basin and Range	Southeastern California	Aridisols and Entisols are the dominant soil orders, and Mollisols also figure prominently in mountainous areas. These soils are loamy-skeletal or sandy-skeletal, and are well drained or somewhat excessively drained. They range from very shallow to very deep.

[a] Entisols: "Soils that show little to no pedogenic horizon development. They occur in areas of recently deposited parent materials or in dunes, steep slopes, or flood plains where erosion or deposition rates are faster than rate of soil development. They make up nearly 16% of the world's ice-free land surface" (NRCS, 2015d).
[b] Histosols: "Histosols have a high content of organic matter and no permafrost. Most are saturated year round, but a few are freely drained. They form in decomposed plan remains that accumulate in water, forest litter, or moss faster than they decay. Histosols make up about 1% of the world's ice-free land surface" (NRCS, 2015d).
[c] Mollisols: "Soils that have a dark colored surface horizon relatively high in content of organic matter. They are base rich throughout and quite fertile. Mollisols form under grass in climates that have a moderate to pronounced seasonal moisture deficit" (NRCS, 2015d).
[d] Aridisols: "Soils that are too dry for the growth of mesophytic plants. Lack of moisture greatly restricts the intensity of the weathering process and limits most soil development processes to the upper part of the soils. They make up about 12% of the world's ice-free land surface" (NRCS, 2015d).
[e] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts." (Purdue University Consumer Horticulture, 2006)
[f] Alfisols: "Soils found in semiarid to moist areas that are formed from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil. They are productive for most crop, are primarily formed under forest or mixed vegetative cover, and make up nearly 10% of the world's ice-free land surface" (NRCS, 2015d).
[g] Vertisols: "Vertisols have a high content of expanding clay minerals. They undergo pronounced changes in volume with changes in moisture, and have cracks that open and close periodically, and that show evidence of soil movement. Vertisols transmit water very slowly, have undergone little leaching, and tend to be high in natural fertility. They make up about 2% of the world's ice-free land surface" (NRCS, 2015d).
[h] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates, and make up nearly 17% of the world's ice-free land surface" (NRCS, 2015d).
[i] Ultisols: "Soils found in humid environments that are formed from fairly intense weathering and leaching processes. This results in a clay-enriched subsoil dominated by minerals. They have nutrients concentrated in the upper few inches and make up 8% of the world's ice-free land surface" (NRCS, 2015d).
[j] Andisols: "As a group, Andisols tend to be highly productive soils. They include weakly weathered soils with much volcanic glass as well as more strongly weathered soils. They are common in cool areas with moderate to high precipitation, especially those areas associated with volcanic materials" (NRCS, 2015d)

4.1.2.4 Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy;[17] there are 12 soil

[17] "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2013c).

orders in the world and they are characterized by both observed and inferred[18] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (NRCS, 2015e). The STATSGO2[19] soil database identifies 32 different soil suborders in California (NRCS, 2015a). Figure 4.1.2-2 depicts the distribution of the soil suborders, and Table 4.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[18] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)" (NRCS, 2015g).
[19] STATSGO2 is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map is comprised of general soil association units and is maintained and distributed as a spatial and tabular dataset.

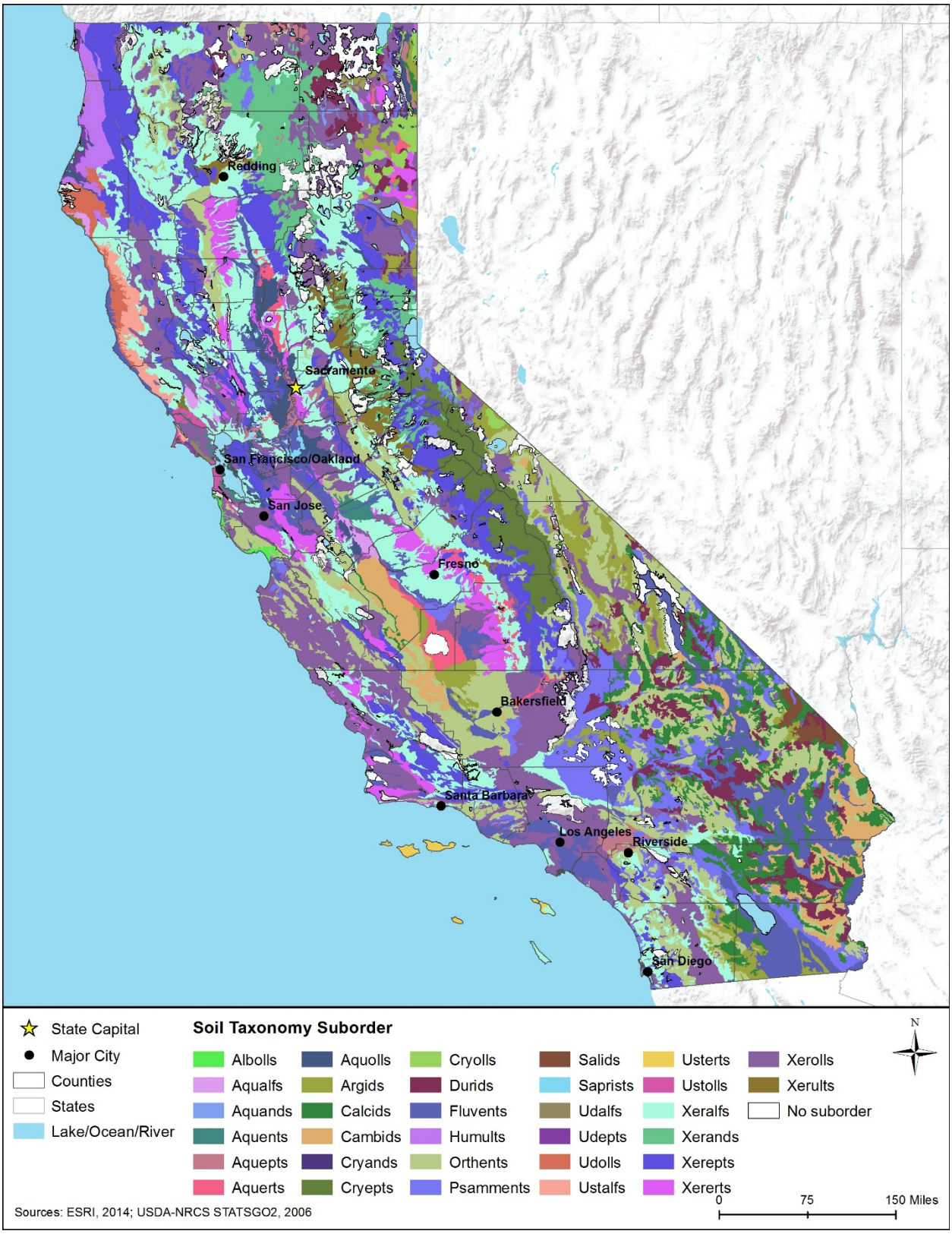


Figure 4.1.2-2: California Soil Taxonomy Suborders

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Table 4.1.2-3: Major Characteristics of Soil Suborders[a] Found in California, as depicted in Figure 4.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[b]	Hydrologic Group	Runoff Potential	Permeability[c]	Erosion Potential	Compaction and Rutting Potential
Mollisols	Albolls	Albolls have a fluctuating ground water table, with gentle slopes. They supported grasses and shrubs, and are typically used as cropland.	Clay, Loam, Sandy clay loam	0–15	Poorly drained to somewhat poorly drained	No, Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Aqualfs are used as cropland for growing corn, soybeans, and rice, and most have some artificial drainage or other water control. Nearly all Aqualfs have likely supported forest vegetation in the past.	Clay loam, Gravelly loam, Sandy clay loam	0–75	Poorly drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Andisols	Aquands	Aquands are primarily found under grass or forest vegetation, and are used as pasture or cropland.	Silt loam	0–1	Poorly drained	Yes	C	Medium	Moderate	Medium	High, due to hydric soil and poor drainage conditions
Entisols	Aquents	Widely distributed, with some forming in sandy deposits, and most forming in recent sediments. Aquents support vegetation that tolerates either permanent or periodic wetness, and are mostly used for pasture, cropland, forest, or wildlife habitat.	Clay, Sand, Silty clay loam	0–3	Very poorly drained to somewhat poorly drained	No, Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage. If these soils have not been artificially drained, ground water is at or near the soil surface at some time during normal years (although not usually in all seasons). They are used primarily for pasture, cropland, forest, or wildlife habitat. Many Aquepts have formed under forest vegetation, but they can have almost any kind of vegetation.	Loam, Loamy fine sand, Mucky clay, Silt loam, Silty clay loam	0–2	Very poorly drained to somewhat poorly drained	No, Yes	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Vertisols	Aquerts	Aquerts are wet soils, with prolonged moisture at or near the soil surface. Their natural vegetation includes savanna, grass, and forest. They are used as forest, rangeland, and cropland, although drainage for cropland can be difficult due to poor drainage.	Clay, Clay loam, Silty clay loam, Weathered bedrock	0–2	Poorly drained to somewhat poorly drained	No, Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Mollisols	Aquolls	Aquolls support grass, sedge, and forb vegetation, as well as some forest vegetation. However, most have been artificially drained and utilized as cropland.	Clay loam, Sandy loam, Silt loam, Silty clay, Silty clay loam, Stratified clay loam to silty clay, Stratified loam to silty clay loam	0–5	Very poorly drained to somewhat poorly drained	No, Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Aridisols	Argids	Argids are found in the western U.S. They are primarily used as wildlife habitat or rangeland, although some can also be used as cropland, if irrigated.	Clay, Fine sandy loam, Gravelly loam, Gravelly loamy fine sand, Gravelly loamy sand, Gravelly sandy loam, Sandy clay loam, Sandy loam, Silty clay, Stratified gravelly loamy sand to sandy loam, Stratified sandy loam to sandy clay loam, Unweathered bedrock, Very gravelly clay loam, Very gravelly coarse sandy loam, Very gravelly sandy loam, Weathered bedrock	0–75	Moderately well drained to well drained	No, Yes	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[b]	Hydrologic Group	Runoff Potential	Permeability[c]	Erosion Potential	Compaction and Rutting Potential
Aridisols	Calcids	Calcids are found in the western United States, and used primarily as wildlife habitat or rangeland, although some have been utilized as irrigated cropland. They have high levels calcium carbonates that persist due to insufficient precipitation.	Coarse sandy loam, Extremely gravelly loam, Fine sandy loam, Gravelly loam, Loamy sand, Sandy loam, Very gravelly sandy loam	0–30	Somewhat poorly drained to somewhat excessively drained	No	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	Low
Aridisols	Cambids	Cambids are found in the western United States, with little soil development. They are primarily used as wildlife habitat or rangeland, although some can also be used as cropland, if irrigated.	Clay, Clay loam, Gravelly sandy loam, Loam, Sandy clay loam, Sandy loam, Stratified extremely gravelly loamy sand to very gravelly loam, Stratified sandy loam to fine sandy loam	0–30	Moderately well drained to somewhat excessively drained	No	B, C	Medium	Moderate, Low	Medium	Low
Andisols	Cryands	Cryands are typically used as forest, and are primarily formed under vegetation in coniferous forests.	Fine sandy loam, Gravelly loamy coarse sand, Weathered bedrock	1–50	Well drained to excessively drained	No	A, B	Low, Medium	High, Moderate	Low to Medium, depending on slope	Low
Inceptisols	Cryepts	Cryepts are soils of high latitudes or high elevations, and support cold weather vegetation such as conifers and hardwoods. They are mostly used as forest or wildlife habitat, although some are also used as cropland.	Extremely stony loamy coarse sand, Gravelly sandy loam, Very cobbly sandy loam, Weathered bedrock	15–75	Moderately well drained to somewhat excessively drained	No	B	Medium	Moderate	Medium	Low
Mollisols	Cryolls	Cryolls are generally freely drained, cold weather soils. They are primarily used as rangeland, along with some forest and pasture. Forest, grass, or grass/shrub vegetation are supported with these soils.	Clay loam, Fine sandy loam, Gravelly clay loam, Very gravelly loam	4–50	Well drained	No	B, C	Medium	Moderate, Low	Medium	Low
Aridisols	Durids	Durids are found in the western United States, with the majority found in Nevada and Idaho. A few areas are used as irrigated cropland, but most are utilized as wildlife habitat or rangeland. They are characterized by a soil subsurface horizon cemented by silica (duripan).	Cemented, Clay, Clay loam, Gravelly sandy loam, Indurated, Loam, Sandy loam, Unweathered bedrock, Very gravelly loam	0–70	Very poorly drained to well drained	No, Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Entisols	Fluvents	Fluvents are mostly freely drained soils that form in recently-deposited sediments on flood plains, fans, and deltas located along rivers and small streams. Unless protected by dams or levees, these soils frequently flood. Fluvents are normally utilized as rangeland, forest, pasture, or wildlife habitat, with some also used for cropland.	Clay, Clay loam, Fine sandy loam, Loam, Loamy fine sand, Loamy sand, Sand, Sandy loam, Silt loam, Stratified gravelly sand to gravelly loam, Stratified sand to loam, Stratified sand to loamy sand, Stratified sand to silt loam, Stratified sandy clay loam to silty clay loam, Stratified sandy loam to loam, Stratified sandy loam to silty clay loam, Stratified silty clay loam to clay, Very fine sandy loam, Very gravelly sandy loam	0–9	Very poorly drained to somewhat excessively drained	No, Yes	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	High, due to hydric soil and poor drainage conditions
Ultisols	Humults	Humults are generally freely drained and support both coniferous forest and rain forest. They are primarily used as pasture, forest, or cropland.	Gravelly clay loam, Gravelly loam, Sandy clay loam, Unweathered bedrock, Weathered bedrock	2–75	Well drained	No	B, C	Medium	Moderate, Low	Medium	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[b]	Hydrologic Group	Runoff Potential	Permeability[c]	Erosion Potential	Compaction and Rutting Potential
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Channery loam, Clay loam, Coarse sand, Coarse sandy loam, Extremely stony loamy coarse sand, Fine sandy loam, Gravelly fine sand, Gravelly fine sandy loam, Gravelly loam, Gravelly loamy coarse sand, Gravelly loamy sand, Gravelly sand, Gravelly sandy loam, Loam, Loamy sand, Sandy loam, Silt loam, Stratified very gravelly loamy coarse sand to gravelly coarse sandy loam, Unweathered bedrock, Variable, Very cobbly loamy sand, Very gravelly fine sandy loam, Very gravelly loam, Very gravelly loamy coarse sand, Very gravelly loamy sand, Very gravelly sand, Very gravelly sandy loam, Very gravelly very fine sandy loam, Weathered bedrock	0–99	Somewhat poorly drained to excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Entisols	Psamments	Psamments are sandy in all layers. In some arid and semi-arid climates, they are among the most productive rangeland soils, and are primarily used as rangeland, pasture, or wildlife habitat. Those Psamments that are nearly bare are subject to wind erosion and drifting, and do provide good support for wheeled vehicles.	Cobbly sand, Fine sand, Gravelly coarse sand, Gravelly fine sand, Gravelly loamy coarse sand, Gravelly sand, Loamy coarse sand, Loamy fine sand, Loamy sand, Sand, Sandy loam, Stratified gravelly sand to gravelly very fine sandy loam, Weathered bedrock	0–75	Well drained to excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Aridisols	Salids	Salids are primarily found in Nevada and Utah, and commonly located in depressions (playas). They have a saline horizon that makes them unsuitable for agricultural use unless they are leached of salts. Therefore, most of these soils are utilized for wildlife habitat or rangeland.	Clay loam	0–2	Poorly drained	No	D	High	Very Low	High	Low
Histosols	Saprists	Saprists have organic materials are well decomposed, and many support natural vegetation and are used as woodland, rangeland, or wildlife habitat. Some Saprists, particularly those with a mesic or warmer temperature regime, have been cleared, drained, and used as cropland.	Muck	0–2	Very poorly drained	Yes	C	Medium	Low	Medium	High, due to hydric soil and poor drainage conditions
Alfisols	Udalfs	Udalfs have an udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Very gravelly loam	15–20	Well drained	No	B	Medium	Moderate	Medium	Low
Inceptisols	Udepts	Udepts have an udic or perudic (saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the Northwest and mixed or hardwood forest in the East. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture.	Sand and gravel, Very gravelly loam	2–30	Well drained	No	B	Medium	Moderate	Medium	Low
Mollisols	Udolls	Udolls are found in humid climates. They are more or less freely drained, and have historically supported tall grass prairie. They are used as pasture or rangeland, and as cropland in areas with little slope.	Unweathered bedrock	50–75	Well drained	No	C	Medium	Low	Medium	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[b]	Hydrologic Group	Runoff Potential	Permeability[c]	Erosion Potential	Compaction and Rutting Potential
Alfisols	Ustalfs	Ustalfs are primarily used for grazing or cropland, and they also support savanna and grassland vegetation. They are found in areas with a marked dry season.	Unweathered bedrock, Weathered bedrock	9–75	Well drained	No	B, C	Medium	Moderate, Low	Medium	Low
Vertisols	Usterts	Usterts are soils with low permeability, and receive low rainfall amounts. They support grasses and forbs, and are mostly used for rangeland or cropland. However, but due to their low permeability, they typically need to be artificially drained if irrigated, to prevent standing water and a buildup of salinity.	Clay, Unweathered bedrock	5–50	Well drained	No	D	High	Very Low	High	Low
Mollisols	Ustolls	Ustolls typically supported grass and forest vegetation, and are now primarily used as cropland or rangeland. They are generally freely drained, and found in subhumid to semiarid climates. Areas with drought are common, and blowing soil can be an issue.	Clay loam, Gravelly loam, Loam, Unweathered bedrock, Very gravelly loam, Very gravelly sandy loam	2–75	Poorly drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Alfisols	Xeralfs	Xeralfs support warmer weather, drier vegetation such as annual grasses, forbs, and woody shrubs, along with cooler, wetter vegetation such as coniferous forest. They are typically used for forest, grazing, and croplands.	Clay, Clay loam, Coarse sandy loam, Cobbly fine sandy loam, Cobbly loam, Extremely cobbly clay loam, Extremely cobbly sandy loam, Extremely gravelly sandy loam, Fine sandy loam, Gravelly clay, Gravelly clay loam, Gravelly loam, Gravelly sandy loam, Indurated, Loam, Loamy coarse sand, Sandy clay, Sandy clay loam, Sandy loam, Silt loam, Silty clay loam, Stony clay loam, Stratified loamy sand to sandy loam, Stratified sandy loam to clay loam, Unweathered bedrock, Very cobbly clay, Very gravelly clay loam, Very gravelly coarse sandy loam, Very gravelly loam, Very gravelly sandy clay loam, Weathered bedrock	0–75	Poorly drained to well drained	No, Yes	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Andisols	Xerands	Xerands are used as forest, pasture, or cropland. They form under grass and shrub vegetation or under coniferous forest vegetation.	Cobbly coarse sandy loam, Cobbly sandy loam, Extremely stony fine sandy loam, Gravelly coarse sandy loam, Gravelly loam, Gravelly sandy clay loam, Gravelly sandy loam, Sandy loam, Very cobbly sandy loam, Very gravelly sandy loam, Weathered bedrock	0–65	Well drained to somewhat excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Inceptisols	Xerepts	Xerepts support coniferous forest, shrubs, grasses, and trees, are typically used for forest, pasture, or croplands, and sometimes as wildlife habitat or rangeland. They are generally freely drained and found in the western United States.	Clay loam, Coarse sandy loam, Cobbly loam, Extremely gravelly clay loam, Extremely gravelly loam, Extremely stony loam, Fine sandy loam, Gravelly coarse sandy loam, Gravelly loam, Gravelly sandy loam, Loam, Loamy sand, Sandy clay loam, Sandy loam, Silt loam, Silty clay loam, Unweathered bedrock, Very cobbly loamy coarse sand, Very fine sandy loam, Very gravelly loam, Very gravelly sandy loam, Weathered bedrock	0–90	Well drained to somewhat excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[b]	Hydrologic Group	Runoff Potential	Permeability[c]	Erosion Potential	Compaction and Rutting Potential
Vertisols	Xererts	Xererts are found in Mediterranean climates. The soils become very dry in the summer, and most in the winter, which can cause significant damage to roads and structures. They are mostly used for cropland or rangeland, and native vegetation is mainly forbs and grasses.	Clay, Clay loam, Cobbly clay loam, Silty clay, Silty clay loam, Very cobbly clay, Very cobbly silty clay, Weathered bedrock	0–75	Poorly drained to well drained	No	D	High	Very Low	High	Low
Mollisols	Xerolls	Xerolls are found on sloping lands that Mediterranean climates. They are generally freely drained, although typically dry for extended periods in summer. These soils are used for irrigated croplands, and those on very steep slopes are used for rangeland and forest.	Cemented, Channery clay loam, Channery loam, Clay, Clay loam, Coarse sandy loam, Cobbly clay, Cobbly clay loam, Cobbly fine sandy loam, Extremely gravelly clay loam, Fine sand, Fine sandy loam, Gravelly clay, Gravelly clay loam, Gravelly coarse sandy loam, Gravelly fine sandy loam, Gravelly loam, Gravelly loamy coarse sand, Gravelly sandy clay loam, Gravelly sandy loam, Indurated, Loam, Loamy coarse sand, Loamy sand, Sandy clay loam, Sandy loam, Silt loam, Silty clay loam, Stratified gravelly coarse sand to gravelly sandy clay loam, Stratified gravelly loamy sand to gravelly loamy fine sand, Stratified sandy loam to clay loam, Unweathered bedrock, Very channery clay, Very channery loam, Very cobbly clay loam, Very cobbly loam, Very cobbly sandy clay loam, Very fine sandy loam, Very gravelly clay loam, Very gravelly loam, Very gravelly loamy coarse sand, Very gravelly sandy clay loam, Very gravelly sandy loam, Weathered bedrock	0–75	Poorly drained to excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Ultisols	Xerults	Xerults are generally freely drained and support coniferous vegetation. They are used as cropland, pasture, or forest.	Clay, Loam, Sandy clay loam, Sandy loam, Unweathered bedrock, Weathered bedrock	2–75	Moderately well drained to well drained	No	B, C, D	Medium, High	Moderate, Low Very Low	Medium to High, depending on slope	Low

[a] Soil suborders constitute a broad range of soil types. Within each suborder, the range of soil types may have a range of properties across the state, which result in multiple values being displayed in the table for that suborder.

[b] Hydric Soil: "A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part." (NRCS, 2015c) Soil suborders constitute a broad range of soil types. Within each soil suborder, some specific soil types are hydric while others are not.

[c] Based on Runoff Potential, described in Section 4.1.2.5.

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4.1.2.5 Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[20] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 4.1.2-3 provides a summary of the runoff potential for each soil suborder in California.

Group A. Sand, loamy sand or sandy loam soils. This group of soils has "low runoff potential and high infiltration rates[21] even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission" (Purdue University, 2015). Cryands, Fluvents, Orthents, Psamments, Xerands, Xerepts, and Xerolls fall into this category in California.

Group B. Silt loam or loam soils. This group of soils has a "moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures" (Purdue University, 2015). This group has medium runoff potential. Aqualfs, Aquepts, Argids, Calcids, Cambids, Cryands, Cryepts, Cryolls, Fluvents, Humults, Orthents, Psamments, Udalfs, Udepts, Ustalfs, Ustolls, Xeralfs, Xerands, Xerepts, Xerolls, and Xerults fall into this category in California.

Group C. Sandy clay loam soils. This group of soils has "low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure" (Purdue University, 2015). This group has medium runoff potential. Aqualfs, Aquands, Aquents, Aquepts, Aquolls, Argids, Cambids, Cryolls, Durids, Fluvents, Humults, Orthents, Psamments, Saprists, Udolls, Ustalfs, Ustolls, Xeralfs, Xerands, Xerepts, Xerolls, and Xerults fall into this category in California.

Group D. Clay loam, silty clay loam, sandy clay, silty clay, or clay soils. This group of soils "has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material" (Purdue University, 2015). Albolls, Aqualfs, Aquents, Aquepts, Aquerts, Aquolls, Argids, Calcids, Durids, Fluvents, Orthents, Psamments, Salids, Usterts, Ustolls, Xeralfs, Xerands, Xerepts, Xererts, Xerolls, and Xerults fall into this category in California.

4.1.2.6 Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015f). Water-induced erosion can transport soil

[20] Classifying soils is highly generalized and it is challenging to differentiate orders as soil properties can change with distance or physical properties. The soil suborders are at a high level, therefore soil groups may be found in multiple hydrologic groups within a state, as composition, topography, etc. varies in different areas.
[21] Infiltration Rate: "The rate at which a soil under specified conditions absorbs falling rain, melting snow, or surface water expressed in depth of water per unit time," (FEMA, 2010).

into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public safety hazard (NRCS, 1996a). Table 4.1.2-3 provides a summary of the erosion potential for each soil suborder in California. Soils with medium to high erosion potential in California include those in the Albolls, Aqualfs, Aquands, Aquents, Aquepts, Aquerts, Aquolls, Argids, Calcids, Cambids, Cryands, Cryepts, Cryolls, Durids, Fluvents, Humults, Orthents, Psamments, Salids, Saprists, Udalfs, Udepts, Udolls, Ustalfs, Usterts, Ustolls, Xeralfs, Xerands, Xerepts, Xererts, Xerolls, and Xerults suborders, which are found throughout the state (Figure 4.1.2-2).

4.1.2.7 Soil Compaction and Rutting

Soil compaction and rutting occurs when soil layers are compressed by machinery or animals, which decreases both open spaces in the soil, as well as water infiltration rates (NRCS, 1996b). Moist soils with high soil water content are most susceptible to compaction and rutting, as they lack the strength to resist deformation caused by pressure. When rutting occurs, channels form and result in downslope erosion (USFWS, 2009a). Other characteristics that factor into compaction and rutting risk include soil composition (i.e., low organic soil is at increased risk of compaction), amount of pressure exerted on the soil, and repeatability (i.e., the number of times the pressure is exerted on the soil). Machinery and vehicles that have axle loads greater than 10 tons can cause soil compaction of greater than 12 inches depth (NRCS, 1996b), (NRCS, 2003).

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS, 1996b). Table 4.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in California. Soils with the highest potential for compaction and rutting in California include those in the Albolls, Aquands, Aquents, Aquepts, Aquerts, Aquolls, Argids, Durids, Fluvents, Saprists, and Xeralfs suborders, which are found throughout the state (Figure 4.1.2-2).

4.1.3 Geology

4.1.3.1 Definition of the Resource

The U.S. Geological Survey (USGS) is the primary government organization responsible for the nation's geological resources. USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and groundwater availability. Several of these elements are discussed in other sections of this PEIS, including Water Resources (Section 4.1.4), Human Health and Safety (Section 4.1.15), and Climate Change (Section 4.1.14).

This section covers the six aspects of geology most relevant to the Proposed Action and Alternatives:

- Section 4.1.3.3, Environmental Setting: Physiographic Regions and Provinces;[22, 23]
- Section 4.1.3.4, Surface Geology;
- Section 4.1.3.5, Bedrock Geology;[24]
- Section 4.1.3.6, Paleontological Resources;[25]
- Section 4.1.3.7, Fossil Fuel and Mineral Resources; and
- Section 4.1.3.8, Geologic Hazards.[26]

4.1.3.2 Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. A list of applicable state laws and regulations is included in Table 4.1.3-1.

Table 4.1.3-1: Relevant California Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CCR Title 24, Building Standards Code	California Building Standards Commission	Provides seismic design guidelines for building construction.
Additional seismic and geologic hazard requirements	Local Agencies	Check with local agencies for additional seismic and geologic hazard requirements for construction activities.
California Public Resources Code Section 5097.5	Legislative Counsel of California	"A person shall not knowingly and willfully excavate upon, or remove, destroy, injure, or deface, any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, rock art, or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over the lands."
CCR Title 14, Natural Resources § 4307a	California Department of Parks and Recreation	"No person shall destroy, disturb, mutilate, or remove earth, sand, gravel, oil, minerals, rocks, paleontological features, or features of caves."

[22] Physiographic regions: Areas of the U.S. that share commonalities based on topography, geography, and geology (Fenneman, 1916).
[23] Physiographic provinces: Subsets within physiographic regions (Fenneman, 1916).
[24] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015b).
[25] Paleontology: "Study of life in past geologic time based on fossil plants and animals," (USGS, 2015c).
[26] Geologic Hazards: Any geological or hydrological process that poses a threat to people and/or their property, which includes but is not limited to volcanic eruptions, earthquakes, landslides, sinkholes, mudflows, flooding, and shoreline movements (NPS, 2013b).

State Law/Regulation	Regulatory Agency	Applicability
CCR Title 14, Natural Resources § 4309	California Department of Parks and Recreation	"The Department may grant a permit to remove, treat, disturb, or destroy plants or animals or geological, historical, archaeological, or paleontological materials; and any person who has been properly granted such a permit shall to that extent not be liable for prosecution for violation of the foregoing."
Additional paleontological regulations	Local Agencies	Check local ordinances and resolutions for additional requirements. For example, Orange and San Bernardino Counties, along with the cities of Carlsbad, Chula Vista, Palmdale, and San Diego have additional regulations.

4.1.3.3 Environmental Setting: Physiographic Regions and Provinces

The concept of physiographic regions was created in 1916 by geologist Nevin Fenneman as a way to describe areas of the United States based on common landforms (i.e., not climate or vegetation). Physiographic regions are areas of distinctive topography, geography, and geology. Important physiographic differences between adjacent areas are generally due to differences in the nature or structure of the underlying rocks. There are eight distinct physiographic regions in the continental United States: 1) Atlantic Plain, 2) Appalachian Highlands, 3) Interior Plains, 4) Interior Highlands, 5) Laurentian Upland, 6) Rocky Mountain System, 7) Intermontane Plateaus, and 8) Pacific Mountain System. Regions are further sub-divided into physiographic provinces based on differences observed on a more local scale (Fenneman, 1916).

California has two major physiographic regions: Intermontane Plateau (Basin and Range Province) and Pacific Mountain System (Cascade-Sierra Mountains, Pacific Border, and Lower Californian Provinces) (USGS, 1964). The locations of these regions are shown in Figure 4.1.3-1 and their general characteristics summarized in the following subsections.

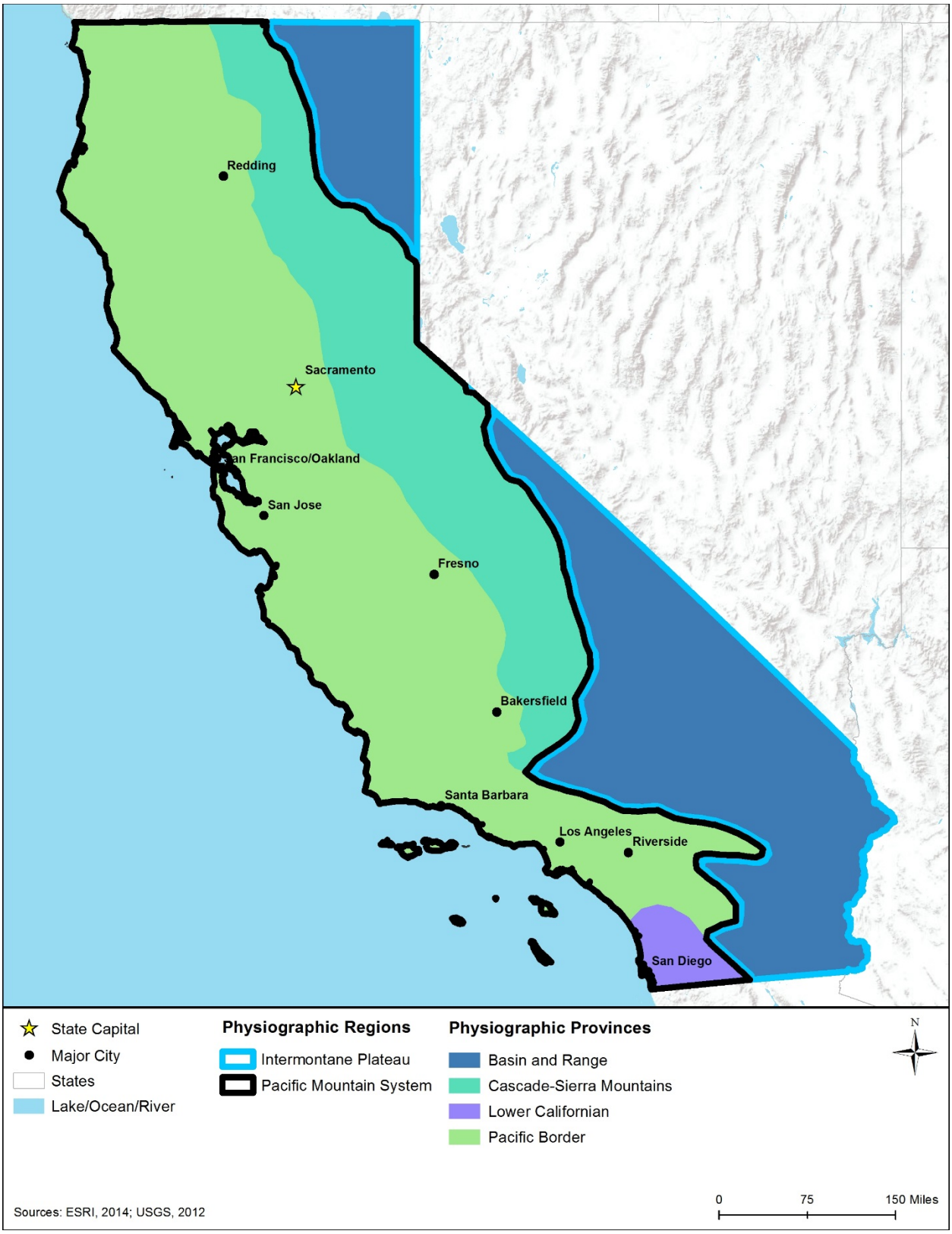


Figure 4.1.3-1: Physiographic Regions and Provinces of California

Intermontane Plateau Region

The Intermontane Plateau Region describes the area between the Rocky Mountains and the Sierra Nevada and Cascade Ranges. The Intermontane Plateau Region dates to 80 million years ago (MYA) and predates the younger Rocky Mountain System to the east which was created roughly 60 MYA.[27] The region is characterized by interspersed high-elevation plateaus and mountains and low-lying basins. The Columbia Plateau Province is one of the major elevated areas in this region. (Lew, A., 2004a)

Basin and Range Province – The Basin and Range Province is characterized by north-south trending mountains and valleys that were created as the landscape in the region underwent extension[28] over the past 30 million years (NPS, 2014a). This tectonic activity has thinned the Earth's crust and created large faults that have resulted in the "distinctive alternating pattern of linear mountain ranges and valleys… Although there are other types of faults in the Basin and Range province, the extension and crustal stretching that have shaped the present landscape produce mostly normal faults. The upthrown side of these faults form mountains that rise abruptly and steeply, and the down-dropped side creates low valleys… In places, the relief or vertical difference between the two sides is as much as 10,000 feet" (USGS, 2014a). Within California, the Basin and Range Province includes the eastern portion of the state along much of the length of the state. One of the Basin and Range's most distinctive features within California is Death Valley, which includes Badwater Basin. At 282 feet below sea level, Badwater Basin is the lowest point in the Western Hemisphere (USGS, 2012a).

Pacific Mountain System Region

The Pacific Mountain System Region describes the area including the Cascade and Sierra Nevada mountain ranges, the Coastal mountain ranges, the valleys in between these mountain ranges, and the Pacific Coast. Peaks in the Cascades and Sierra Nevada mountains rise to over 14,000 feet in elevation, while peaks in the Coastal range's granitic mountains are over 6,000 feet high. The Pacific Coast is an area of volcanic and earthquake activity from tectonic movement. (Lew, A., 2004b)

The Pacific Mountain System within California is composed of several physiographic provinces, including the Cascade-Sierra Mountains, Pacific Border, and Lower Californian (NRC, 2003).

Cascade-Sierra Mountains Province – The Cascade-Sierra Mountains Province parallels the Pacific Ocean coastline in an arc shape, and is one of the most tectonically active, and youngest, province in the nation. It is characterized by a mountainous landscape, and includes thousands of short-lived volcanoes that have built up layers of lava and debris, as well as 13 major volcanic centers (NPS, 2014b). "The Sierra [Mountains are] a tilted fault block nearly 400 miles long. Its east face is a high, rugged multiple scarp, contrasting with the gentle western slope (about 2 [degrees]) that disappears under sediments of the Great Valley." California's highest point,

[27] For consistency, this PEIS uses the University of California Berkeley Geologic Time Scale for all of the FirstNet PEIS state documents. Time scales differ among universities and researchers; FirstNet utilized a consistent time scale throughout, which may differ slightly from other sources. (University of California Museum of Paleontology, 2011)

[28] Extension: "In geology, the process of stretching the Earth's crust. Usually cracks (faults) form, and some blocks sink, forming sedimentary basins" (USGS, 2015d).

Mount Whitney (14,495 feet above sea level [ASL]) is part of the Sierra Mountains (California Geological Survey, 2002a).

Pacific Border Province – The Pacific Border Province follows the Pacific coastline of California along most of the length of the state. This province includes the lands west of the Sierra Mountains, and south to the Lower Californian Province in southern California. It is very tectonically active, and one of the youngest geological areas on the North American continent. The Pacific Border Province is characterized by lowlands and mountains on the eastern margin, and coastal areas to the west (NPS, 2014c). Within California, the Pacific Border Province's "Coast Ranges are northwest-trending mountain ranges (2,000 to 4,000, occasionally 6,000 feet elevation [ASL]), and valleys. The ranges and valleys trend northwest, subparallel to the San Andreas Fault… To the west is the Pacific Ocean. The coastline is uplifted, terraced, and wave-cut. The Coast Ranges are composed of thick Mesozoic [(251 to 66 MYA)] and Cenozoic [(66 MYA to present)] sedimentary[29] strata" (California Geological Survey, 2002a).

Lower Californian Province – The Lower Californian Province includes a portion of southwestern California including the city of San Diego. "Dominated by faults,[30] the Lower California province (sometimes called the Peninsular Ranges) is a group of mountain ranges that stretch from southern California to the tip of Baja California in Mexico. The core of the province consists of a large mass of Mesozoic plutonic[31] igneous[32] rock" (NPS, 2015a). Valleys within this area trend to the northwest and parallel the Province's faults (California Geological Survey, 2002a).

4.1.3.4 Surface Geology

Surficial geology is characterized by materials such as till,[33] sand and gravel, or clays that overlie bedrock. The surface terrain, which can include bedrock outcrops, provides information on the rock compositions and structural characteristics of the underlying geology. Because surface materials are exposed, they are subject to physical and chemical changes due to weathering from precipitation (rain and snow), wind and other weather events, and human-caused interference. Depending on the structural characteristics and chemical compositions of the surface materials, heavy precipitation can cause slope failures,[34] subsidence,[35] and erosion (Thompson, 2015).

Within California, surface deposits are particularly prevalent within California's Central Valley, which includes the cities of Sacramento, Fresno, and Bakersfield. The Great Valley measures

[29] Sedimentary Rock: "Sedimentary rocks are formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding" (USGS, 2015d).
[30] Fault: "A fracture in the Earth along which one side has moved in relative to the other. Sudden movements on faults cause earthquakes" (USGS, 2015d).
[31] Plutonic Rock: "Any igneous rock that cools beneath the surface" (USGS, 2015d).
[32] Igneous Rock: "Rock formed when molten rock (magma) that has cooled and solidified (crystallized)" (USGS, 2015d).
[33] Till: "An unsorted and unstratified accumulation of glacial sediment, deposited directly by glacier ice. Till is a heterogeneous mixture of different sized material deposited by moving ice (lodgement till) or by the melting in-place of stagnant ice (ablation till). After deposition, some tills are reworked by water" (USGS, 2013b).
[34] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses. (Idaho State University 2000)
[35] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000a).

roughly 50 miles wide by 400 miles long and has been accumulating alluvial[36] sediments since the Jurassic Period (200 to 146 MYA) (California Geological Survey, 2002a). Southern portions of the valley are "filled with marine sediments overlain by continental sediments, in some places thousands of feet deep, deposited largely by streams draining the mountains, and partially in lakes that inundated portions of the valley floor from time to time. More than half the thickness of the continental sediments is composed of fine-grained (clay, sandy clay, sandy silt, and silt) stream (fluvial) and lake (lacustrine) deposits susceptible to compaction" (Galloway & Riley, 2006). In southeastern California, the Mojave Desert contains extensive alluvial fans[37] and playas[38] that have developed over the last several thousand years. Sporadic volcanic ash deposits and lava beds are also found in the Mojave Desert (USGS, 2004). Further to the south, the Colorado Desert is also characterized by silt-laden alluvial deposits (California Geological Survey, 2002a). Figure 4.1.3-2 depicts the main surficial composition of California.

[36] Alluvium: "Sand, gravel, and silt deposited by rivers and streams in a valley bottom" (USGS, 2015d).
[37] Alluvial Fan: "A fan-shaped pile of sediment that forms where a rapidly flowing mountain stream enters a relatively flat valley. As water slows down, it deposits sediment (alluvium) that gradually builds a fan" (USGS, 2015d).
[38] Playa: "Playas are shallow, short-lived lakes that form where water drains into basins with no outlet to the sea and quickly evaporates. Playas are common features in arid (desert) regions and are among the flattest landforms in the world" (USGS, 2015d).

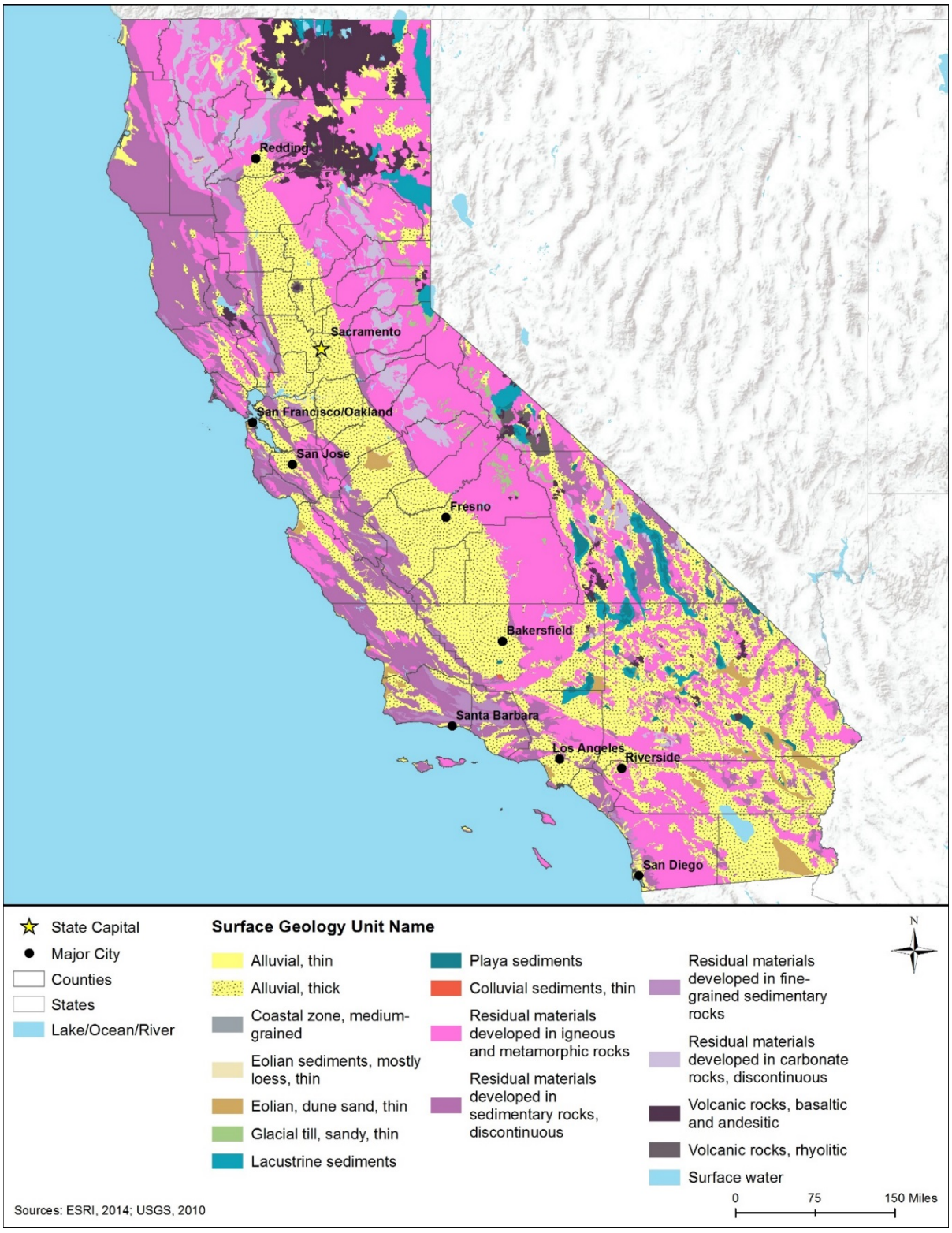


Figure 4.1.3-2: Generalized Surface Geology for California

4.1.3.5 Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015a) reveals important information about a region's surface and subsurface characteristics (i.e., three dimensional geometry), including dip (slope of the formation),[39] rock composition, and regional tectonism.[40] These structural aspects of bedrock geology are often indicative of regional stability, as it relates to geologic hazards such as landslides, subsidence, earthquakes, and erosion (New Hampshire Department of Environmental Services, 2014).

California's oldest bedrock includes Precambrian (older than 542 MYA), Paleozoic (542 to 251 MYA), and Mesozoic metamorphic[41] rocks that make up the Klamath Mountains[42] and foothills of the Sierra Mountains. Mesozoic granitic[43] rocks "are most common in the mountainous areas such as the Klamath Mountains, the Sierra Nevada, and the Peninsular Ranges," while sedimentary rocks from the same timeframe are prevalent in the Coast Ranges and coastal southern California. Cenozoic volcanic rocks are found in northern California's Cascade Mountains, as well as northeastern California's Modoc Plateau. "[Cenozoic] sandstone, shale, and conglomerate, [which are] usually deposited in relatively," shallow marine water comprise parts of coastal California, particularly in the southern half of the state. Lastly, Quaternary (2.6 MYA to present) sedimentary deposits are found throughout California's Great Valley, and include gravel, sand, silt, and clay. (California Geological Survey, 2002b)

Figure 4.1.3-3 shows the general bedrock geology for California.

[39] Dip: "A measure of the angle between the flat horizon and the slope of a sedimentary layer, fault plane, metamorphic foliation, or other geologic structure." (NPS, 2000)
[40] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust," (USGS, 2015d).
[41] Metamorphic Rocks: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids" (USGS, 2015d).
[42] The Klamath Mountains are part of the Pacific Border Province in northern California.
[43] Granite: "A coarse-grained intrusive igneous rock with at least 65% silica. Quartz, plagioclase feldspar and potassium feldspar make up most of the rock and give it a fairly light color. Granite has more potassium feldspar than plagioclase feldspar" (USGS, 2015d).

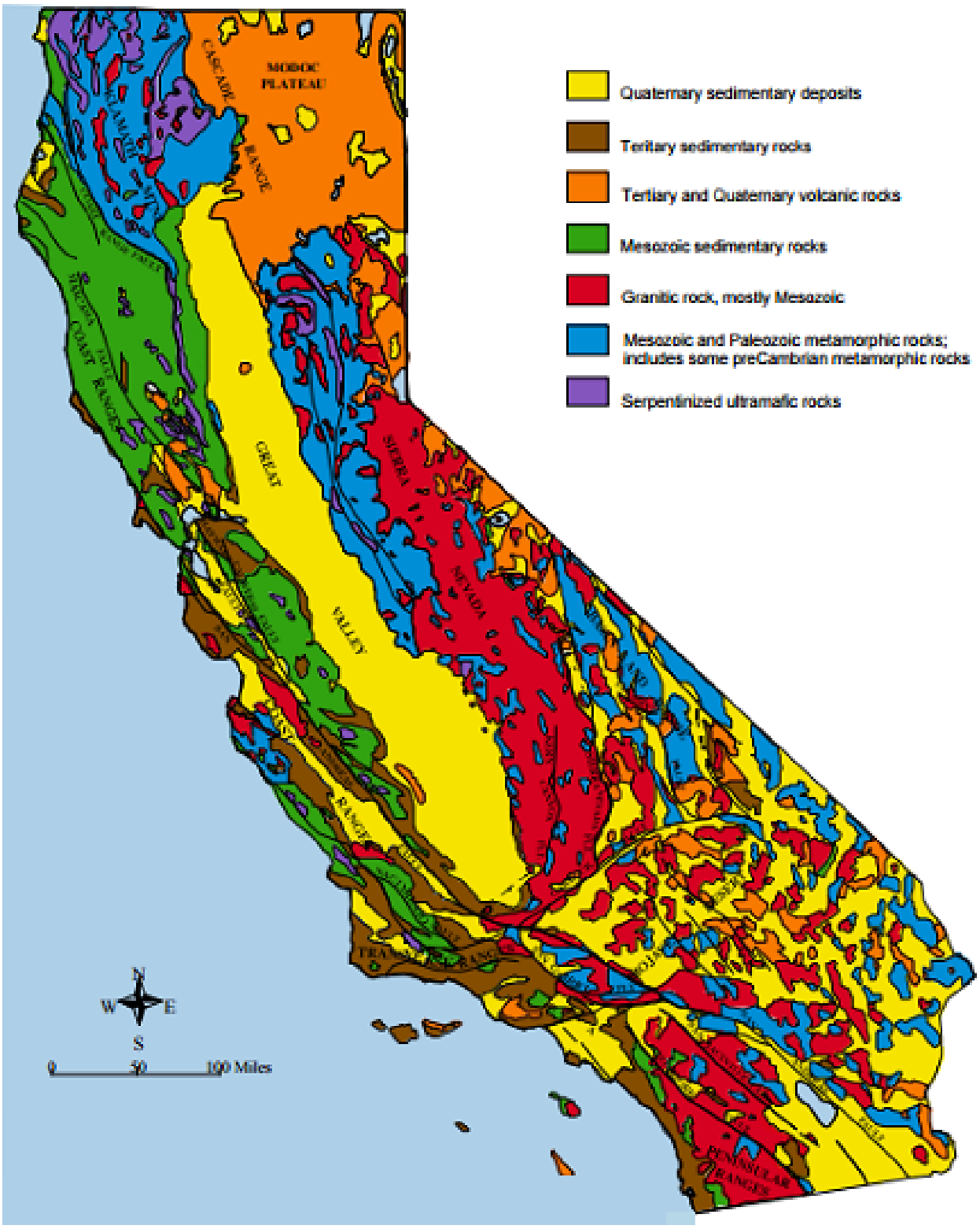


Figure 4.1.3-3: Generalized Bedrock Geology for California

Source: (California Geological Survey, 2002b)

4.1.3.6 Paleontological Resources

The western edge of North America (including California) was mostly underwater through the Paleozoic (542 to 251 MYA) and Mesozoic (251 to 66 MYA) Eras, resulting in the preservation of marine organisms from these periods. Fossils in California from the early Paleozoic Era include trilobites,[44] brachiopods,[45] corals, gastropods,[46] ammonites, and crinoids.[47] Fish, mollusk, and algae fossils have been recorded from the Carboniferous (359 to 299 MYA) and Permian (299 to 251 MYA) Periods, along with plant and insect fossils from swamp and estuarine environments. During the Triassic (251 to 200 MYA) Period, most of California was still under water, with fossils recorded from brachiopods, bivalves,[48] ammonites, echinoderms,[49] and marine reptiles. By the Jurassic (200 to 146 MYA) and Cretaceous (146 to 66 MYA) Periods, volcanic activity started building terrain on the western edge of North America. As such, fossils from marine reptiles, bivalves, brachiopods, and ammonites have been preserved in California, along with terrestrial plants. Through much of the early Cenozoic (66 MYA to present) Era, most of California was still underwater, yielding fossils from bivalves, gastropods, corals, tusk shells, echinoderms, and foraminifera.[50] Throughout the Quaternary (2.6 MYA to present) Period, California has been a terrestrial environment, with vertebrate and plant fossils recorded similar to present day species (Paleontology Portal, 2015). The state fossil of California, the sabretooth cat *Smilodon californicus*, lived from the early Oligocene (34 to 23 MYA) through the Pleistocene (2.6 MYA to 11,700 years ago) Epoch. Many sabretooth cat fossils have been found in the Rancho La Brea pits in Los Angeles (California Department of Conservation, 2015a).

4.1.3.7 Fossil Fuel and Mineral Resources

Oil and Gas

In 2015, California produced 201,740 thousand barrels of crude oil. In 2014 crude oil was produced from 42 rotary rigs (2015 numbers were not readily available at the time this document was being produced) (EIA, 2016a). In September 2015, California ranked third in the country for crude oil production. Geologic basins along the Pacific Coast and Central Valley have

[44] Trilobite: "Any member of Trilobita, an extinct class of marine arthropods. Trilobites are known from the Cambrian to the Permian. They had segmented, oval-shaped bodies and were the first animals to have complex eyes (similar to the compound eyes in modern insects)." (Smithsonian Institution, 2016)
[45] Brachiopod: "Any member of a phylum of marine invertebrate animals called Brachiopoda. Brachiopods are sessile, bivalved organisms, but are more closely related to the colonial Bryozoa than the bivalved mollusks. Brachiopod diversity peaked in the Paleozoic, but some species survive." (Smithsonian Institution, 2016)
[46] Gastropods: "Any member of a large class of mollusks (Gastropoda), commonly called snails. Gastropods live in marine, freshwater, and terrestrial habitats. They have a univalve, often spiral shell (or none at all), a muscular foot for locomotion, and distinctive sensory organs." (Smithsonian Institution, 2016)
[47] Crinoid: "The common name for any echinoderm of the class Crinoidea, including sea lilies, feather stars, etc. Crinoids are common fossils in the Paleozoic and persist to the present. Many species have stalks and radiating arms and feed on particles in the water column." (Smithsonian Institution, 2016)
[48] Bivalve: "A mollusk with a soft body enclosed by two distinct shells that are hinged and capable of opening and closing." (Smithsonian Institution, 2016)
[49] Echinoderm: "The common name for members of the phylum Echinodermata. These organisms are characterized by bodies showing radial symmetry (usually in fives) and the presence of tube feet in most forms." (Smithsonian Institution, 2016)
[50] Foraminifera: "Any member of the order Foraminifera. Foraminifera, or forams, are single-celled organisms with calcareous shells that can be found in every marine habitat." (Smithsonian Institution, 2016)

proven petroleum reservoirs, particularly in the San Joaquin Basin (EIA, 2015b). Most oil from the San Joaquin Basin has moderate sulfur content, and is derived from Tertiary (66 MYA to 2.6 MYA) formations (USGS, 2007).

In 2015, California produced 222,498 million cubic feet of natural gas. In 2014, natural gas production accounted for 0.9 percent of total nationwide production, and ranked 15th among gas producing states for that year (2015 was not readily available at the time this document was being produced) (EIA, 2016b). Geologic basins in the Central Valley and on the Pacific Coast are the largest contributors to natural gas production (EIA, 2015b).

Minerals

In 2015, California's total nonfuel mineral production was valued at $3.300B. This level of production ranked sixth nationwide (in terms of dollar value), and accounted for 4.22 percent of the total nationwide production value. In 2015, California's leading nonfuel minerals were construction sand and gravel, Portland cement, boron minerals, crushed stone, and gold. As of 2015, California was the leading producer of construction sand and gravel in the nation. Other minerals produced in the state include bentonite, common clay, dimension stone,[51] feldspar, gold, gypsum, magnesium compounds, perlite, pumice, silver, zeolites, borates, fuller's earth, soda ash, rare earth elements, salt, and tungsten. (USGS, 2016a)

4.1.3.8 Geologic Hazards

The four major geologic hazards of concern in California are volcanoes, earthquakes, landslides, and subsidence. A discussion of each geologic hazard is included below.

Volcanoes

California's 8 high to moderate threat volcanoes have collectively had eruptions over 10 times during the past 1,000 years (California Emergency Management Agency, 2013). During the last 300,000 years, 30 domes have erupted in Lassen Volcanic National Park. The largest eruptions occurred 27,000 years ago and formed Lassen Peak (NPS, 2015b). Other volcanic eruptions within the last 1,000 years include events at Mount Shasta, Long Valley Caldera Mono-Inyo Chain, Ubehebe Craters, Medicine Lake, and Lassen Peak (California Emergency Management Agency, 2013).

Lassen Volcanic National Park

The most recent eruptions of Lassen Peak, 55 miles east of Redding, occurred between 1914 and 1917. On May 22, 1915, a dome collapse that had occurred three days earlier resulted in an ash column rising 30,000 feet into the air. Fine ash from the column reached Winnemucca, Nevada, almost 200 miles to the east. The resulting snowmelt caused mudflows and landslides (California Emergency Management Agency, 2013).

[51] Dimension stone: "Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape." (USGS, 2016c)

Earthquakes

California is particularly vulnerable to earthquake activity due to the dozens of active faults and fault zones in the state. "Each year the southern California area has about 10,000 earthquakes. Most of them are so small that they are not felt. Only several hundred are greater than magnitude 3.0 [(on the Richter scale[52])], and only about 15-20 are greater than magnitude 4.0" (USGS, 2014b). "Earthquake is a term used to describe both sudden slip on a fault, and the resulting ground shaking and radiated seismic activity caused by the slip, or by the volcanic or magmatic activity, or other sudden stress changes in the earth" (USGS, 2012b). "In California, about 40 millimeters per year of the slip occur on the faults of the San Andreas system and about 10 millimeters per year occur in the Mojave Desert and in the Basin and Range area east of the Sierra Nevada on a fault system known as the eastern California shear zone" (California Emergency Management Agency, 2013).

The shaking due to earthquakes can be significant many miles from its point of origin depending on the type of earthquake and the type of rock and soils beneath a given location. Crustal earthquakes, the most common, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale. Subduction zone earthquakes happen where tectonic plates converge. "When these plates collide, one plate slides (subducts) beneath the other, where it is reabsorbed into the mantle of the earth" (Oregon Department of Geology, 2015). Subduction zones are found off the coast of Washington, Oregon, and Alaska (USGS, 2014c). Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale (Oregon Department of Geology, 2015). "In California, earthquakes are almost all in the top 15 miles of the crust, except in northern California along the Cascadia Subduction Zone, which extends into Oregon, Washington, and British Columbia" (USGS, 2016b).

Figure 4.1.3-4 depicts the seismic risk throughout California; the box surrounding the range of colors shows the seismic hazards in the state. The map indicates levels of horizontal shaking (measured in Peak Ground Acceleration) that have a 2 percent chance of being exceeded in a 50-year period. Units on the map are measured in terms of acceleration due to gravity (% g). Most pre-1965 buildings are likely to experience damage with exceedances of 10% g. Post-1985 buildings (in California) have experienced only minor damage with shaking of 60% g. (USGS, 2010).

Ranked as the second highest state in terms of earthquake activity, areas of greatest seismicity in California are concentrated along the coast of the state. Two of the most powerful earthquakes recorded to date are the 1857 Fort Tejon earthquakes (magnitude 7.9) and the 1906 San Francisco earthquake (magnitude 7.8) due to movement along the San Andreas Fault. The Fort Tejon earthquake uprooted trees and destroyed buildings up to 20 kilometers away. (California Governor's Office of Emergency Management, 2013) (USGS, 2014d)

[52] The Richter scale is a numerical scale for expressing the magnitude of an earthquake on the basis of seismograph oscillations. The more destructive earthquakes typically have magnitudes between about 5.5 and 8.9; the scale is logarithmic and a difference of one represents an approximate thirtyfold difference in magnitude. (USGS, 2014e)

Within California, earthquakes of magnitude 7.0 to 7.9 occur approximately every 10 years, and earthquakes of magnitude 6.0 to 6.9 occur every two to three years. No earthquake with a magnitude 8.0 or greater has been officially recorded in the state. However, geological studies indicate that "a magnitude 9.0 earthquake occurred in January 1700 on the Cascadia Subduction Zone, extending north from Cape Mendocino in North California to British Columbia." It is estimated that there is a 63 percent probability that a magnitude 6.7 earthquake will hit the San Francisco area before 2032, and between 80 and 90 percent likelihood that a magnitude 7.0 earthquake will hit southern California before 2024. (California Emergency Management Agency, 2013)

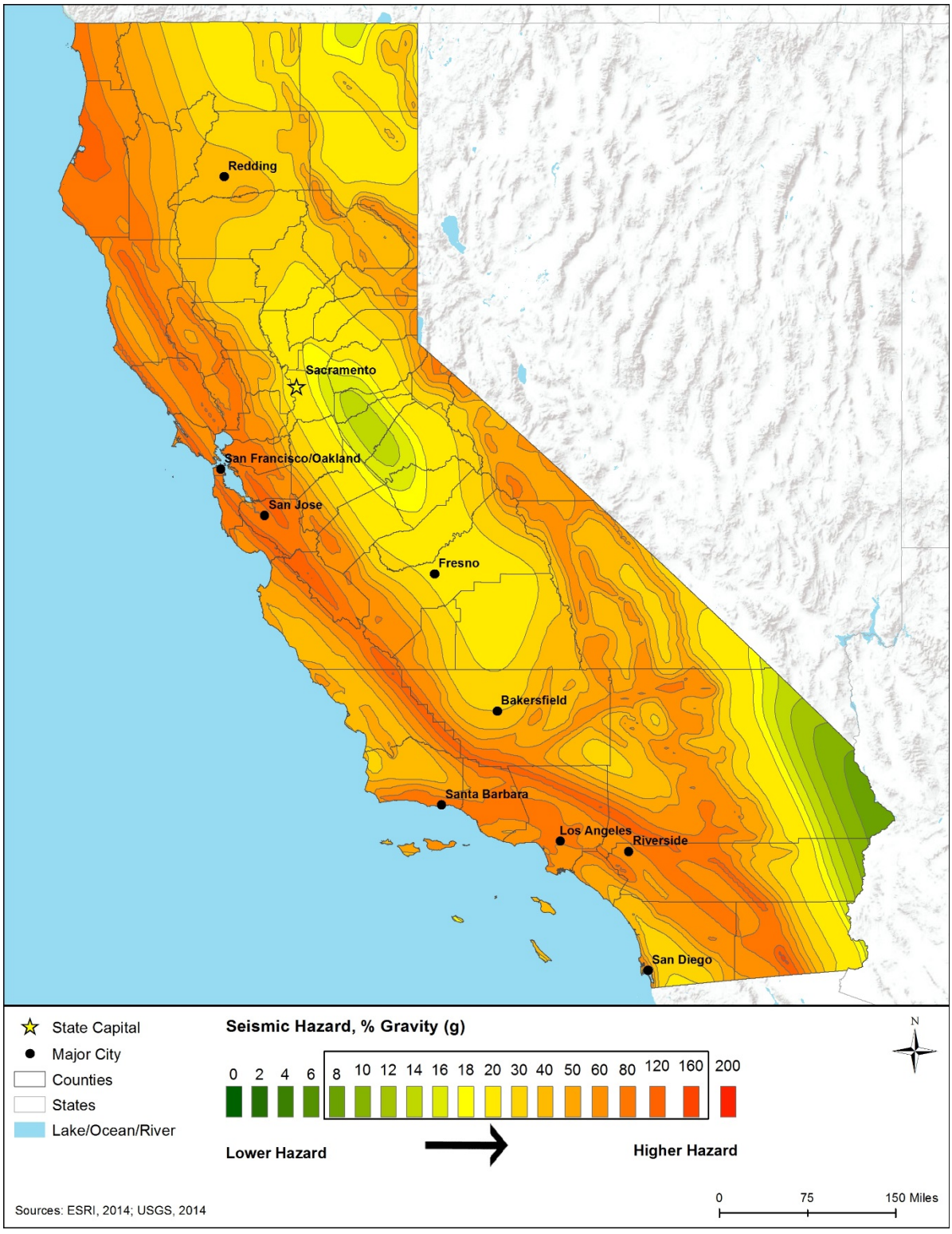


Figure 4.1.3-4: California 2014 Seismic Hazard Map

Landslides

California is highly susceptible to landslide events in western portions of the state, particularly within the Coast Ranges (Radbruch-Hall, et al., 1982); as shown in Figure 4.1.3-5, areas in and around San Francisco and northwestward, as well as in, and around, Santa Barbara experience high incidence rates of landslides. "The term 'landslide' describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides and other ground failures." Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale (USGS, 2003).

Landslides can be triggered by a single severe storm or earthquake, causing widespread damage in a short period. Most landslide events are triggered by water infiltration that decomposes and loosens rock and soil, lubricates frictional surfaces, adds weight to an incipient landslide, and imparts buoyancy to the individual particles. Intense rainfall, rapid snowmelt, freeze/thaw cycles, earthquakes, volcanic eruptions, and human alterations to the natural landscape can trigger mass land movements. Large landslides can dam rivers or streams, and cause both upstream and downstream flooding (USGS, 2003).

"Steep topography, weak rocks, heavy winter rains, and occasional earthquakes all lead to slope failures more frequently than would otherwise occur under gravity alone." The Franciscan Formation, in northern California is particularly susceptible to landslides due to its weak composition and high susceptibility to erosion (California Emergency Management Agency, 2013). The most damaging landslide occurrences in southern California are debris flows,[53] whereas in the central part of the state, landslides occur due to "poorly consolidated Tertiary rocks" (Radbruch-Hall, et al., 1982). Between 1950 and 2012, nine state and federally-declared disasters for landslides occurred in California (California Emergency Management Agency, 2013).

In 1994, a magnitude 6.7 earthquake in Northridge, California produced more than 11,000 landslides over 3,800 square miles, within the Santa Susana Mountains and north of the Santa Clara River Valley. In winter 1997 and spring 1998, heavy rainfall associated with El Niño storms resulted in approximately 300 documented landslides across 10 counties in the San Francisco Bay Area. During these events "hillside material, both natural and engineered, [failed] and impact[ed] the built environment." (Highland & Schuster, 2013)

Figure 4.1.3-5 shows landslide incidence and susceptibility throughout California.

[53] Debris Flow: "A type of landslide made up of a mixture of water-saturated rock debris and soil with a consistency similar to wet cement. Debris flows move rapidly downslope under the influence of gravity" (USGS, 2015d).

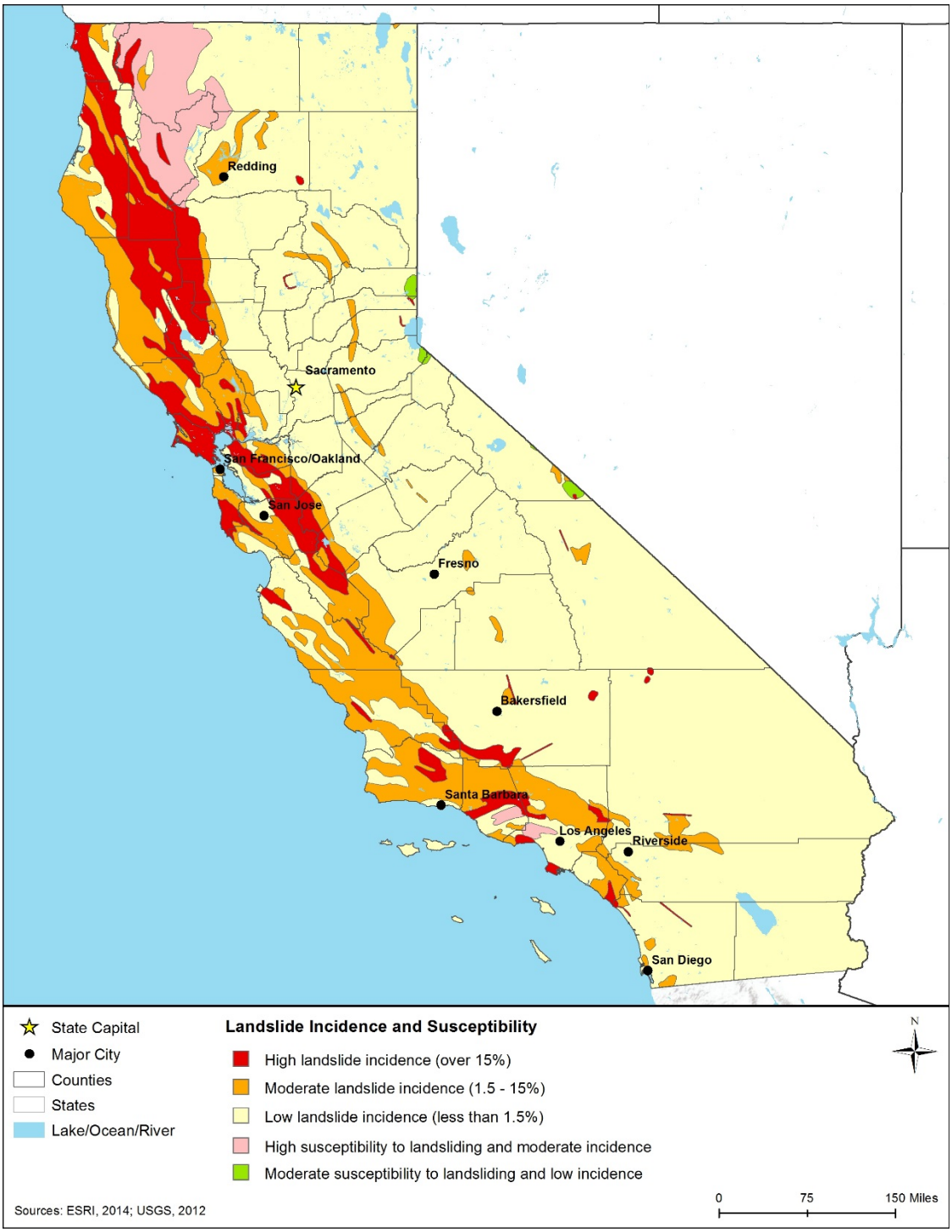


Figure 4.1.3-5: California Landslide Incidence and Susceptibility Hazard Map[54]

[54] Susceptibility hazards not indicated in Figure 4.1.3-5 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated (USGS, 2014f).

Land Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000a). Within California, the primary cause of land subsidence is aquifer compaction (Galloway & Riley, 2006). Nationwide, the primary causes of land subsidence are attributed to aquifer system compaction, drainage of organic soils, underground mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the United States is a consequence of over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If an aquifer is confined by layers of silt or clay, which do not transport groundwater, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the permanent lowering of the land surface elevation (USGS, 2000a).

Land subsidence can result in altered stream elevations and slopes; detrimental effects to infrastructure and buildings; and collapse of wells due to compaction of aquifer sediments. Subsided areas can become more susceptible to inundation, both during storm events and non-events. Lowered terrain is more susceptible to inundation during high tides. Additionally, land subsidence can affect vegetation and land use (USGS, 2013a).

In California, a significant cause of land subsidence is aquifer compaction. "Subsidence in excess of 1 foot had affected more than 5,200 square miles of irrigable land – one half of the entire San Joaquin Valley" (Galloway & Riley, 2006). Near Mendota, California, the land surface elevation has dropped by more than 28 feet since 1925. The primary causes for this land subsidence include: "1) subsidence caused by aquifer system compaction due to the lowering of groundwater levels by sustained ground-water overdraft; and (2) subsidence caused by the hydrocompaction of moisture-deficient deposits above the water table." As of 1955, nearly 25 percent of all groundwater used for agriculture nationwide was extracted from the San Joaquin Valley. Land subsidence rates were highest during the 1950s and 1960s, but abated starting in the 1970s as groundwater usage slowed. (Galloway & Riley, 2006) Although not considered to be a major threat, some areas in California are underlain by karst topography, as shown in Figure 4.1.3-6.

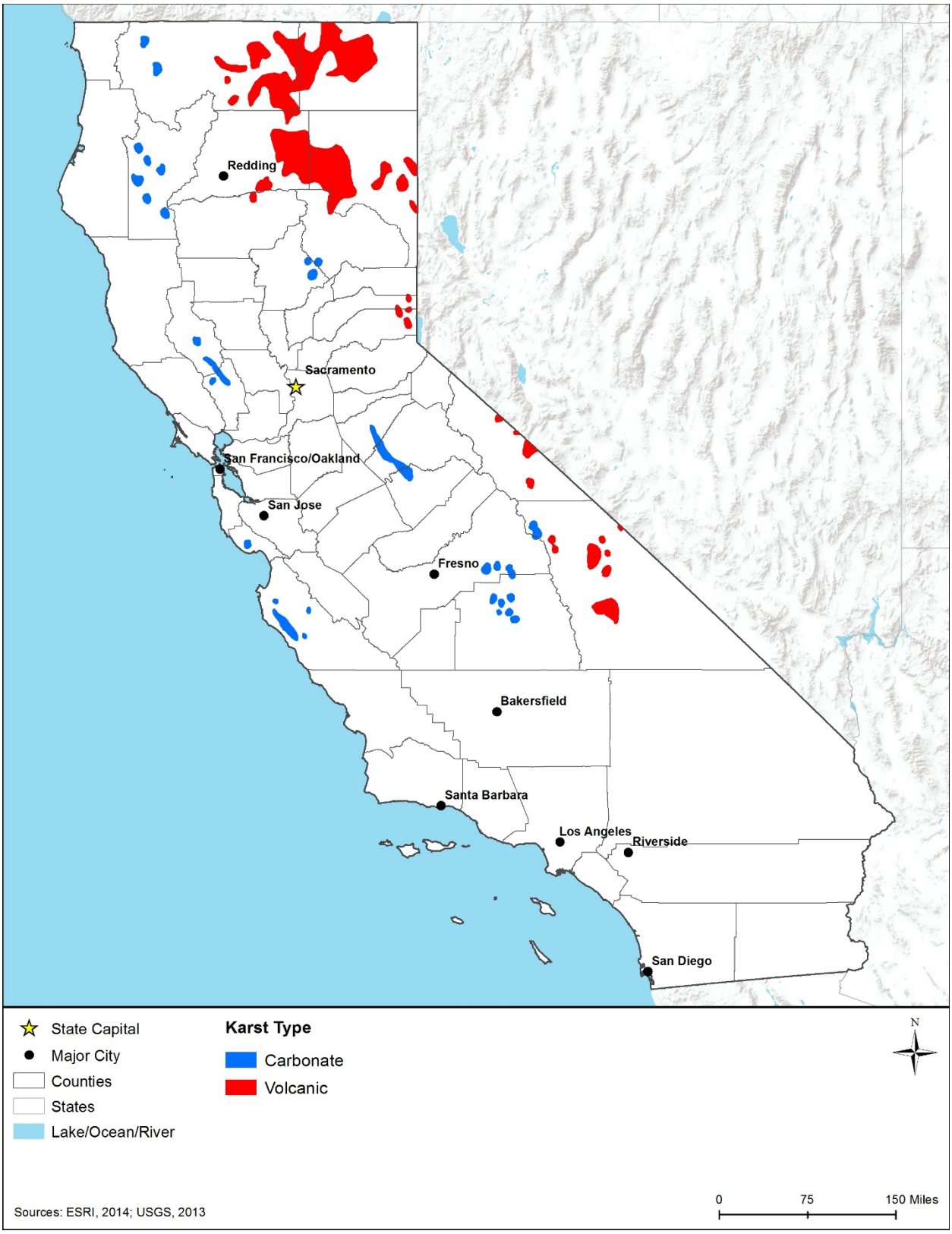


Figure 4.1.3-6: Areas Susceptible to Subsidence due to Karst Topography in California

4.1.4 Water Resources

4.1.4.1 Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine waters, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 4.1.5). These resources can be grouped into watersheds which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for available water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human health, economic wellbeing, and ecological health. (USGS, 2014g)

4.1.4.2 Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Table 4.1.1-1. Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders, summarize the major California laws and permitting requirements relevant to the state's water resources.

Table 4.1.4-1: Relevant California Water Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
California Water Code (Division 2)	State Water Resources Control Board (SWRCB)	Defines California water permit requirements.
Clean Water Act (CWA) Section 401 Certification	Regional Water Quality Control Board (RWQCB)	In accordance with Section Addressed. Verified California general water laws and regulations added to the table. 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from a RWQCB indicating that the proposed activity will not violate water quality standards.
Streambed Alteration Agreement	California Department of Fish and Game (DFG)	Regulates activities that would alter the flow, bed, channel, or bank of streams and lakes by issuing Lake or Streambed Alteration Agreements. In riparian areas, DFG jurisdictional limits are usually delineated by the top of the stream or lake banks, or the outer edge of riparian vegetation; whichever is wider.
California Coastal Act	California Coastal Commission	Any "development"[55] activity in the coastal zone requires a permit from the Coastal Commission or local government.

[55] Development is broadly defined to include demolition, construction, replacement of structures, repair or maintenance activities that could result in environmental impacts, grading, removal of, or placement of rock, soil, or other materials, or land use changes (California Coastal Commission, 2014).

State Law/Regulation	Regulatory Agency	Applicability
McAteer-Petris Act of 1965	San Francisco Bay Conservation and Development Commission (BCDC)	Regulates work within the bay, certain creeks, and a shoreline band of 100 feet inland from line of highest tidal action. Projects that require BCDC permits often must receive authorization from the RWQCB and U.S. Army Corps of Engineers (USACE).
NPDES	RWQCB	Issued as coverage under the state's Construction Storm water General Permit for sites that disturb 1 acre or more of land or as NPDES permits for other discharges to waters of the U.S. (including wetlands).
Public Trust Doctrine	State Lands Commission	Protects publicly owned property rights in the navigable waters of the state. The Commission manages the use of the state owned wetland/waters through leases to other public agencies and private parties.

Law of the River. The Colorado River is managed and operated under numerous compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines. In 1922, the 7 Colorado River basin states negotiated the Colorado River Compact, which divided the states into two basins—upper and lower—and apportioned 7.5 million acre-feet (maf) per year[56] to each basin. The compact also referenced Mexico's right to the Colorado River. The Boulder Canyon Project Act of 1928 ratified the Compact and established California's apportionment at 4.4 maf/year. In 1944, the United States signed a water treaty in which it agreed to deliver an annual quantity of 1.5 maf of water annually to Mexico. While compact negotiators estimated the flow of the river to be at least 17 maf per year, 2010 records indicate a flow of 15 million just below Lake Powell. Therefore, the sum of the actual compact apportionments and the Mexican treaty exceed the flow of the river in most years. (CDWR, 2013a)

Before 2003, California's annual use of Colorado River water ranged between 4.5 and 5.2 maf. In recent years, Arizona has begun to exercise full use of its basic apportionment, and Nevada has approached full use of its entitlement and surplus allocation. Therefore, California has had to reduce its dependence on Colorado River water to 4.4 maf in average years. A record 8-year drought in the Colorado River basin has reduced current reservoir storage throughout the river system to just over 50 percent of total storage capacity. (CA RWQCB Colorado Region, 2014)

American Indian Water Rights. Water management on California American Indian tribal land is sometimes administered through the tribal government or a defined department, which would have the primary responsibility to oversee all water-related matters within the exterior boundaries of the reservation. Administrative duties and responsibilities include local and regional water-related matters, water rights compliance, management of local resources, land use planning, and ensuring the tribe is in compliance with all current regulations and laws. (CDWR, 2013a)

[56] An acre-foot is a unit of volume commonly used to reference large-scale water resources. One acre-foot/year is approximately 898 gallons per day (USGS, 2000b).

4.1.4.3 Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams, as well as estuarine[57] and coastal waters. According to California's State Water Resources Control Board (SWRCB) database, has approximately 211,513 river and streams miles; 10,141 lakes, ponds, and reservoirs, including approximately 491,733 acres of saline lakes; over 602,705 square miles of estuaries, harbors, and bays; and approximately 3,427 miles of Pacific Ocean shoreline. These surface waters supply drinking water; provide flood control and aquatic habitat; and support recreation, tourism, agriculture, fishing, power generation, and manufacturing across the state. (SWRCB, 2003)

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains streams and rainfall to a common outlet (e.g., reservoir, bay). California's waters (lakes, rivers, and streams) are divided into 10major watersheds, or drainage basins: North Coast, Central Coast, South Coast, San Francisco Bay, Sacramento River, San Joaquin River, Tulare Lake, North and South Lahontan, and Colorado River (Figure 4.1.4-1) (California Department of Conservation, 2012a).

- The **North Coast Basin** drains into the Pacific Ocean from the California-Oregon state line southerly to the watershed's boundary (NCRWQCB, 2006).
- To the south is the **San Francisco Bay Basin**, which includes the San Francisco Bay Estuary, the largest estuary on the west coast of the United States (SFBRWQCB, 2015).
- Moving down California's coast, is the **Central Coastal Basin**, a 300-mile long by 40-mile wide section of California's central coast, which includes cities such as Santa Barbara and Monterey, and drains into the Pacific Ocean (CA RWQCB Central Coast Region, 2011).
- **South Coast Basin** drains into the Pacific Ocean from the southeastern boundary of Rincon Creek basin to the border with Mexico (CDWR, 2013a).
- **Sacramento River and San Joaquin River.** Surface water from the two river Basins meet at the Sacramento-San Joaquin River Delta (as shown in Figure 4.1.4-2) and then drains to San Francisco Bay (CA RWQCB Central Valley Region, 2011).
- **Tulare Lake.** The closed drainage basin at the south end of the San Joaquin Valley, south of the San Joaquin River watershed, encompassing basins draining to the Kern lakebed, Tulare lakebed, and Buena Vista lakebed (CA RWQCB Santa Ana Region, 2008) (CDWR, 2013a).
- **North Lahontan** Basin east of the Sierra Nevada and west of the Nevada state line from the Oregon border south to the southern boundary of the Walker River (CDWR, 2013a).
- **South Lahontan** is an interior drainage basin east of the Sierra Nevada crest, south of the Walker River, and north of the Colorado River Basin (CDWR, 2013a).
- **Colorado River Basin** drains the Colorado River, Salton Sea, and other closed basins north of the Mexico (CA RWQCB Colorado Region, 2014).

[57] Estuarine: related to an estuary, or a "partially enclosed body of water where fresh water from rivers and streams mixes with salt water from the ocean. It is an area of transition from land to sea" (USEPA, 2015f).

Figure 4.1.4-1: Major California Watersheds and Surface Waterbodies

Freshwater

As shown in Figure 4.1.4-1, there are eight major rivers in California: Klamath, Smith, Sacramento, San Joaquin, Colorado, San Diego, and Salinas rivers, and Coachella Canal. The Sacramento and San Joaquin Rivers are in California's Central Valley, supply approximately 51 percent of the state's water supply, and are California's longest rivers (CA RWQCB Central Valley Region, 2011).

Some of the state's large lakes and dammed reservoirs provide flood control, hydropower[58] generation, and drinking water sources (USEPA, 2009). Several of California's key lakes and reservoirs include Clear Lake, Lake Shasta, Lake Elsinore, Mono Lake, Lake Tahoe, and Salton Sea. The principal feature within the North Coast Basin is the 527,000 acre-foot Clear Lake Reservoir on the Upper Lost River (NCRWQCB, 2006). Lake Elsinore, in Santa Ana Basin, is a closed basin (has with no outflow). High annual evaporation rates have historically limited the amount of water in the lake, which has gone dry several times in this century. Only torrential rains or extended wet cycles have produced the rare overflows (CA RWQCB Santa Ana Region, 2008). Regional drainage waters resulting from Colorado River diversions, and which do not return to the Colorado River, drain into the Salton Sea, the state's largest inland body of water (CA RWQCB Colorado Region, 2014).

Estuarine and Coastal Waters

Estuaries (including bays and tidal rivers) are bodies of water that are transition zones between fresh river water and saline ocean water. California's estuarine environments support a variety of habitats, including tidal wetlands, mudflats, rocky shores, oyster reefs, freshwater wetlands, sandy beaches, and eelgrass beds, and are a critical part of the life cycle of many different plant and animal species (USEPA, 2012a).

Along the California coastline, there are numerous estuaries, bays, and beaches (USEPA, 2015c). Water quality associated with these systems are directly affected by land-based pollution, such as "municipal sewage discharges, industrial waste discharges, dredge spoils, and agricultural and urban runoff" (Ocean Protection Council, 2015). Three state agencies, the California Coastal Commission, the Bay Conservation and Development Commission, and the California Coastal Conservancy, manage coastal activities associated with development along the California coast (except for San Francisco Bay), oversee development within San Francisco Bay, and protect and restores coastal resources, respectively (CCC, 2015).

California has five major estuaries that are managed by federal and state agencies along its coast (Figure 4.1.4-2).

- **Elkhorn Slough National Estuarine Research Reserve** is a 1,400-acre parcel of marsh and open water, and the site of several programs that promote education, research, and conservation of the slough. There is a visitor center and five miles of trails through oak woodlands, tidal creeks, and freshwater marshes. The site also contains the second largest salt marsh in the state. In 1979, NOAA's National Estuarine Research Reserve System

[58] Hydropower: "electrical energy produced by falling or flowing water" (USEPA, 2004).

designate the Elkhorn Slough as a National Estuarine Research Reserve. This site was selected in support of "long-term research, water quality monitoring, education, and coastal stewardship." (NOAA, 2015b)

- **Morro Bay Estuary** is approximately 2,300 acres on the northern shores of Morro Bay in the City of Morro Bay. The estuary receives freshwater inputs from Chorro and Los Osos Creeks, and provides habitat for several threatened and endangered species. In 1994, the Morro Bay was recognized as a state estuary. In 1995, the USEPA National Estuary Program (NEP) recognized Morro Bay as "an estuary of national significance." The estuary "supports efforts that can conserve water or help recharge water supplies." Currently Morro Bay is "listed as impaired for pathogens, sedimentation, and dissolved oxygen" due to contaminated runoff, leaking septic systems, and waste discharges from boats. The Morro Bay Estuary's Comprehensive Conservation and Management Plan (CCMP) identified corrective actions in seven program areas: accelerated sedimentation, bacterial contamination, elevated nutrient levels, toxic pollutants, scarce freshwater resources, preserving biodiversity, and environmentally balanced uses. (USEPA, 2015d)
- **San Francisco Bay Estuary** is composed of eight named bays (Suisan Bay, San Pablo Bay, San Francisco Bay, Honker Bay, Richardson Bay, San Rafael Bay, San Leandro Bay, and Grizzly Bay) and is considered the largest estuary on the Pacific Coast (SFBCDC, 2007). In addition, rainfall and snowmelt within this watershed provides about half of California's surface water supply (USEPA, 2015e). In 2003, NOAA's National Estuarine Research Reserve System designated two areas within the estuary, Rush Ranch and China Camp State Park, as the San Francisco Bay National Estuarine Research Reserve. These two sites have been selected in support of tidal marsh restoration (NOAA, 2015a). In 2007, the San Francisco Bay Estuary Project's revised CCMP identified corrective actions in nine program areas with the goal of "achieving high standards of water quality, including restoration and maintenance of a balanced indigenous population of fish, shellfish and wildlife, and recreational activities in the estuary, and assure that the designated uses of the estuary are protected" (USEPA, 2015e).
- **Santa Monica Bay** is a 266 square mile area of coastal Los Angeles that supports a variety of terrestrial and marine habitats, including coastal sand dunes, salt and brackish marshes, and kelp and seagrass beds. In 1988, the USEPA NEP and the state of California established Santa Monica Bay National Estuary Program (SMBNEP). The SMBNEP's Comprehensive Plan (or Bay Restoration Plan) identifies three main priority areas: water quality, natural resources, and benefits and values to humans. (CalEPA, 2015j)

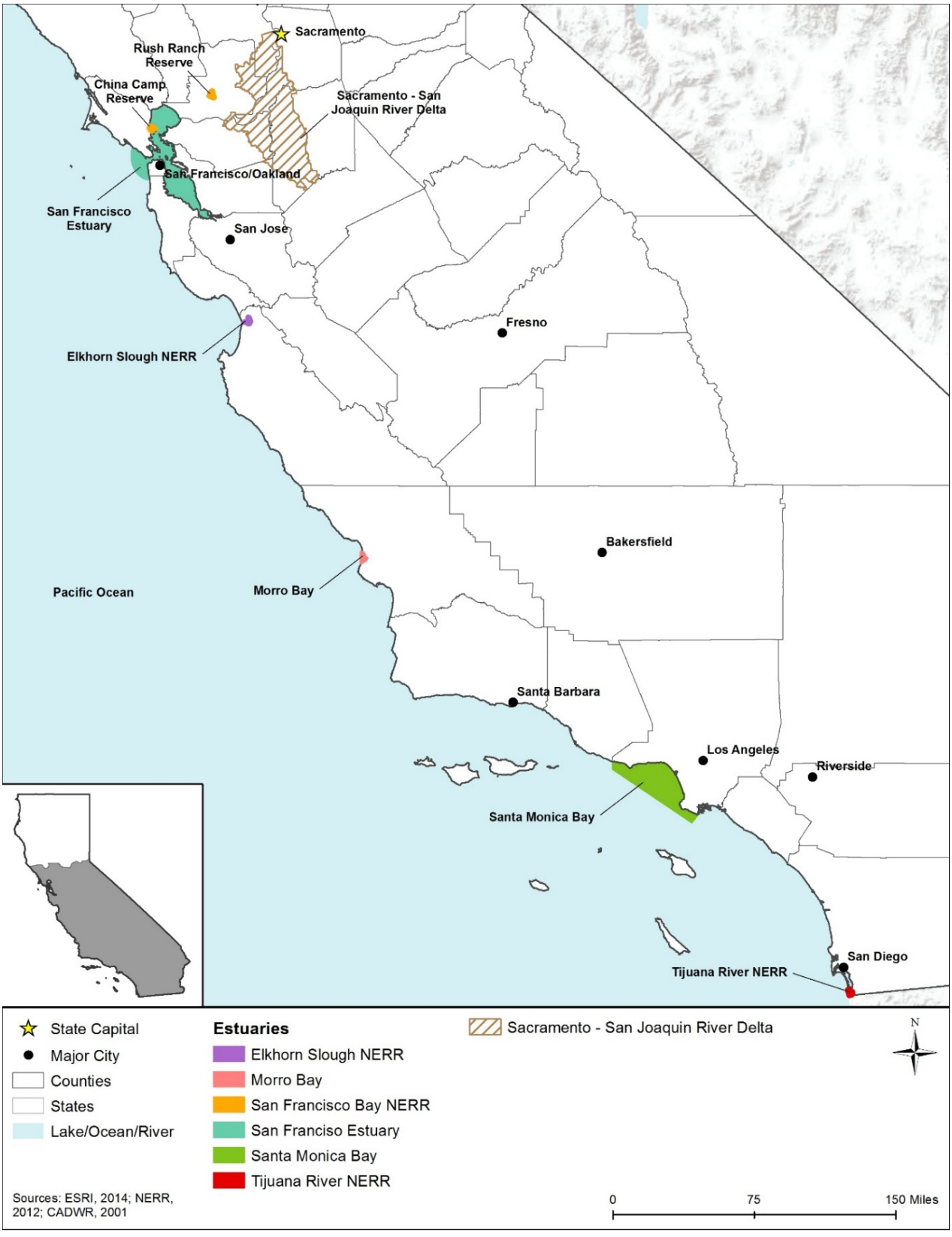


Figure 4.1.4-2: California's Estuaries and Critical Resource Waters

- **Tijuana River National Estuarine Research Reserve** is a 2,293-acre area in San Diego County, with three-fourths of its watershed in Mexico and the Tijuana River originating in the mountains of Baja California, Mexico. The shallow water estuary provides habitat for several threatened and endangered species and contains "one of the largest remaining examples of coastal wetlands in southern California." In 1982, NOAA's National Estuarine Research Reserve System designated the Tijuana River as a National Estuarine Research Reserve. This site was selected in support of "long-term research, water quality monitoring, education, and coastal stewardship." The reserve focuses on "habitat restoration, endangered species management, wastewater from Mexico, sediment management, and recreational use." (NOAA, 2015c)

4.1.4.4 Sensitive or Protected Waterbodies

Wild and Scenic Rivers

The Wild and Scenic Rivers Act was established in 1968 to "preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations" (refer to Appendix C, Environmental Laws and Regulations, for more information) (National Wild and Scenic Rivers System, 2015a). Statewide, there are 23 segments, totaling almost 2,000 miles, designated as national Wild, Scenic, or Recreational Rivers in California (National Wild and Scenic Rivers System, 2015c). California Appendix A, Table A-1 identifies each of these rivers.

In 1972, California passed the California Wild and Scenic Rivers Act, designating that specified rivers "possess extraordinary scenic, recreational, fishery, or wildlife values, and should be preserved in a free flowing state for the benefit of the people of California." Under most circumstances, the act does not allow a dam, reservoir, or water impoundment be constructed on a designated river. However, a diversion can be added if required to supply water to residents, and if the Secretary for Resources determines that the diversion would not adversely affect the river's free-flowing character. (CalEPA, 2009)

4.1.4.5 Impaired Waterbodies

Several elements, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, observations of aquatic wildlife communities, and sampling of fish tissue, are used to evaluate water quality. Under Section 403(d) of the Clean Water Act, states are required to assess water quality and report a listing of impaired waters,[59] the causes of impairment, and probable sources. Table 4.1.4-2 summarizes the water quality of California's assessed major waterbodies by category, percent impaired, designated use,[60] cause, and probable sources. Figure 4.1.4-3 shows the Section 403(d) waters in California as of 2014.

[59] Impaired waters: waterways that do not meet state water quality standards. Under the CWA, Section 403(d), states, territories, and authorized tribes are required to develop prioritized lists of impaired waters (USEPA, 2015f).

[60] Designated Use: an appropriate intended use by humans and/or aquatic life for a waterbody. Designated uses may include recreation, shellfishing, or drinking water supply (USEPA, 2015f).

As shown in Table 4.1.4-2, various sources affect California's waterbodies, causing impairments. Of the waterbodies assessed in California (see Table 4.1.4-2 below), the majority are in poor condition, with most surface waterbodies being impaired. Nearly all of California's assessed rivers, streams, lakes, and reservoirs are categorized as impaired, mostly due to excessive nutrients and low dissolved oxygen, and some places due to metal contamination (other than mercury). The main causes for these impairments are nonpoint source pollution[61] from agriculture and residential land use, and streambank erosion. Many of California's estuaries, bays, and coastal waters are also impaired due to high pathogen, fecal coliform, and pesticide concentrations. The main sources of coastal water impairments are nonpoint and point source pollution from urban areas and overruns from storm sewer systems. Pesticides, such as dichlorodiphenyltrichloroethane and dieldrin and polychlorinated biphenyls, are likely from historic industry uses and improper waste disposal. (USEPA, 2012b)

According to CalEPA, the primary challenge to California's waters has been controlling non-point sources, such as runoff from urban areas, mine drainage, timber operations, and agriculture (CDWR, 2013b).

Table 4.1.4-2: Section 403(d) Impaired Waters of California, 2012

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	32%	91%	Cold freshwater habitat, municipal and domestic supply, water contact recreation, and warm freshwater habitat	Temperature, sediment/siltation, aluminum, organic enrichment/low dissolved oxygen, and nutrients	Habitat alterations, impacts from flow alteration, forestry, and streambank modification/destabilization
Lakes, Reservoirs, and Ponds	40%	97%	Commercial and sport fishing, warm freshwater habitat, water contact recreation, and cold freshwater habitat	Arsenic, nutrients, mercury, and dissolved oxygen	Nonpoint source, natural/wildlife, livestock/grazing, and urban runoff/storm sewers
Estuaries and Bays	42%	100%	Commercial and sport fishing, estuarine habitat, and non-contact water recreation	Mercury, PCBs, pesticides (DDT), and invasive exotic species	Industrial point source discharge, nonpoint source discharge, natural/wildlife, and atmospheric deposition[d]
Pacific Ocean coastal shoreline	199.2 miles (total size of coastal shoreline not available)	59%	Water contact recreation, shellfish harvesting, commercial and sport fishing, and wildlife habitat	Pathogens (total coliform, and fecal coliform), PCBs, and pesticides (DDT),	Nonpoint source, municipal point source discharges, urban runoff/storm sewers

[61] Nonpoint source pollution: a source of pollution that does not have an identifiable, specific physical location or a defined discharge point. Non-point source pollution includes nutrients that run off croplands, lawns, parking lots, streets and other land uses. It also includes nutrients that enter waterways via air pollution groundwater, or septic systems (USEPA, 2015f).

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Ocean and near coastal	103.8 miles (total size for Ocean and Near Coastal not available)	40%	Shellfish harvesting	Pesticides (dieldrin)	Source unknown

Source: (USEPA, 2012b)

[a] Some waters may be considered for more than one water type.
[b] CalEPA has not assessed all waterbodies within the state.
[c] Pathogen: a bacterium, virus, or other microorganism that can cause disease (USEPA, 2015f)
[d] Atmospheric deposition: the process by which airborne pollutants settle onto to the earth's surface and pollutants travel from the air into the water through rain and snow ("wet deposition"), falling particles ("dry deposition"), and absorption of the gas form of the pollutants into the water (USEPA, 2015f).

4.1.4.6 Floodplains

The Federal Emergency Management Agency (FEMA) defines a floodplain or flood-prone area as "any land area susceptible to being inundated by water from any source" (44 Code of Federal Regulations [CFR] 59.1) (FEMA, 2000).[62] Through FEMA's flood hazard mapping program, the agency identifies flood hazards and risks associated with the 100-year flood, which is defined as "a flood that has a 1 percent chance of occurring in any given year," to allow communities to prepare and protect against flood events (FEMA, 2013).

Floodplains provide suitable and sometimes unique habitat for a wide variety of plants and animals, and are typically more biologically diverse than upland areas due to the combination of both terrestrial and aquatic ecosystems. Vegetation along stream banks provides shade, which helps to regulate water temperature for aquatic species. During flood events, sediment and debris settle out and collect on the floodplain, enriching the soil with additional nutrients. Pollutants from floodwater runoff are also filtered by floodplain vegetation and soils; thereby improving water quality. Furthermore, floodplains protect natural and built infrastructure by providing floodwater storage, erosion control, water quality maintenance, and groundwater recharge. Historically, floodplains have been favorable locations for agriculture, aquaculture, and forest production due to the relatively flat topography and nearby water supply. Floodplains can also offer recreational activities, such as boating, swimming, and fishing, as well as hiking and camping (FEMA, 2014a).

[62] To search for and locate CFR records, see the Electronic Code of Federal Regulations (e-CFR): www.ecfr.gov.

Figure 4.1.4-3: Section 403(d) Impaired Waters of California, 2014

There are two primary types of floodplains in California.

- **Riverine and lake floodplains** occur along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. Californians have settled near the 38 major rivers in the state — from the Klamath River in the north to the San Diego River in the south. In mountainous areas, floodwaters can build and recede quickly, with fast moving and deep water. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters. Whereas, flatter floodplains may remain inundated for days or weeks, covered by slow-moving and shallow water. (FEMA, 2014d)
- **Coastal floodplains** in California border the Pacific Ocean and include all coastal areas, back bays, bays, sounds, and inland tidal waterways (CDWR, 2013b). Coastal flooding can occur when strong wind and storms, usually winter and spring coastal storms, increase water levels on the adjacent shorelines (FEMA, 2013). In addition, a storm surge event that takes place during high tide can cause floodwaters to exceed normal tide levels, resulting from strong winds preventing tidal waters to recede in conjunction with additional water pushed toward the shore (CDWR, 2013b).

Flooding results in significant damage throughout the California annually, and is the leading cause nationally for issuance of disaster declarations by the President of the United States (NOAA, 2015k). In California, 20 percent of the almost 38 million residents live within 500-year floodplains (i.e., have a 0.2 percent chance of flooding in a given year). At least one federal flood disaster has been declared in each of California's 58 counties in the last 20 years. According to California's Department of Water Resources, "over the last 60 years, California floods have resulted in more than 300 lives lost, more than 750 injuries, and billions of dollars in disaster claims to the California Emergency Management Agency" (CDWR, 2013a).

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. FEMA provides floodplain management assistance, including mapping of 100-year floodplain limits, to approximately 526 communities in California through the National Flood Insurance Program (NFIP) (FEMA, 2014b). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, California had 93communities participating in the CRS (FEMA, 2014c).[63]

[63] A list of CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (Community Rating System, 2014) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

4.1.4.7 Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and includes underground water that occupies pore spaces between sand, clay, or rock particles. An aquifer is a permeable geological formation that stores or transmits water to wells and springs. Groundwater is contained in either confined (bound by clays or nonporous bedrock) or unconfined (no layer to restrict the vertical movement of groundwater) aquifers (USGS, 1999). When the water table reaches the ground surface, groundwater will reappear as either streams, surface bodies of water, or wetlands. This exchange between surface water and groundwater is an important feature of the hydrologic (water) cycle.

California's principal aquifers consist of carbonate-rock,[64] sand, and gravel aquifers of alluvial origin,[65] and igneous and metamorphic-rock aquifers,[66] unconsolidated coastal-plain aquifers. Groundwater contributes approximately 38 percent of California's total water supply, under non-drought conditions. During dry years, it can contribute 46 percent or more of the state's water supply. Many city, agricultural, and disadvantaged communities rely on groundwater for up to 100 percent of their water supply needs. Generally, the water quality of California's aquifers is suitable for drinking and daily water needs. According to California's Department of Public Health, many of the state's aquifers are polluted with salts, industrial chemicals, and naturally occurring pollutants. (CDWR, 2013a) Table 4.1.4-3 provides details on aquifer characteristics in the state; Figure 4.1.4-1 shows California's principal and sole source aquifers.

Table 4.1.4-3: Description of California's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Basin and Range basin-fill aquifers Consists primarily on limestone and dolomite	Underlying southern California desert	The water is hard and contains high levels of dissolved-solids concentrations, just above the drinking-water standard. Groundwater is the only source of water in these desert areas and the water levels are declining as a result of increased public, industrial, and agricultural use.
California Coastal Basin aquifers Consists of unconsolidated continental deposits, primarily sand and gravel	Underlies the West coast of the state stretching up from San Diego to San Francisco	Water is generally suitable for most uses. Low levels of dissolved-solids concentrations make the water safe to drink though there are some areas with higher levels of salinity due to sea water encroachment. Primary use of water is for public supply and agricultural purposes.
Central Valley aquifer system Primarily sand and gravel	Central part of the state, stretching from Bakersfield to south of Redding	Water quality varies significantly throughout the aquifer. Compared to other aquifers in the state, water is softer but still hard. Generally suitable for most purposes though in some areas high levels of saline and boron, make it unsuitable for irrigation.

[64] Carbonate-rock aquifers typically consist of limestone with highly variable water-yielding properties (some yield almost no water and others are highly productive aquifers) (Planert & Williams, 1995).

[65] Sand and gravel aquifers of alluvial (sand, silt, or gravel materials left by river waters) and glacial origin are highly productive aquifers in the northern part of the country, consisting of mostly sand and gravel deposits formed by melting glaciers (USGS, 2015e).

[66] Igneous and metamorphic-rock aquifers are formed from lava flow and have variable permeability (how easily water or contaminants can flow through the aquifer/how tight the rocks are pressed together) in Idaho, Oregon and Washington. Basaltic rocks are the most productive aquifers in volcanic rocks. (USGS, 2015e)

Aquifer Type and Name	Location in State	Groundwater Quality
Pacific Northwest basin-fill aquifers Primarily sand and gravel	Northern part of the state	Suitable for most purposes. Dissolved-solids concentrations are generally low though sulfur and sodium are present. Primary use of water is for irrigated agricultural purposes.
Pacific Northwest basaltic-rock aquifers Volcanic rock consisting of sand and gravel layers	Northern part of the state	Groundwater use is minimal from this aquifer, as more exploration is needed. Deposits that overlay the aquifer are highly mineralized creating unproductive aquifers.
Basin and Range carbonate-rock aquifers Primarily limestone and dolomite	East central part of the state, along the Nevada border	Generally, water is suitable for most purposes including drinking though some areas high higher levels of arsenic and fluoride. Uses of water are for farming, mining, ranching, light industry, and domestic and public supply.

Sources: (Moody, Carr, Chase, & Paulson, 1986) (Planert & Williams, 1995)

Sole Source Aquifers

The USEPA defines sole source aquifers (SSAs) as "an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and are areas with no other drinking water sources (USEPA, 2015g). California has four designated SSAs within the state, Santa Margarita/Scott's Valley Aquifer in the north; Fresno County Aquifer in the center of the state; and Campo/Cottonwood Creek and Ocotillo-Coyote Wells Aquifers in the south (as shown in Figure 4.1.4-4) (USEPA, 2015h). Designating a groundwater resource as an SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized (USEPA, 2015g).

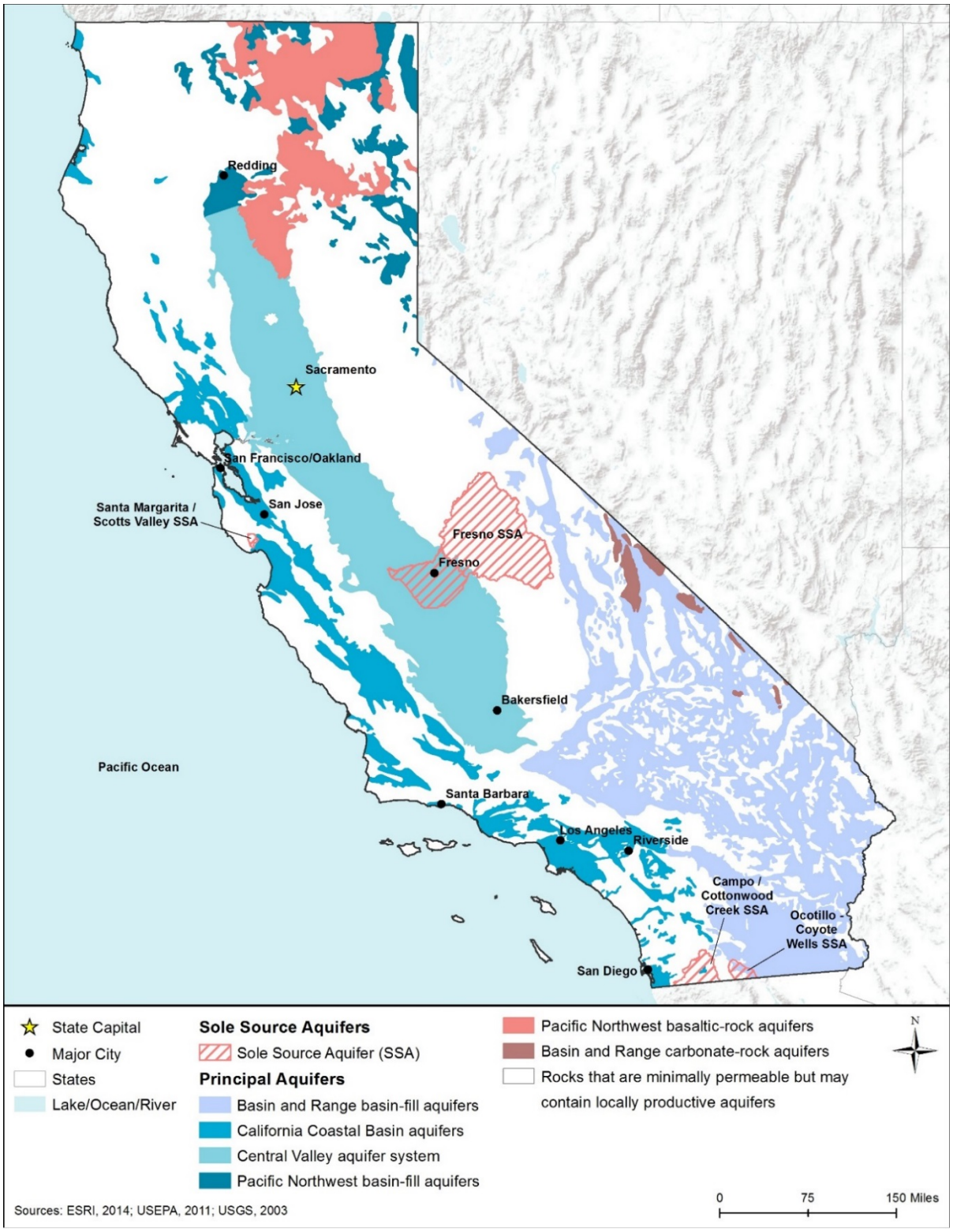


Figure 4.1.4-4: Principal and Sole Source Aquifers of California

4.1.5 Wetlands

Definition of the Resource

The Clean Water Act (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), 1993).

USEPA estimates that "more than one-third of the United States' threatened and endangered species live only in wetlands, and nearly half of such species use wetlands at some point in their lives" (USEPA, 1995). In addition to providing habitat for many plants and animals, wetlands also benefit human communities. Wetlands store water during flood events, improve water quality by filtering polluted runoff, help control erosion by slowing water velocity and filtering sediments, serve as points of groundwater recharge, and help maintain base flow in streams and rivers. Additionally, wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography (USEPA, 1995).

Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, describes the pertinent federal laws protecting wetlands in detail. Table 4.1.5-1 summarizes the major California state laws and permitting requirements relevant to the state's wetlands.

Table 4.1.5-1: Relevant California Wetland Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CWA Section 401 Certification	Regional Water Quality Control Board (RWQCB)	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from a RWQCB indicating that the proposed activity will not violate water quality standards. (CA SWRCB, 2015a)
CWA Section 404 permit, California regional requirements	USACE Sacramento, Los Angeles, and San Francisco District	A preconstruction notice (PCN) is require for all activities that would result in the discharge of fill material into any vernal pool. For NWP 12, permittees shall ensure the construction of utility lines does not result in the draining of any waters of the U.S., including wetlands. For NWPs 29, 39, 40, 42, and 43, the permittee shall establish and maintain upland vegetated buffers in perpetuity, unless specifically determined to be impracticable by the USACE, next to all preserved open waters, streams and wetlands including waters of the U.S., consistent with General Condition (GC) 23(f). All NWPs except 3, 6, 20, 27, 32, and 38 are revoked for activities in histosols, fens, bogs, and peatlands and in wetlands contiguous with fens. For NWPs 3, 6, 20, 27, 32, and 38, the permittee shall submit a PCN to the USACE per GC 31 and Regional Condition 1. (USACE, 2012)
National Pollutant Discharge Elimination System (NPDES)	RWQCB	Issued as coverage under the state's Construction Storm water General Permit for sites that disturb 1 acre or more of land or as NPDES permits for other discharges to waters of the U.S. (including wetlands). (CA SWRCB, 2015b)

State Law/Regulation	Regulatory Agency	Applicability
Porter-Cologne Water Quality Control Act	California Water Quality Control Boards	Authorizes the State Water Boards to regulate those activities and factors which may affect the quality of the waters of the state (including wetlands) to attain the highest water quality which is reasonable. (SWRCB, 2015)
Suisun Marsh Preservation Act of 1977 (California Public Resources Code § 29000 - 29612)	California Department of Fish and Wildlife	Recognizing the threats to the Suisun Marsh from potential residential, commercial, and industrial developments, and the need to preserve this unique wildlife resource for future generations, the Act was enacted to incorporate the findings and policies contained in the Suisun Marsh Protection Plan into state law.

Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as detailed in Table 4.1.5-2.

Based on the 2014 NWI data, there are more than 3 million acres of wetland in the state. California has lost more than 90 percent of total wetland acres since European settlement. Draining and filling for agriculture and urban development over the years have been the main threats to wetlands in the state. (Natural Resources Agency, 2010) In California, the main type of wetland is palustrine (freshwater) wetlands found on river and lake floodplains across the state, as shown in Figure 4.1.5-1 and Figure 4.1.5-2. Lacustrine, riverine, and estuarine/marine (tidal) wetlands also occur within in the state, as described below.

Table 4.1.5-2 uses 2014 NWI data to characterize and map California wetlands on a broad-scale.[67] The data is not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known. The map codes and colorings in Table 4.1.5-2 correspond to the wetland types in the figures.

- "The Marine System consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the Water Regimes are determined primarily by the ebb and flow of oceanic tides. Salinities exceed 30 parts per thousand (ppt), with little or no dilution except outside the mouths of estuaries." Where wave energy is low, mangroves or mudflats may be present. (FGDC, 2013)
- "The Estuarine System consists of deepwater tidal habitats and adjacent tidal habitats that are usually semi enclosed by land but have open, partly obstructed, or sporadic access to the

[67] The wetland acreages were obtained from the USFWS (2014) National Wetlands Inventory. Data from this inventory was downloaded by state at https://www.fws.gov/wetlands/. The wetlands data contains a wetlands classification code, which are a series of letter and number codes, adapted to the national wetland classification system in order to map from (e.g., PFO). Each of these codes corresponds to a larger wetland type; those wetland areas are rolled up under that wetlands type. The codes and associated acres that correspond to the deepwater habitats (e.g., those beginning with M1, E1, L1) were removed. The wetlands acres were derived from the geospatial datafile, by creating a pivot table to capture the sum of all acres under a particular wetland type. The maps reflect/show the wetland types/classifications and overarching codes; the symbolization used in the map is standard to these wetland types/codes, per the USFWS and Federal Geographic Data Committee.

open ocean, and the ocean water is at least occasionally diluted by freshwater runoff from the land." (FGDC, 2013)

- "Riverine System includes all wetlands and deepwater habitats contained within a channel with two exceptions (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 ppt." (FGDC, 2013)
- Lacustrine System includes inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30 percent vegetation cover, and occupy greater than 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc. (FGDC, 2013)
- "Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent." The System is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types). (Cowardin, Carter, Golet, & LaRoe, 1979) (FGDC, 2013)

Table 4.1.5-2: California Wetland Types, Descriptions, Location, and Amount, 2014

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Palustrine forested wetland	PFO	PFO wetlands contain woody vegetation that are at least 20 feet tall. Floodplain forests, hardwood swamps, and silver maple-ash swamps are examples of PFO wetlands.	Forested lowlands within the state	425,211
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.	Throughout the state, often on stream floodplains	
Palustrine emergent wetlands	PEM	Palustrine emergent wetlands have erect, rooted, green-stemmed, annual, water-loving plants, excluding mosses and lichens, present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens,[c] prairie potholes, and sloughs.	On river and lake floodplains	1,041,605
Palustrine unconsolidated bottom	PUB	PUB and PAB are commonly known as freshwater ponds, and includes all wetlands with at least 25% cover of particles smaller than stones and a vegetative cover less than 30%.	Throughout the state	93,576
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Other Palustrine wetland	Misc. Types	Farmed wetland, saline seep,[d] and other miscellaneous wetlands are included in this group.	Abandoned fields, depressions (seeps), along hillsides and highways	403,537

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Riverine wetland	R	Riverine systems include rivers, creeks, and streams. They are contained in natural or artificial channels periodically or continuously containing flowing water.	Throughout the state	128,209
Lacustrine wetland	L2	Lacustrine systems are lakes or shallow reservoir basins generally consisting of ponded waters in depressions or dammed river channels, with sparse or lacking persistent emergent vegetation, but including any areas with abundant submerged or floating-leaved aquatic vegetation. These wetlands are less than 8.2 feet deep.	Throughout the state, several in the eastern section	877,394
Estuarine and Marine intertidal wetland	E2/M2	These intertidal wetlands include the areas between the highest tide level and the lowest tide level. Semidiurnal tides (two high tides and two low tides per day) periodically expose and flood the substrate. Wetland examples include vegetated and non-vegetated brackish (mix of fresh and saltwater), and saltwater marshes, shrubs, beaches, sandbars, or flats.	Along the California coast (western edge of the state)	84,801
TOTAL				**3,054,333**

Sources: (Cowardin, Carter, Golet, & LaRoe, 1979) (USFWS, 2015a) (FGDC, 2013)

[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin et al. (1979), some data have been revised based on the latest scientific advances. The USFWS uses these standards as the minimum guidelines for wetlands mapping efforts. (FGDC, 2013)

[b] All acreages are rounded to the nearest whole number. The maps are prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground-truth verification work conducted. (USFWS, 2015b)

[c] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water (Edinger, et al., 2014).

[d] Saline seep is an area where saline groundwater discharges at the soil surface. These wetland types are characterized by saline soils and salt tolerant plants (City of Lincoln, 2015).

Palustrine Wetlands

In California, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, swamps, bogs, and ponds). There are almost 2 million acres of palustrine wetlands, comprising approximately 64 percent of the total wetlands (USFWS, 2014a). Palustrine forested (PFO) wetlands include red alder *(Alnus rubra),* western sycamore *(Platanus racemosa),* cottonwood *(Populus balsamifera),* valley oak *(Quercus lobata),* non-native broadleaved species, and conifers in California. Palustrine scrub-shrub (PSS) wetlands vegetation includes red willow *(Salix laevigata),* Pacific willow *(S. lucida subsp. lasiandra*), or (particularly in the Central Valley Basin) Goodding willow *(S. gooddingii)* may occur with Fremont cottonwood *(Populus fremontii*), dogwoods *(Cornus spp.),* and speckled alder *(Alnus incana*). Low shrubs in PSS habitat include curly dock *(Rumex crispus*), poison oak

(Toxicodendron diversilobum), blackberry (*Rubus ursinus*), and coltsfoot (*Petasites frigidus*) (San Francisco Estuary Institute, 2013a).

Common palustrine emergent (PEM) wetlands in California are dominated by the sedges[68] and sedge-like species, such as, watercress *(Rorippa nasturtium-aquaticum),* creeping buttercup *(Ranunculus flamula*), smartweeds *(Persicaria spp*), rushes (*Juncus spp*.), curly dock, broad-leaved cattail (*Typha latifolia*), bulrush (*Schoenoplectus californicus*), and coyote brush *(Baccharis piluaris*). PEM wetlands are the most common wetlands in the state. (San Francisco Estuary Institute, 2013b)

Many seasonal depressional wetlands are characterized by a central shallow marsh zone dominated by grasses and sedges surrounded by a mixed matrix of upland and riparian species. In these cases vegetation can occur in a concentric pattern from a wetter middle dominated by various species of spikerush (*Eleocharis spp*.) through a ring of annual grasses and an outer margin of western wheatgrass (*Pascopyrum smithii*) or thickspike wheatgrass (*Elymus lanceolatus).*

Palustrine wetlands also include the shallow water zones of lakes, rivers, and ponds and aquatic beds (PAB/PUB) formed by water lilies and other floating-leaved or free-floating plants. Cattails *(Typha spp.)* are often found growing in or around PAB/PUB wetlands in California, and they offer important breeding grounds for waterfowl and other wildlife. These are the easiest wetlands to recognize and occur throughout the state. Common emergent and floating vegetation includes species of duckweed *(Lemna spp.*), water hyacinth (*Eichhornia crassipes),* ditchgrass (*Ruppia cirrhosa*), water buttercup *(Ranunculus aquatilis*), and leafy pondweed *(Potamogeton foliosus*). (San Francisco Estuary Institute, 2013a)

Lacustrine Wetlands

There are approximately 877,400 acres of lacustrine wetlands in California, or 29 percent of the total wetlands (USFWS, 2014a). Lacustrine wetlands tend to be dominated by cattails and bulrushes (*Schoenoplectus spp*.) along the fringe, with bulrush, often occurring as a near monoculture, or with rush species or common threesquare (*Schoenoplectus pungens)* along slightly drier margins. In permanently flooded sites, a floating layer of vegetation, including aquatic buttercups (*Ranunculus spp*.), aquatic smartweeds, pondweeds (*Potamogeton spp*.) or duckweeds, may occur. These wetlands are found adjacent to permanent areas of open water and can occur as fringes of vegetation, such as around ponds or oxbows (U-shaped or curved rivers or lakes) (San Francisco Estuary Institute, 2013b).

[68] Sedge: an herbaceous plant with triangular cross-sectional stems and spirally arranged leaves (grasses have alternative leaves) typically associated with wetlands or poor soils.

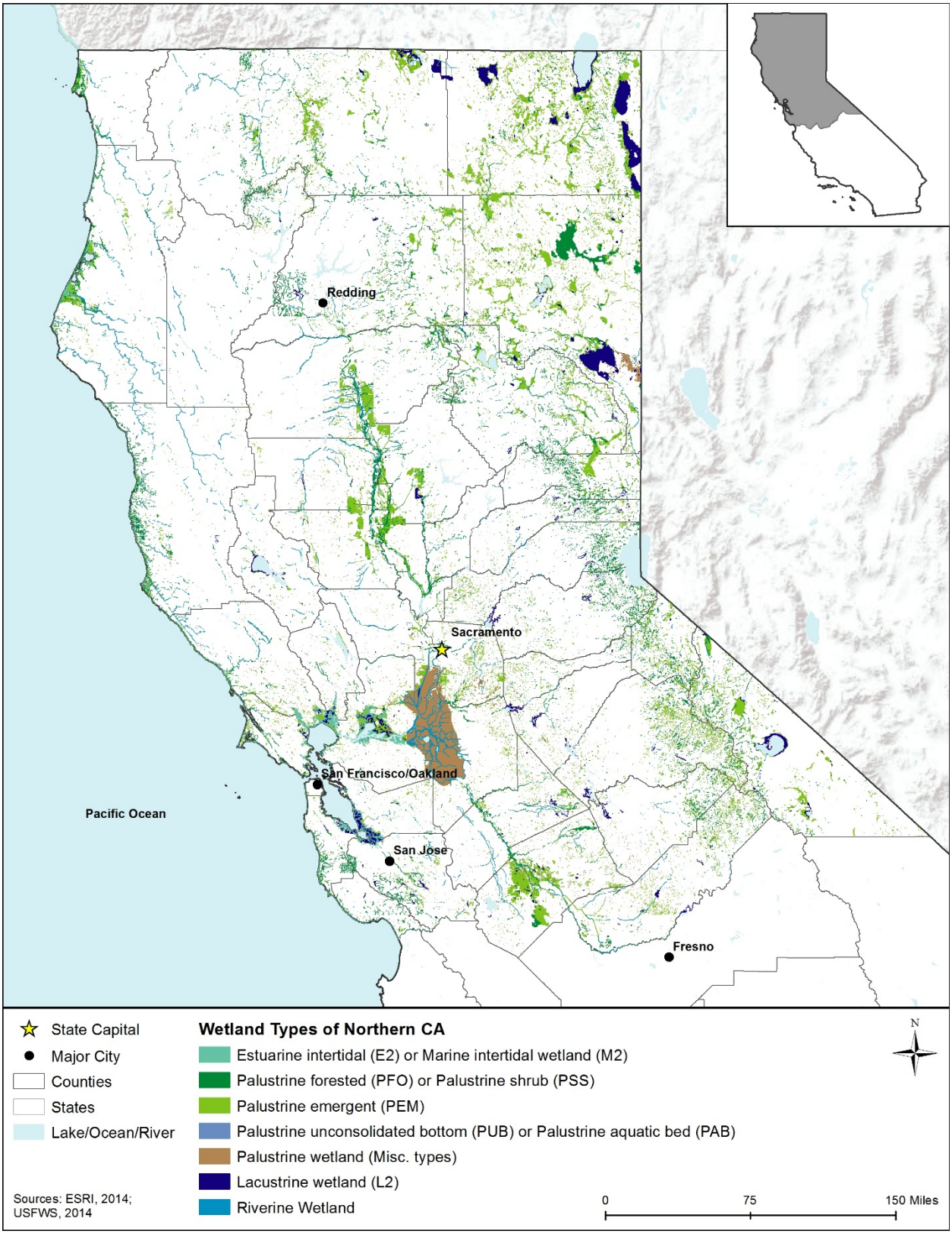


Figure 4.1.5-1: Wetlands by Type, Northern California, 2014

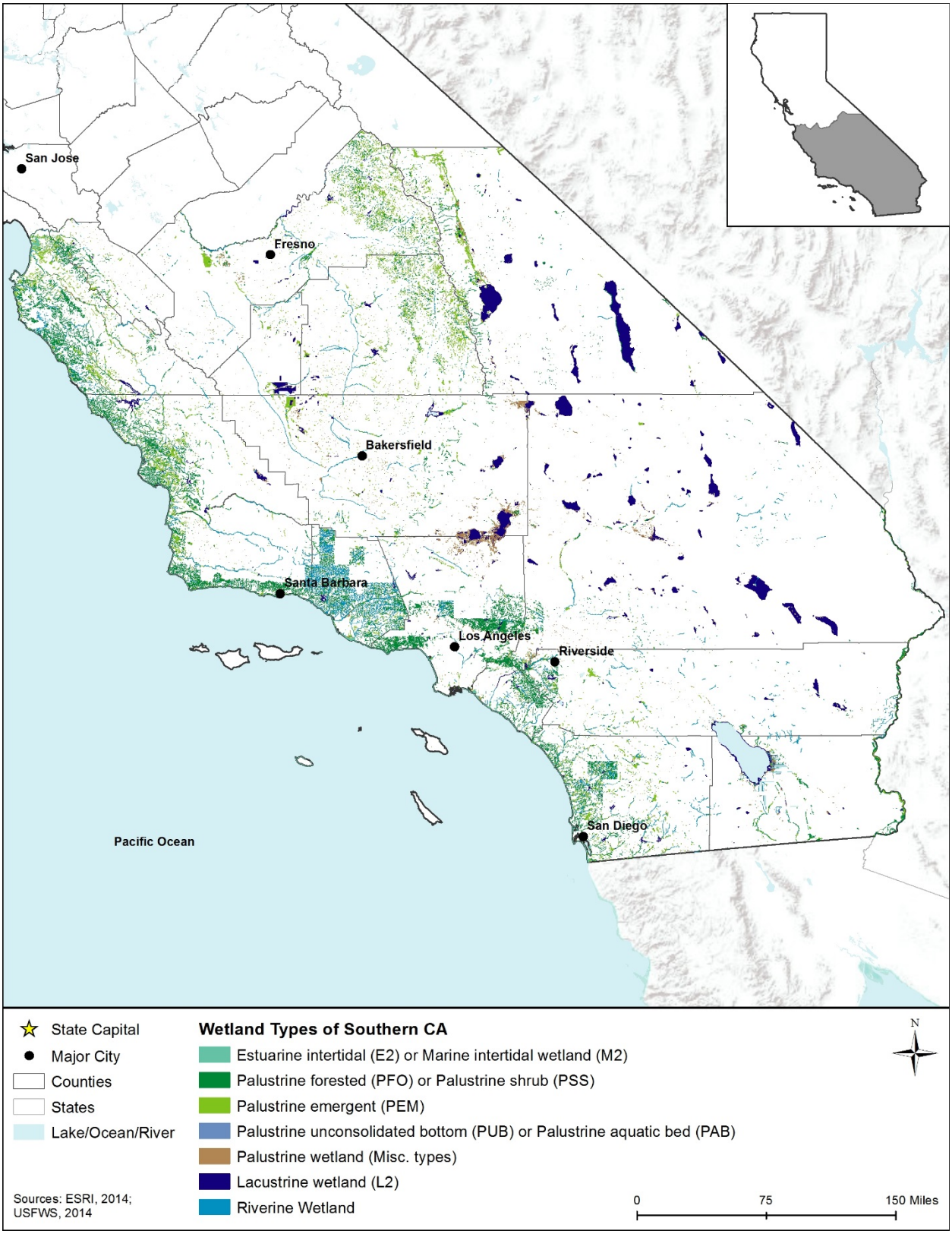


Figure 4.1.5-2: Wetlands by Type, Southern California, 2014

Riverine Wetlands

A riverine wetland consists of the riverine channel and its active floodplain. There are approximately 128,209 acres of riverine wetlands in the state, or 4 percent of the total wetlands (USFWS, 2014a). Typical plant species include small emergent vegetation and plants and shorter grasses, such as watercress, rushes, creeping buttercup, redwood sorrel (*Oxalis oregana*), forget-me-not (*Myosotis sylvatica*), mulefat (*Baccharis salicifolia*), and broad-leaved cattail. Tree species could include hazelnut (*Corylus californicus*), narrow-leaf willow (*Salix exigua*), alder (*Alnus spp*.), black willow, and redwood (*Sequoia sempervirens*) (San Francisco Estuary Institute, 2013a).

Estuarine and Marine Wetlands

Estuarine and marine wetlands in California can be vegetated (marshes) or unvegetated (mud and sand flats), and are found between the open saltwater of the bays or Pacific Ocean and the uplands of coastal California. Estuarine wetlands include vegetated mudflats exposed at low tide, and salt marshes (tidally flooded grasslands) found in the near shore areas. Most commonly, wetlands in this region occur along the fringe of bays, as lagoons, river mouth marshes, and salt marshes (San Francisco Estuary Institute, 2013c). There are approximately 84,801 acres of estuarine and marine wetlands in the state, or 3 percent of the total wetlands (USFWS, 2014a).

Typical plant species include saline estuarine wetlands such as cordgrass (*Spartina spp*.), pickleweed (*Sarcocornia spp*.), and salt grass (*Distichlis spp*.) along the banks of the larger tidal channels. In non-saline wetlands (i.e., brackish or freshwater estuarine wetlands), the plant community along the banks of the larger tidal channels at low tide is dominated by species that do not tolerate high salinities, such as cattails, rushes, and willows (*Salix spp.*). Small emergent vegetation and plants include rushes and curly dock. Examples of emergent vegetation and larger shrubs include gumplant (*Grindelia stricta*), arroyo willow (*Salix lasiolepis*), Monterey cypress (*Cupressus macrocarpa*), blue gum *(Eucalyptus spp.*), and coyote brush. (San Francisco Estuary Institute, 2013c)

Wetlands of Special Concern or Value

In addition to protections under the state's wetland protections and national CWA, California considers certain wetland communities as high quality because they are environmental areas of special concern or value due to their global or regional scarcity, "unusual local importance," or habitat they support. These high-quality wetlands include vernal pools, fens, bogs and peatlands and in wetlands contiguous with fens. (USACE, 2012)

Vernal Pools

Vernal pools are a type of small, depressional, temporary wetland. The pools occur in shallow depressions that fill from spring or fall precipitation, and are usually dry by late summer or during droughts since they are not connected to a permanent water source. Vernal pools fill from rain, snowmelt, or groundwater. These small wetlands contribute to storage and filtration of surface water and help recharge aquifers. Each vernal pool has distinctive native plant species

based on its location within the state. Example endemic (or native or restricted to California) vernal pool species include heartscale *(Atriplex cordulata)*, Hoover's calicoflower *(Downingia bella)*, yellowray goldfields *(Lasthenia glabrata)*, and Sierra mock stonecrop *(Sedella pumila)*. (San Francisco Estuary Institute, 2013d)

Bogs, Fens, and Peatlands

In California, areas classified as a bog or fen are protected under the U.S. Army Corps of Engineers (USACE) Nationwide permit due to the scarcity of this habitat in the state and the difficulty with in-kind mitigation. Bogs are acidic wetlands that form thick organic (peat) deposits up to 50 feet deep or more. They have little groundwater influence and are recharged through precipitation. The stagnant, nutrient-poor, acidic water slows all processes in a bog, including nutrient recycling, making bogs very sensitive to external disturbance. (USACE, 2012)

Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water. This wet meadow habitat supports distinctive plant communities, including many species that are restricted to California. (USACE, 2012)

Other Important Wetland Sites in California

- The San Francisco Estuary, which includes the San Francisco Bay, the Suisun Marsh, and the Sacramento-San Joaquin Delta, is the largest estuary on the west coast of North and South America. A study found that only 19 percent (44,400 acres) of the original tidal marshes remain in this estuary, which is approximately 52 percent of the total estuarine wetlands in the state. (CDWR, 2013a)
- National Natural Landmarks in California range in size from 2 acres to nearly 600,000 acres, including vernal pools, and are owned by USFWS, The Nature Conservancy, California State Parks, counties, municipalities, and other conservation organizations and individuals. (NPS, 2012a) Section 4.1.8, Visual Resources, describes the state's National Natural Landmarks.
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state. These include Natural Resources Conservation Service (NRCS) Agricultural Conservation Easement Program and easements managed by natural resource conservation groups such as state land trusts, The Nature Conservancy, Ducks Unlimited, and Elkhorn Slough Foundation. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), NRCS holds more than 132,000 acres in conservation easements in California. (NCED, 2015)

4.1.6 Biological Resources

4.1.6.1 Definition of the Resource

This Section describes the biological resources of California. Biological resources include terrestrial[69] vegetation, wildlife, fisheries and aquatic[70] habitats, and threatened[71] and endangered[72] species, as well as species of conservation concern. Because of the significant topographic, climate, and landscape variation within the state, California supports a wide diversity[73] of biological resources. These range from the mountainous ranges along the coastline, to the Sierra Nevada and Klamath mountains in the northern portion of the state, to chaparral[74] and oak woodlands and valleys within the central portion of the state, to the Southern California Mountains and Central, Mojave, and Sonoran basin and ranges regions in the southern portion of the state.

4.1.6.2 Specific Regulatory Considerations

The federal laws relevant to the protection and management of biological resources in California are summarized in detail in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders. Table 4.1.6-1 summarizes major state laws relevant to California's biological resources.

Table 4.1.6-1: Relevant California Biological Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
California Native Plant Protection Act (NPPA) of 1977 (California Fish and Game Code Section 1900 et seq.)	California Department of Fish and Wildlife (CDFW)	Provides protection to endangered and rare plant species, subspecies, and varieties of wild native plants in California. The California Native Plant Protection Act definitions of "endangered" and "rare" parallel the California Endangered Species Act definitions of endangered and threatened plant species.
California Endangered Species Act (CESA) of 1984 (California Fish and Game Code Section 2050 through 2069)	CDFW	Prohibits the taking of state-listed endangered or threatened species, as well as candidate species being considered for listing. Under the California ESA, applicants may obtain a Section 2081 incidental take permit if impacts of the take are minimized and fully mitigated and the take would not jeopardize the continued existence of the species. A "take" of species, under the California ESA, is defined as an activity that would directly or indirectly kill an individual species.

[69] Terrestrial: "Pertaining to land" (USEPA, 2015w).

[70] Aquatic: "Pertaining to water" (USEPA, 2015w).

[71] Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C. §1532(20)).

[72] Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. §1532(6)).

[73] Diversity: "An ecological measure of the variety of organisms present in a habitat" (USEPA, 2015w).

[74] Chapparral: "An area of dry land especially in southern California that is covered with bushes and short trees." (Merriam Webster Dictionary, 2016a)

State Law/Regulation	Regulatory Agency	Applicability
CEQA (Public Resources Code Section 2011 et seq.)	State, Regional, and Local Planning Agencies (e.g., cities, counties, special districts)	Requires public agencies to analyze and publicly disclose the environmental impacts from projects they approve, and adopt feasible alternatives and mitigation measures to mitigate for the significant impacts they identify. During CEQA review, public agencies must evaluate and disclose impacts to the 220 plant species protected under CESA and the NPPA, and in most cases must mitigate all significant impacts to these species to a level of less than significance. In addition, during the CEQA process, public agencies must also address plant species that may not be listed under CESA or the NPPA, but that may nevertheless meet the definition of rare or endangered provided in CEQA.
Natural Community Conservation Planning Act (NCCPA) (California Fish and Game Code Division 3, Section 2800, as amended, Chapter 10).	CDFW	Allows for the development of broad-based ecosystem-level plans for the protection and perpetuation of biological diversity. The primary objective of Natural Community Conservation Plans (NCCPs) prepared under the NCCPA is to conserve natural communities at the ecosystem level while accommodating compatible land use. Plants protected under an approved NCCP may be "taken" by activities covered under the plan, but also typically receive a large amount of conservation and protection.
California Desert Native Plants Act (CDNPA) (California Food and Agriculture Code, Division 23, Chapters 1 through 8)	CDFW	Protects certain species of California desert native plants from unlawful harvesting on both public and privately owned lands. The CDNPA only applies within the boundaries of Imperial, Inyo, Kern, Los Angeles, Mono, Riverside, San Bernardino, and San Diego Counties. Within these counties, the CDNPA prohibits the harvest, transport, sale, or possession of specific native desert plants unless a person has a valid permit or wood receipt, and the required tags and seals. The appropriate permits, tags and seals must be obtained from the sheriff or commissioner of the county where collecting will occur, and the county will charge a fee.
Lake and Streambed Alteration Program (California Fish and Game Code Section 1602 – Streambed Alteration)	CDFW	All diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by the CDFW under Sections 1600 et seq. of the California Fish and Game Code. Under Section 1602, it is unlawful for any person to substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated by CDFW, or use any material from the streambeds, without first notifying CDFW of such activity and obtaining a Lake or Streambed Alteration Agreement authorizing such activity.
Protection of Bird Nests and Raptors (California Fish and Game Code Section 3503-3503.5)	CDFW	It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird. Specifically, it is unlawful to take, possess, or destroy any raptors (i.e., hawks, owls, eagles, and falcons), including their nests or eggs. Violations of the code include destroying active nests by removing the vegetation in which the nests are located and disturbance of nesting pairs that results in the failure of active raptor nests.

4.1.6.3 Terrestrial Vegetation

The distribution of flora within the state is a function of the characteristic geology,[75] soils, climate,[76] and water of a given geographic area and correlates with distinct areas identified as ecoregions.[77] Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions, and represent ecosystems contained within a region. The boundaries of an ecoregion are not fixed, but rather depict a general area with similar ecosystem types, functions, and qualities (National Wildlife Federation, 2015) (USDA, 2015a) (World Wildlife Fund, 2015). The ecoregions mapped by the USEPA and USGS are the most commonly referenced, although individual states and organizations have also developed ecoregions that may differ slightly from those designated by the USEPA. The USEPA divides North America into 15 broad Level I ecoregions. These Level I ecoregions are further divided into 50 Level II ecoregions. These Level II ecoregions are further divided into 182 smaller Level III ecoregions. This Section provides an overview of the terrestrial vegetation resources for California at USEPA Level III (USEPA, 2016a) (Griffith, et al., 2016).

As shown in Figure 4.1.6-1, the USEPA divides California into 13 Level III ecoregions. The 13 ecoregions support a variety of different plant communities, all predicated on their general location within the state. Communities range from coniferous forests in the Coast Range and Klamath Mountains in northern California, to chaparral, oak woodlands, grasslands and agricultural cropland of the state's central valley; to chaparral, oak woodlands, and ponderosa pine (*Pinus ponderosa*) that distinguish the Southern California Mountains and creosote bush and palo verde-cactus shrub and saguaro cactus of the Mojave and Sonoran Basin and Range regions of the far southern portion of the state (Griffith, et al., 2016) (USEPA, 2000). Table 4.1.6-2 provides a summary of the general abiotic[78] characteristics, vegetative communities, and the typical vegetation found within each of the 13 California ecoregions.

[75] "Geology is the study of the planet earth- the materials it is made of, the processes that act on those materials, the products formed, and the history of the planet and its life forms since its origin" (USEPA, 2015w).

[76] Climate: "The average weather conditions in a particular location or region at a particular time of the year. Climate is usually measured over a period of 30 years or more" (USEPA, 2015w).

[77] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables" (USEPA, 2015w).

[78] Abiotic: "Characterized by absence of life; abiotic materials include non-living environmental media (e.g., water, soils, sediments); abiotic characteristics include such factors as light, temperature, pH, humidity, and other physical and chemical influences." (USEPA, 2015w)

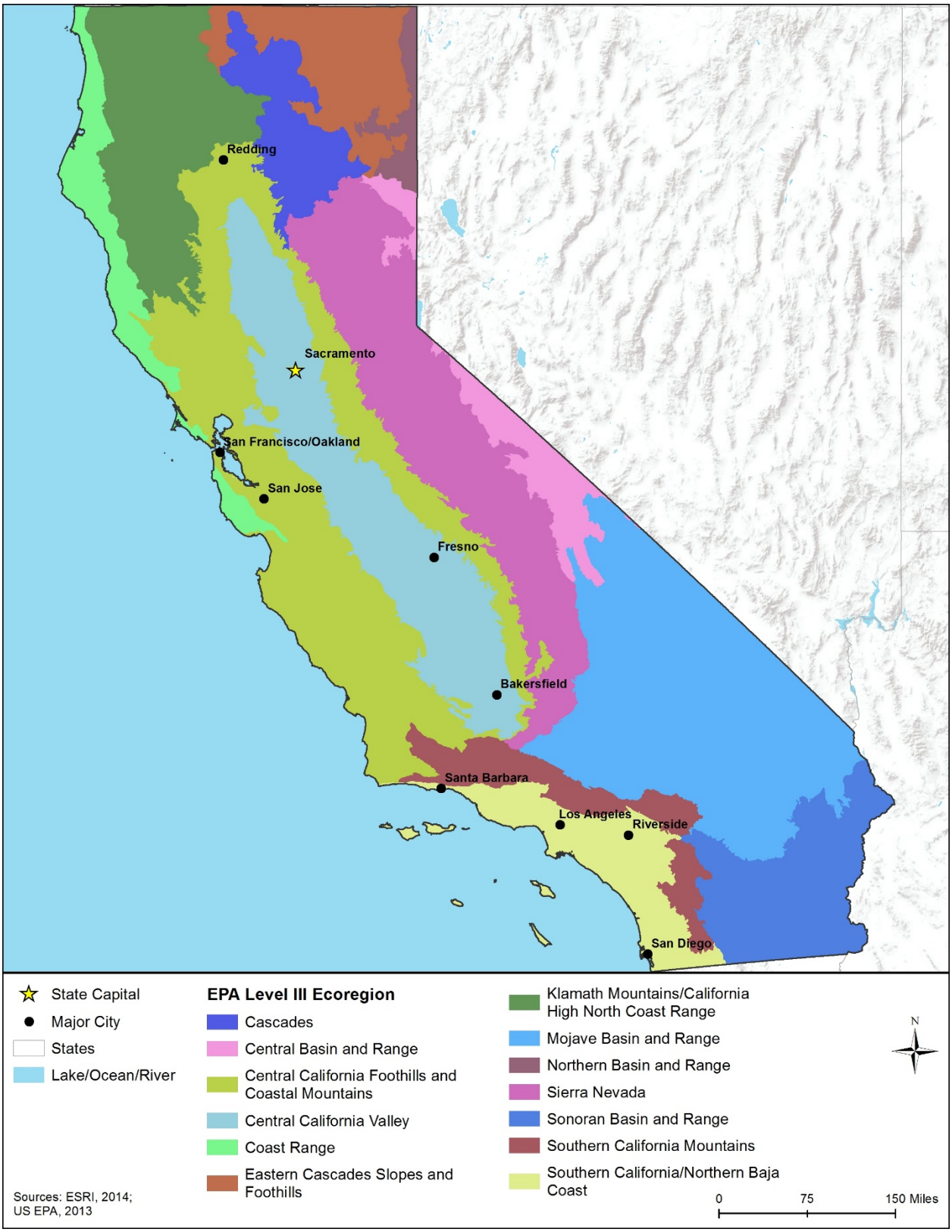


Figure 4.1.6-1. USEPA Level III Ecoregions in California

Table 4.1.6-2. USEPA Level III Ecoregions of California

USEPA Ecoregion Number	Ecoregion Name	Abiotic Characterization	Plant Zone Ecosystem	Typical Dominant Vegetation
Geographic Region: Northern California				
1	Coast Range	Highly productive, rain-drenched coniferous forests cover the low mountains of the Coast Range. The region was once dominated by Sitka spruce and coastal redwood forest, and a mosaic of western red cedar, western hemlock, and seral Douglas-fir covered the inland areas. Today Douglas-fir plantations are prevalent on the intensively logged and managed landscape. The coastal lowlands consist of low gradient streams, tidal marshes and floats; the coastal uplands consist of steeper gradients with medium and large streams.	Redwood Forest, Douglas-fir/Western Hemlock Forests, Sand Dunes, Tidal Flats, Marshes	• **Hardwoods** – Red alder (*Alnus rubra*), Oregon ash (*Fraxinus latifolia*) • **Conifer Trees** – Shore pine (*Pinus contorta)*, Sitka spruce (*Picea sitchensis*), Western hemlock (*Tsuga heterophylla)*, Western red-cedar (*Thuja plicata)*, Douglas-fir (*Pseudotsuga menziesii)* • **Shrubs** – Salal (*Gaultheria shallon)*, Evergreen huckleberry (*Vaccinium ovatum*), salmonberry (*Rubus spectabilis)*
4	Cascades	A mountainous ecoregion underlain by Cenozoic volcanoes that has been affected by alpine glaciations. The Cascades are characterized by broad, easterly trending valleys, steep ridges in the west, a high plateau in the east, and both active and dormant volcanoes. Elevations range upwards to 14,400 feet. Its moist, temperate climate supports an extensive and highly productive coniferous forest. Subalpine meadows occur at high elevations.	Douglas-fir/Western Hemlock Forests, Silver fir/Red fir Forests	• **Hardwoods** – Red alder (*Alnus rubra)*, Cottonwood (*Hibiscus tilliaceus)*, Bigleaf maple (*Acer macrophyllum*) • **Conifer Trees** – Douglas-fir (*Pseudotsuga menziesii)*, Western hemlock (*Tsuga heterophylla)*, True firs (*Abies species*) • **Shrubs** – Vinemaple (*Acer circinatum*), Red dosier dogwood (*Cornus sericea)*, Salmonberry (*Rubus spectabilis)*, Stinkcurrent (*Ribes bracteosum*)

USEPA Ecoregion Number	Ecoregion Name	Abiotic Characterization	Plant Zone Ecosystem	Typical Dominant Vegetation
9	Eastern Cascade Slopes and Foothills	Varies greatly from cool and moist along the cascade border to dry and warm towards the east. Forested uplands, marshes, and agricultural fields characterize this ecoregion.	Mixed Conifer Forest, Ponderosa Pine Forest, Western Juniper, Grand fir Forest, Bitterbrush Woodland, Grasslands, and Shrubland Steepe	• **Hardwoods** – Mountain alder (*Alnus viridis)*, Water birch (*Betula occidentalis)* • **Conifer Trees** – Grand fir (*Abies grandis)*, White fir (*Abies concolor)*, Ponderosa pine (*Pinus ponderosa)*, Western-red cedar (*Thuja plicata)*, Lodgepole pine (*Pinus contorta)* • **Shrubs** – Vinemaple (*Acer cirinatum)*, Douglas spiraea (*Spiraea douglasii)*, Red dosier dogwood *(Cornus sericea)*, Snowberry *(Symphoricarpos)*
78	Klamath Mountains and California High North Coast Range	A physically and biologically diverse ecoregion characterized by highly dissected, folded mountains, foothills, terraces, and floodplains underlain by igneous, sedimentary, and some metamorphic rock. A mild, subhumid climate characterizes the mountainous area, followed by a lengthy summer drought. It supports a vegetal mix of northern Californian and Pacific Northwest conifers.	Northern California and Pacific Northwest Conifer Forests, Hardwood Forests, Oak Woodlands, Pine Woodland, Pastureland	• **Hardwoods** – Mountain alder (*Alnus viridis)*, Water birch (*Betula occidentalis)*, Oregon white oak (*Quercus garryana*), California black oak (*Quercus kelloggii)*, Tanoak (*Notholithocarpus)*, Port orford cedar (*Chamaecyparis lawsoniana)*, Shasta red fir (*Abies magnifica)* • **Conifer Trees** – Grand fir (*Abies grandis)*, White fir (*Abies concolor)*, Ponderosa pine (*Pinus ponderosa)*, Western-red cedar (*Thuja plicata)*, Lodgepole pine (*Pinus contorta)*, Incense cedar (*Calocedrus)* • **Shrubs** – Vinemaple (*Acer cirinatum)*, Douglas spiraea (*Spiraea douglasii)*, Red dosier dogwood *(Cornus sericea)*, Snowberry *(Symphoricarpos)*, Madrone (*Arbutus menziesii)*

USEPA Ecoregion Number	Ecoregion Name	Abiotic Characterization	Plant Zone Ecosystem	Typical Dominant Vegetation
80	Northern Basin and Range	Consists of arid tablelands, intermountain basins, dissected lava plains, and scattered low mountains.	Sagebrush Steppe, Shadescale Scrub, Greasewood	• **Conifer Trees –** Douglas-fir *(Pseudotsuga mensiesii)* • **Hardwood Trees –** Quaking aspen (*Populus tremuloides)* • **Shrubs –** Mountain sagebrush (*Artemisia tridentate vaseyana)*, Little sagebrush (*Artemisia arbuscula),* Wyoming big sagebrush (*Artemisia tridentate wyomingensis)* • **Grasses/Forbs –** Idaho fescue (*Festuca idahoensis),* Spiny hopsage (*Grayia spinosa)*
Geographic Region: Sierra Nevada Range and Eastern California				
5	Sierra Nevada	A deeply dissected block fault that rises sharply from the arid basin and range ecoregions to the east. This region slopes gently towards Central California to the west. The central and southern portion is underlain by granite.	Ponderosa Pine Forest, Jeffery Pine Forest, Lodgepole Pine Forest, Fir-Spruce Forest	• **Conifer Trees –**Ponderosa pine *(Pinus ponderosa)*, Lodgepole pine *(Pinus contorta)*, Jeffery pine (*Pinus jeffreyi)*, Red Fir *(Abies magnifica)*, White Fir (*Abies concolor)*, Incense Cedar (*Calocedrus decurrens)*, Western white pine (*Pinus monticola),* Sugar pine (*Pinus lambertiana)* • **Hardwood Trees –** Mountain willow (*Salix eastwoodiae),* Dusky Willow (*Salix melanpsis),* Quaking aspen (*Populus tremuloides)*, California poplar (*Populus trichocarpa)*, White Alder (*Alnus rhombifolia)* • **Shrubs –** Madrone (*Aesculus californica),* Chamise (*Adenostoma fasciculatum),* Manzanita (*Arctostaphylos spp.),* Sierra currant (*Ribes nevadense),* Common sagebrush (*Artemisia tridentata),* Utah juniper (*Juniperus osteosperma)*

USEPA Ecoregion Number	Ecoregion Name	Abiotic Characterization	Plant Zone Ecosystem	Typical Dominant Vegetation
13	Central Basin and Range	A mosaic of arid[a] basins with scattered low mountains, high mountains, and salt flats. This ecoregion tends to be hot with a greater density of mountains with perennial streams.[b]	Mixed desert scrub, Pinyon-Juniper woodland, Sagebrush scrub, Sagebush steppe, Salt-Desert shrub	• **Cacti–** Joshua tree (*Yucaa brevifolia)* • **Conifer Trees –** Pinyon pine (*Pinus monophylia),* Juniper (*Juniperus osteosperma)* • **Shrubs –** Creosote bush (*Larrea tridentate*), Bursage (*Ambrosia dumosa),* Shadescale (*Atriplex* spp.), Searls' prairie clover (*Dalea searlsiae),* Blackbush (*Colegyne ramosissima),* Burrobush (*Ambrosia dumonsa*), saltbush species (*Artiplex species),* Sagebrush (*Artemisia),* Winterfat (*Ceratoides lanata),* Rabbitbrush (*Chrysothamnus),* blackbrush (*Coleogyne),* Horsebrush (*Tetradymia)*
Geographic Region: Central Valley				
6	Central California Foothills and Coastal Mountains	Distinguished by a Mediterranean climate of hot dry summers and cool moist winters, and associated vegetative cover comprising chaparral and oak woodlands. Grasslands occur in lower elevations and patches of pine are found at higher elevations. Most of the region consists of open low mountains or foothills, but there are areas of irregular plains in the south. Much of this region is grazed by domestic livestock; very little land has been cultivated.	Chaparral, Coastal Sage Scrub, Coastal Salt Marsh, Coastal Strand, Foothill Woodland, Freshwater Marsh, Southern Oak Woodland, Valley Grassland	• **Hardwood Trees** – Bigleaf maple (*Acer macrophyllum),* white alder (*Alnus rhombifolia),* California juniper (*Juniperus californica)* • **Coniferous Trees -** Coulter pine (*Pinus coulteri),* Singleleaf pinyon (*Pinus monophylla),* California foothill pine (*Pinus usabiniana),* Torrey pine (*Pinus torreyana)* • **Shrubs –** Bobtail barley (*Hordeum intercedens),* Summer lupine (*Lupinus formosus),* Desert deervetch (*Lotus micranthus),* American pillwort (*Pilularia Americana)*

USEPA Ecoregion Number	Ecoregion Name	Abiotic Characterization	Plant Zone Ecosystem	Typical Dominant Vegetation
7	Central California Valley	Characterized by flat, intensively farmed plains having long, hot dry summers and cool wet winters. Nearly half of the region is in cropland, about three fourths of which is irrigated.	Grassland Prairie, Oak Savanna Woodland, Desert Grasslands, Riparian Woodlands, Freshwater Marshes, Vernal Pools	• **Deciduous Trees –** Arroyo willow (*Salix lasiolepis)*, California sycamore (*Platanus racemosa)*, Box Elder (*Acer negundo)*, Fremont cottonwood (*Populus fremontii)*, Valley Oak (*Quercus lobata)*, White alder (*Alnus rhombifolia)* • **Shrubs –** Coyote brush (*Baccharis pilularis)*, Western spicebush (*Calycanthus occidentalis)*, Pink Manzanita (*Arctostaphylos bakeri)*, Mountain mahogany (*Cercocarpus betuloides)* • **Grasses –** Nodding needle grass **(***Stipa cerua)*, Wild rye *(Elymus spp.)*, Pine bluegrass *(Poa scabrella)*, Wiregrass *(Arisida spp.)*, June grass (*Koeleria cristata)*, Deergrass *(Muhlenbergia rigins)*,California melic *(Melica imperfect)*
Geographic Region: Southern California and Mojave Desert				
8	Southern California Mountains	Mediterranean climate of hot dry summers and moist cool winters. Although Mediterranean vegetation such as chaparral and oak woodlands predominate, elevations are considerably higher in this region, the summers are slightly cooler, and precipitation amounts are greater that surrounding areas, causing the landscape to be more densely vegetated and stands of ponderosa pine to be larger.	Oak Woodland, Chamise Chaparral, Mixed Chaparral, Juniper Woodland, Coniferous Woodland, Coniferous Forest, Montane Hardwood, Jeffery Pine Forest, Lodgepole Pine Forest	• **Coniferous Trees –** Jeffery pine, Coulter pine (*Pinus coulteri)*, Ponderosa pine (*Pinus ponderosa)*, Sugar pine (*Pinus lambertiana)*, White fir (*Pinus strobus)*, Bigcone Douglas-fir (*Pseudotsuga macrocarpa)*, Lodgepole pine, Limber pine (*Pinus flexillis*) • **Deciduous Trees –** Valley oak (*Quercus lobata*), California black oak (*Quercus kelloggii*), Canyon live oak (*Quercus chrysolepis*) **Shrubs –** American dogwood (*Cornus stolonifera)*, Brittlebush (*E. farinose)*, California buckwheat (*Eriogonum fasciculatum)*, Winterfat (*Eurotia lanata)*, Goldenbush (*Haplopappus parishii)*

USEPA Ecoregion Number	Ecoregion Name	Abiotic Characterization	Plant Zone Ecosystem	Typical Dominant Vegetation
14	Mojave Basin and Range	Scattered low mountains with very little rainfall.	Creosote Bush Scrub, Alkali Sink, Aspen-Conifer Forest, Basin Big Sagebrush, Black Greasewood, Mixed Desert Scrub, Inland Saltgrass, Joshua Tree Woodland, Pinyon-Juniper Woodland, Shadscale scrub	• **Conifer Trees –** Utah juniper (*Juniperus osteosperma),* California juniper (*Juniperus californica)* • **Hardwood Trees –** Rocky Mountain maple (*Acer glabrum),* Boxelder (*Acer negundo),* Thinleaf alder (*Alnus incana tenuifolia*), Water birch (*Betula occidentalis)* • **Shrubs –** Creosote bush (*Larrea tridentate),* Burrobrush (*Hymenoclea salsola),* Rusty Molly (*Kochia californica),* Slender bedstraw (*Galium angustifolium)* • **Grasses/Forbs –** Mojave woolly sunflower (*Eriophyllum mohavense),* Thomas buckwheat (*Eriogonum thomasii),* Common fiddleneck (*Amsinckia menziesii)*

USEPA Ecoregion Number	Ecoregion Name	Abiotic Characterization	Plant Zone Ecosystem	Typical Dominant Vegetation
81	Sonoran Basin and Range	Terrain consists of scattered low mountains and broad basins similar to the Mojave Basin and Range and is generally hotter. Winter rainfall decreases from west to east while summer rainfall decreases from east to west.	Lowland Sonoran Desertscrub, Upland Sonoran Desertscrub, Mojave Desertscrub, Interior Chaparral	• **Hardwood Trees** – Saguaro (*Carnegiea gigantea*), mesquite (*Prosopis pubescens)*, paloverde (*Cercidium floridum)*, tamarisk (*Tamarix pentandra)*, willow (*Salix spp.)*, cottonwood (*Populus deltoids)*, ironwood (*Olneya tesota*), smoke tree (*Psorothamnus spinosus*), desert willow (*Chilopsis linearis*) • **Shrubs and Cacti** – Ephedra (*Ephedra fasciculate)*, white bursage (*Ambrosia dumosa)*, desert buckwheat (*Eriogonum deserticola*), creosotebush, saltbush (*Atriplex canescens)*, brittlebush (*Encelia farinose)*, Jumping cholla (*Opuntia bigelovii)*, Range ratany (*Krameria erecta*), Ocotillo (*Fouquieria splendens*), barrel cactus (*Ferocactus* spp.), beavertail cactus (*Opuntia basilaris)*, fourwing saltbush (*Atriplex canescens)*, Wolfberry (*Lycium spp*.), Globe mallow (*Sphaeralcea spp*.), Triangleleaf bursage (*Ambrosia deltoidea*), Catclaw acacia • **Grasses** – Big galleta (*Hilaria ridgida)*, California threeawn (*Aristida californica*), bush muhly (*Muhlenbergia porter)*, six weeks grama (*Bouteloua barbata*), fluffgrass (*Dasyochloa pulchella*)

USEPA Ecoregion Number	Ecoregion Name	Abiotic Characterization	Plant Zone Ecosystem	Typical Dominant Vegetation
85	Southern California/ Northern Baja Coast	Terrain contains coastal and alluvial plains, marine terraces, and some low hills in the coastal area of Southern California.	Coastal Sage Scrub, Chaparral	• **Coniferous Trees** – Torrey pine • **Hardwood Trees** –coast live oak (*Quercus agrifolia*), canyon live oak (*Quercus chrysolepis*), poison oak (*Toxicodendron diversilobum*), California walnut (*Juglans californica*) • **Shrubs** – ceanothus (*Ceanothus spp*.), manzanita (*Arctostaphylos spp*.), coastal sage scrub oak (*Quercus dumosa*), mountain-mahogany (*Cercocarpus spp*.), coastal cholla (*Cylindropuntia prolifera*) • **Grasses/Forbs –** chamise (*Adenostoma fasciculatum*), white sage (*Salvia apiana*), black sage (*Salvia mellifera*), golden-yarrow (*Eriophyllum confertiflorum*)

[a] Arid: "Terrestrial systems characterized by a climate regime where the potential evapotranspiration exceeds precipitation, annual precipitation is not less than 5 cm and not more than 60 cm, and daily and seasonal temperatures range from 40 C to 50 C" (USEPA, 2015w).
[b] Perennial stream: "A stream that runs continuously throughout the year" (USEPA, 2015w).

Sources: (Griffith, et al., 2016) (USEPA, 2000) (CEC, 2011)

Communities of Concern

California contains vegetative communities of concern that include rare natural plant communities, plant communities with greater vulnerability or sensitivity to disturbance, and communities that provide habitat for rare plant and wildlife species. The ranking system for these communities gives an indication of the relative rarity, sensitivity, uniqueness, or vulnerability of these areas to potential disturbances. This ranking system also gives an indication of the level of potential impact to a particular community[79] that could result from implementation of an action.

CDFW manages a list of all types of Natural Communities (NCs) known to occur, or that have historically occurred, in the state using the California Natural Diversity Database (CNDDB) (CDFW, 2015a). The CNDDB is a program that inventories the status and locations of rare plants and animals in California. Using the CNDDB, CDFW tracks and maps approximately 96 NCs, and many of the 2,500 individual rare plant and animal tracked species occur within these NCs (CDFW, 2015a). Governmental agencies and the public can query and report CNDDB data using a program known as RareFind 5, an internet application that allows users to query, track, and report rare plant and animal species (CDFW, 2015c).

Since 1999, the CDFW has mapped and classified NCs using the state's Vegetation Classification and Mapping Program (VegCAMP); they have also standardized vegetation nomenclature for California to comply with the National Vegetation Classification System (NVCS) (CDFW, 2015a). VegCAMP is California's version of the NVCS and they implement it through assessment and mapping projects in high-priority conservation and management areas (CDFW, 2015d). Since 2007, California has followed the NVCS for vegetation mapping and implemented the program through VegCAMP. The purpose of the NVCS and VegCAMP is to determine the level of rarity and imperilment of vegetation types. California ranks NCs according to rarity, trends, and threats, and it follows NatureServe's Heritage Methodology, which ranks vegetation communities using both a global (G) and state (S) ranking system. Ranking and tracking the historical occurrences of NCs and at-risk species is important for assessing previously undocumented occurrences or re-occurrences of previously documented species. Under the NVCS used in the CNDDB, each natural community is assigned a rank based on its rarity and vulnerability. The USNVC ranking system assesses rarity using a state rank (S1, S2, S3, S4, and S5) that indicates its rarity within California. Communities ranked as an S1 by the NatureServe Heritage Methodology are of the greatest concern. State ranks of S1 through S3 are considered to be highly imperiled (CDFW, 2015a). This rank is typically based on the range of the community, the number of occurrences, the viability of the occurrences, recent trends, and the vulnerability of the community. A list of California's rare S1 communities was compiled from the September 2010 Natural Communities List (CDFW, 2015h).

[79] Community: "In ecology, an assemblage of populations of different species within a specified location in space and time. Sometimes, a particular subgrouping may be specified, such as the fish community in a lake or the soil arthropod community in a forest" (USEPA, 2015w).

Thirty vegetative communities are ranked as S1 communities[80] in California (CDFW, 2015h). A description of the communities of conservation concern in California, along with their state rank, distribution, abundance, and the associated USEPA Level III ecoregions, are summarized in California Appendix B-1. These communities represent the rarest terrestrial habitat in the state. The communities can be found scattered throughout the state, with some being concentrated in unique areas (CDFW, 2015h). According to the 2015 California State Wildlife Action Plan (SWAP), 475 plant species are identified as Species of Greatest Conservation Need (SGCN (CDFW, 2015e)).

Nuisance and Invasive Plants

There are a large number of undesirable plant species that are considered nuisance and invasive[81] plants. Noxious weeds are typically non-native species that have been introduced into an ecosystem inadvertently; however, on occasion native species can be considered a noxious weed. Noxious weeds greatly affect agricultural areas, forest management, natural, and other open areas (GPO, 2011). The federal government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S.C. 7701 et seq.). As of September 2014, 112 federally recognized noxious weed species have been catalogued nationwide (88 terrestrial, 19 aquatic, and 5 parasitic) (USDA, 2015b).

In California, four laws and related regulations control the movement of noxious weeds. The Plant Quarantine and Pest Control regulation (Food and Agricultural Code (FAC) Division 4, Section 6305, 6344, 6461 and 6465) (California Legislative Information, 1967a) provides quarantine authority against all weed pests, specifically related to the transport of seeds, the shipment of seeds, and the abatement, reshipment, and treatment of weed pests. The California Seed Law (FAC Division 18, Chapter 2, Sections 52251 through 52515) (California Legislative Information, 1967b) regulates noxious weed seeds found in agricultural and vegetable seed. The law designates noxious weeds and seeds into two categories: prohibited noxious weed seeds and restricted noxious weed seeds. The third regulation, the Federal Seed Act (7 CFR Part 201, §§1551-1611) (GPO, 2009) is the federal counterpart to the California Seed Law. This regulation oversees the interstate movement of designated noxious weed seeds. The fourth law, the Federal Noxious Weed Act (7 U.S.C. § 2814) (GPO, 1998) and 7 CFR Part 36 (GPO, 2015) are concerned with the introduction of federally designated noxious weed plants or seeds across international borders (CDFA, 2005a).

A total of 197 state-listed noxious weeds are regulated in California, each assigned 1 of 5 ratings based on the overall distribution in the state and the severity of threat (CDFA, 2015). "A" rated weeds are limited in distribution, "B" rated weeds are more widespread, "C" rated weeds are generally widespread, "Q" rated species are treated as temporary "A" weeds (pending determination of a permanent rating), and "D" rated weeds are organisms that are considered to be of little or no economic importance to the state (CDFA, 2005a). Twelve of these species

[80] S1 – Communities "at high risk because of extremely limited and/or rapidly declining population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the state" (MFWP; MNHP, 2015).

[81] Invasive: "These are species that are imported from their original ecosystem. They can out-compete native species as the invaders often do not have predators or other factors to keep them in check" (USEPA, 2015w).

occur on the Federal Noxious Weed List (USDA, 2014). Of the 197 state-listed species, 178 of them are terrestrial and 19 are aquatic species. The following species by vegetation type are regulated in California.

- **Aquatic –** Narrowleaf elodea (*Egeria najas*), Hydrilla (*Hydrilla verticillata*), Frogbit (*Hydrocharis morsus-ranae*), Indian swampweed (*Hygrophila polysperma*), Oxygen weed (*Lagarosiphon major*), South American spongeplant (*Limnobium laevigatum*), North American spongeplant (*Limnobium spongia*), Ambulia (*Limnophila indica*), Asian marshweed (*Limnophila sessiliflora*), Banana waterlily (*Nymphaea mexicana*), Yellow floating heart (*Nymphoides peltata*), Sulfur cinquefoil (*Potentilla recta*), Giant salvinia (*Salvinia auriculata*), Giant foxtail (*Setaria faberi*), Chinese saltcedar (*Tamarix chinensis*), French saltcedar (*Tamarix gallica*), Small flowered saltcedar (*Tamarix parviflora*), Branched saltcedar (*Tamarix ramosissima*), Japanese eelgrass (*Zostera japonica*), Wavy-leafed gaura (*Oenothera sinuosa*), and Drummond's gaura (*Oenothera xenogaura*).
- **Shrubs –** Kangaroothorn (*Acacia paradoxa*), Tree-of-heaven (*Ailanthus altissima*), Camelthorn (*Alhagi maurorum*), Panicled onion (*Allium paniculatum*), Wild garlic (*Allium vineale*), Alligator weed (*Alternanthera philoxeroides*), Sessile joyweed (*Alternanthera sessilis*), Giant ragweed (*Ambrosia trifida*), Dudaim melon (*Cucumis melo),* Dodder (*Cuscuta spp*.), Scotch broom (*Cytisus scoparius),* Cap ivy (*Delairea odorata*), Tree spurge (*Euphorbia dendroides*), Leafly spurge (*E. virgata*), Grassland spurge (*Euphorbia graminea*), Oblong spurge (*Euphorbia oblongata*), Serrate spurge (*Euphorbia serrata*), Carnation spurge (*Euphorbia terracina*), French broom (*Genista monspessulana*), Russian salt tree (*Halimodendron halodendron*), Halogeton (*Halogeton glomeratus*), Black henbane (*Hyoscyamus niger*), Canary Island St. John Wort (*Hypericum canariense*), Klamathweed (*Hypericum perforatum*), Dyer's woad (*Isatis tinctoria*), Globe-podded hoary cress (*Lepidium appelianum*), Long-leaved groundcherry (*Physalis longifolia*), Grape groundcherry (*Physalis viscosa*), Creeping mesquite (*Prosopis strombulifera*), Bridal broom (*Retama monosperma*), Mediterranean sage (*Salvia aethiopis*), Meadow sage (*Salvia virgata*), Spanish broom (*Spartium junceum*), Austrian peaweed (*Sphaerophysa salsula*), Gorse (*Ulex europaeus*), European mistletoe (*Viscum album*), and Syrian beancaper (*Zygophyllum fabago*).
- **Terrestrial Forbs and Grasses** – Biddy-biddy (*Acaena anserinifolia*), Biddy-biddy (*Acaena novae-zelandiae*), Pale biddy-biddy (*Acaena pallid*), Punagrass (*Stipa brachychaeta*), Russian knapweed (*Acroptilon repens*), Jointed goatgrass (*Aegilops cylindrica*), Ovate goatgrass (*Aegilops geniculata*), Barb goatgrass (*Aegilops triuncialis*), Jointvetch (*Aeschynomene*), Bladder flower (*Araujia sericifera*), Capeweed (*Arctotheca calendula*), Giant reed (*Arundo donax*), Onion weed (*Asphodelus fistulosus*), River saltbrush (*Atriplex amnicola*), Hoary allysum (*Berteroa incana*), Slender false brome (*Brachypodium sylvaticum*), Carolina fanwort (*Cabomba caroliniana*), Lens spotted hoarycress (*Lepidium chalepense*), Heart podded hoarycress (*Lepidium draba*), Globe podded hoarycress (*Lepidium appelianum*), Plumeless thistle (*Carduus acanthoides*), musk thistle (*Carduus nutans*), Italian thistle (*Carduus pycnocephalus*), Slenderflowered thistle (*Carduus tenuiflorus*), Smooth distaff thistle (*C. creticus*), Wooly distaff thistle (*Carthamus lanatus*),

Whitestem distaff thistle (*Carthamus leucocaulos*), Southern sandbur (*Cenchrus echinatus*), Coast sandbar (*Cenchrus incertus*), Mat sandbar (*Cenchrus longispinus*), Purple star thistle (*Centaurea calcitrapa*), Diffuse knapweed (*Centaurea diffusa*), Iberian star thistle (*Centaurea iberica*), Meadow knapweed (*Centaurea jacea*), Spotted knapweed (*C. stoebe ssp. micranthos*), Malta star thistle (*Centaurea melitensis*), Squarerose knapweed (*Centaurea squarrosa*), Yellow starthistle (*Centaurea solstitialis*), Sicilian star thistle (*Centaurea sulphurea*), Watersprite (*Ceratopteris thalictroides*), Skeletonweed (*Chondrilla juncea*), Purple mustard (*Chorispora tenella*), Canada thistle (*Cirsium arvense*), Japanese thistle (*Cirsium japonicum*), Yellowspine thistle (*Cirsium ochrocentrum*), Wavyleaf thistle (*Cirsium undulatum*), Bullthistle (*Cirsium vulgare*), Star mustard (*Coincya monesis*), Field bindweed (*Convolvulus arvensis*), Bearded creeper (*Lepidium coronopus*), Paddy melon (*Cucumis myriocarpus*), Artichoke thistle (*Cynara cardunculus*), Artichoke thistle (*Flavescens wiklund*), Purple nutsedge (*Cyperus rotundus*), Yellow nutsedge (*Cyperus esculentus*), Virginia buttonweed (*Diodia virginiana*), Stinkweed (*Dittrichia graveolens*), Tropical chickweed (*Drymaria cordata*), Medusahead (*Taeniatherum caput-medusae*), Quackgrass (*Elymus repens*), Quackgrass (*Elytrigia repens*), Japanese knotweed (*Fallopia japonica*), Giant knotweed (*Fallopia sachalinensis*), Bohemian knotweed (*Fallopia xbohemica*), Hairy crabweed (*Fatoua villosa*), Goatsrue (*Galega officinalis*), Drummond's gaura (*Oenothera xenogaura*), Wavy-leafed gaura (*Oenothera sinuosa*), Blueweed (*Helianthus ciliaris*), Tanglehead (*Heteropogon contortus*), Lens podded hoarycress (*Lepidium chalepense*), Swinecress (*Lepidium coronopus*), Heart podded hoarycress (*Lepidium draba*), Perennial peppercress (*Lepidium latifolium*), Chinese sprangletop (*Leptochloa chinensis*), Dalmation toadflax (*Linaria genistifolia*), Winged water primrose (*Ludwigia decurrens*), Water primrose (*Ludwigia hexapetala*), Peruvian water primrose (*Ludwigia peruviana*), Purple loosestrife (*Lythrum salicaria*), Spanish mercury (*Mercurialis ambigua*), Nimblewill (*Muhlenbergia schreberi*), Giant chickweed (*Myosoton aquatica*), False garlic (*Nothoscordum inodorum*), Foxtail restharrow (*Ononis alopecuroides*), Scotch thistle (*Onopordum acanthium*), Illyrian thistle (*Onopordum Illyricum*), Taurian thistle (*Onopordum tauricum*), Branched broomrape (*Orobanche ramose*), Perennial wild red rice (*Oryza rufipogon*), Blue panicgrass (*Panicum antidotale*), Santa Maria feverfew (*Parthemium hysterophorus*), Harmel (*Peganum harmala*), Kikuyugrass (*Pennisetum clandestinum*), Himalayan knotweed (*Persicaria wallichii*), Star endive (*Rhagadiolus stellatus*), Austrian fieldcress (*Rorippa austriaca*), Creeping yellow fieldcress (*Rorippa sylvestris*), Ravennagrass (*Saccharum ravennae*), Spineless Russian thistle (*Salsola collina*), Wormleaf salsola (*Salsola damascena*), Barbwire Russian thistle (*Salsola paulsenii*), Russian thistle (*Salsola tragus*), Golden thistle (*Scolymus hispanicus*), Tansy ragwort (*Senecio jacobaea*), Fireweed groundsel (*Senecio linearifolius*), Oxford ragwort (*Senecio squalidus*), Scarlett rattlebox (*Sesbania punicea*), Heartleaf nightshade (*Solanum cardiophyllum*), Carolina horsenettle (*Solanum carolinense*), Torrey's nightshade (*Solanum dimidiatum*), White horsenettle (*Solanum elaeagnifolium*), Lanceleaf nightshade (*Solanum lanceolatum*), White margined nightshade (*Solanum marginatum*), Perennial sow thistle (*Sonchus arvensis*), Johnson grass (*Sorghum halepense*), Smooth cordgrass (*Spartina alterniflora*), Common cordgrass (*Spartina anglica*), Dense flowered cordgrass (*Spartina densiflora*),

Saltmeadow cordgrass (*Spartina patens*), Punagrass (*Achnatherum brachychaetum*), Witchweed (*Striga asiatica*), Rough comfrey (*Symphytum asperum*), Wild marigold (*Tagetes minuta*), Capegrass (*Tribolium obliterum*), Puncturevine (*Tribulus terrestris*), and Canary Island knapweed (*Volutaria canariensis*).

4.1.6.4 Terrestrial Wildlife

This section discusses the terrestrial wildlife species in California, divided among mammals,[82] birds,[83] reptiles[84] and amphibians,[85] and invertebrates.[86] Terrestrial wildlife consist of those species, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals, furbearers, [87] nongame animals, game birds, waterfowl, and migratory birds as well as their habitats within California. A discussion of non-native and/or invasive terrestrial wildlife species is also included within this section. Information regarding the types and location of native and non-native/invasive wildlife is useful for assessing the importance of any impacts to these resources or the habitats they occupy. According to CDFW and the CNDDB, the state supports approximately 1,152 native species that include approximately 227 mammals, 70 freshwater fish, 109 reptiles, 672 birds, and 74 amphibians (CDFW, 2016b). According to the 2015 SWAP, approximately 48 mammals, 64 birds, 72 amphibians and reptiles, and 20 freshwater fish reside only in California (CDFW, 2015e) (CDFW, 2015b). Of these wildlife species, the CDFW tracks 19 introduced and non-native bird, reptile, amphibian, fish, and invertebrate species to prevent the spread of the invasive species (CDFW, 2015d). Of the native species in the state, 414 of these fish and wildlife species are tracked as SGCN (CDFW, 2015a).

Mammals

California has a large number of mammal species largely due to the state's diverse natural communities (CDFW, 2015a). During the past 150 years, approximately 515 species and subspecies of native terrestrial mammals have been recorded in California. There are approximately 227 known mammal species that commonly occur in California, including 48 mammal species that do not occur anywhere else in the world (CDFW, 2016b) (CDFW, 2015b) (Williams, D.F. 1986). Unique and rare native wildlife species in the state are also common, including the largest bird in North America, California condor (*Gymnogyps californianus*); Blainsville horned lizard (*Phrynosoma blainvillii*); Coastal tailed frog (*Ascaphus truei*); and California legless lizard (*Anniella pulchra*) (CDFW, 2016b). California waters are also home to

[82] Mammals: "Warm-blooded vertebrates that give birth to and nurse live young; have highly evolved skeletal structures; are covered with hair, either at maturity or at some stage of their embryonic development; and generally have two pairs of limbs, although some aquatic mammals have evolved without hind limbs" (USEPA, 2015w).

[83] Birds: "Warm-blooded vertebrates possessing feathers and belonging to the class Aves" (USEPA, 2015w).

[84] Reptile: "Cold-blooded, air-breathing vertebrates belonging to the class Reptilia, usually covered with external scales or bony plates" (USEPA, 2015w).

[85] Amphibian: "A cold-blooded vertebrate that lives in water and on land. Amphibians' aquatic, gill-breathing larval stage is typically followed by a terrestrial, lung-breathing adult stage" (USEPA, 2015w).

[86] Invertebrates: "Animals without backbones: e.g., insects, spiders, crayfish, worms, snails, mussels, clams, etc." (USEPA, 2015w).

[87] Furbearer is the name given to mammals that traditionally have been hunted and trapped primarily for fur.

the once-endangered California gray whale (*Eschrichtius robustus*); the Sierra Nevada mountains are home to the rare Sierra Nevada red fox (*Vulpes vulpes necator*) (USFS, 2010).

Common and widespread mammalian species in California include the American pika (*Ochonta princeps),* elk (*Cervus elaphus),* red fox (*Vulpes vulpes),* raccoon *(Procyon lotor),* and least chipmunk *(Tamias minimus).* Most mammals are widely distributed in the state; however, there are some species that are restricted to small geographic ranges due to their strong associations with certain limited habitats. The desert slender salamander (*Batrachoseps major aridus),* a federal and state listed endangered species is known to only occur in two small populations in the Santa Rosa Mountains in Riverside County (CDFW, 2015a). Similarly, the Mount Hermon June beetle (*Polyphilla barbata*) and Zayante band-winged grasshopper (*Trimerotropis infantillis),* also both federal and state-listed endangered species are restricted to small outcrops of sandstone and limestone soils derived from marine sediments in the Santa Cruz mountains (CDFW, 2015a). Other species, such as mule deer (*Odocoileus hemionus)* and pronghorn antelope (*Antilocapra Americana)* migrate long distances between summer ranges in the Sierra Nevada and winter ranges in the lower-elevation sagebrush-steppe habitat in northern California (CDFW, 2015a). A number of threatened and endangered mammals are located in California. Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

In California, pronghorn antelope (*Antilocapra americana*), gray wolf (*Canus lupus*), bighorn sheep (*Ovis Canadensis*), and black bear (*Ursus americanus*) are classified as big game species, whereas small game species include small mammals [e.g., tree squirrels (*Sciurus* spp.), rabbits (*Sylvilagus* spp.), hares (*Lepus spp*.), and jackrabbits (*Lepus californicus, L. townsendii*)], non-game species [e.g., bobcats (*Lynx rufus*), coyote (*Canis latrans*), Virginia opossum (*Didelphis virginiana*), western spotted skunk (*Spilogale gracilis*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), ermine (*Mustela erminea*), American crow (*Corvus brachyrhynchos*)], furbearers [e.g., badgers (*Taxidea taxus*), beavers (*Castor canadensis*), gray fox (*Urocyon cinereoargenteus*), American mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*)], and upland and migratory game birds [e.g., pheasant (*Phasianus colchicus*), quail (*Callipepla californica, C. gambelii, Oreortyx pictus*), chukar (*Alectoris chukar*), greater sage-grouse (*Centrocercus urophasianus*), sooty (blue) ruffed grouse (*Dendragapus obscurus*), white-tailed ptarmigan (*Lagopus leucura*), wild turkey (*Meleagris gallopavo*), mourning dove (*Zenaida macroura*), spotted dove (*Spilopelia chinensis*), ringed turtle-dove (*Streptopelia risoria*), Eurasian collared doves (*Streptopelia decaocto*), band-tailed pigeon (*Patagioenas fasciata*), and Snipe (*Gallinago gallinago*) (CDFW, 2015e). The following six species of furbearers may be legally hunted or trapped in California: badger (*Taxidea taxus*), beaver (*Castor canadensis*), gray fox (*Urocyon cinereoargenteus*), mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), and raccoon (*Procyon lotor*) (CDFW, 2015a).

California has identified 121 mammals as SGCN (CDFW, 2015a). The SGCN list consists of at-risk species that are in need of most attention for conservation. Proposed species for the SGCN list were evaluated by analyzing several inclusion and exclusion criteria. Although these species have been targeted for conservation they are not currently under legal protection because of the SGCN listing. The SGCN list is updated every 15 years and is used by California to focus their

conservation efforts for implementing their SWAP. For the 2015 SWAP, the state developed criteria and re-evaluated species, which resulted in a revised SGCN list of mammals, invertebrates, amphibians, reptiles, fish, birds, and plants. The result is an improved set of criteria to identify SGCN, and a more scientifically rigorous process and list compared to the 2005 SWAP and SGCN list (CDFW, 2015a).

Birds

The number of native bird species documented in California varies according to the timing of the data collection effort, changes in bird taxonomy,[88] and the reporting organization's method for categorizing occurrence and determining native versus non-native status. California's diverse ecological communities (i.e., mountains, valleys, delta, large rivers and lakes, etc.) and extensive coastline support a variety of bird species. California is often considered to have the most diverse concentration of birds nationwide (California Audubon, 2016).

A total of 672 species of resident and migratory birds have been documented and tracked in California (CDFW, 2016b). Among the 672 bird species that occur within the state, approximately 74 species are on the species of state's special concern list. California also maintains a "Bird Responsibility List" for longer-term conservation planning, which includes 125 bird species that qualify because all or a very high proportion of their global populations occur in the state. A species occurrence on both the special concern and responsibility lists indicates a particularly high level of conservation concern in California (CDFW, 2008a). CDFW has also identified 114 SGCN based on the general range and abundance, seasonal status, historical range, ecological requirements, threats, and monitoring recommendations for those bird species (CDFW, 2015e).

California is within the Pacific Flyway. The Pacific Flyway covers the entire state and ranges from the west coast of Mexico to the Arctic. Large numbers of migratory birds utilize this flyway and other migration corridors throughout the state each year during their annual migrations northward in the spring and southward in the fall. "The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations" (USFWS, 2013a). The USFWS is responsible for enforcing the MBTA and maintaining the list of protected species[89] (USFWS, 2013a).

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act. Bald eagles are generally found near large rivers and lakes in the entire state all year (eBird, 2015a). Golden eagles typically nest in mountains and cliffs and can be found throughout the state all year round (eBird, 2015b). However, according to the California Department of Fish and wildlife, "Golden eagle abundance in California is unknown" (California Department of Fish and Wildlife, 2016c).

[88] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2015w).

[89] Migratory bird species protected under the MBTA are listed in 50 CFR Part 10.13 (https://www.gpo.gov/fdsys/pkg/CFR-2000-title50-vol1/pdf/CFR-2000-title50-vol1-sec10-13.pdf).

A number of Important Bird Areas (IBAs) have also been identified in California. The IBA program is an international bird conservation initiative with a goal of identifying the most important places for birds, and to conserve these areas. These IBAs are identified according to standardized, scientific criteria through a collaborative effort among state, national, and international conservation-oriented non-governmental organizations (NGOs), state and federal government agencies, local conservation groups, academics, grassroots environmentalists, and birders. These IBAs link global and continental bird conservation priorities to local sites that provide critical habitat for native bird populations. IBA priority areas are based on a number of specific criteria. Generally, global IBAs are sites determined important for globally rare species or support bird populations at a global scale. Continental IBAs are sites determined important for continentally rare species or support bird populations at a continental scale, but do not meet the criteria for a global IBA. State IBAs are sites determined important for state rare species or support local populations of birds.

A total of 177 IBAs have been identified in California, including breeding;[90] migratory stop-over, feeding, and over-wintering areas; and a variety of habitats such as native grasslands, grasslands, sage brush, and wetland/riparian areas (National Audubon Society - California, 2015) (National Audubon Society, 2015), as can be seen in Figure 4.1.6-2. These IBAs are widely distributed throughout the state, and cover more than 19 million acres that are essential habitat for breeding, wintering, and migrating birds areas (National Audubon Society - California, 2015) (National Audubon Society, 2015). Major IBAs include the Mono Lake Basin along the edge of the eastern Sierra Nevada mountain range; the Modoc Plateau in the northeast corner of California; coastal areas, such as the Mendocino Coast and Farallon Islands; Sand Ridge in the Central Valley; and Imperial Valley in southern California (National Audubon Society, 2015). IBA habitats range from coastal zones and pelagic open water habitat, to freshwater marsh ecosystems in the Sacramento-San Joaquin delta to vernal-pool rich grasslands. One of the largest IBAs in California is the Farallon National Wildlife Refuge located off the coast of the San Francisco Bay (USFWS, 2015cr). It is known to support the largest seabird nesting colony in the contiguous United States, as more than 400 bird species have been recorded in the refuge and approximately 25 percent of the breeding seabird populations in California occur in the Farallon Islands (USFWS, 2015cr). Common species on the islands include Leach's Storm-petrel (*Oceanodroma leucorhoa),* Ashy Storm-petrel (*O. homochroa),* Fork-tailed Storm-petrel (*O. furcata),* Tufted puffin (*Fratercula cirrhata),* and the Pelagic cormorant (*Phalacrocorax pelagicus)* (USFWS, 2015cr).

A number of threatened and endangered birds are located in California, including the Yellow-billed cuckoo *(Coccyzus americanus).* Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

[90] Breeding range: "The area utilized by an organism during the reproductive phase of its life cycle and during the time that young are reared" (USEPA, 2015w).

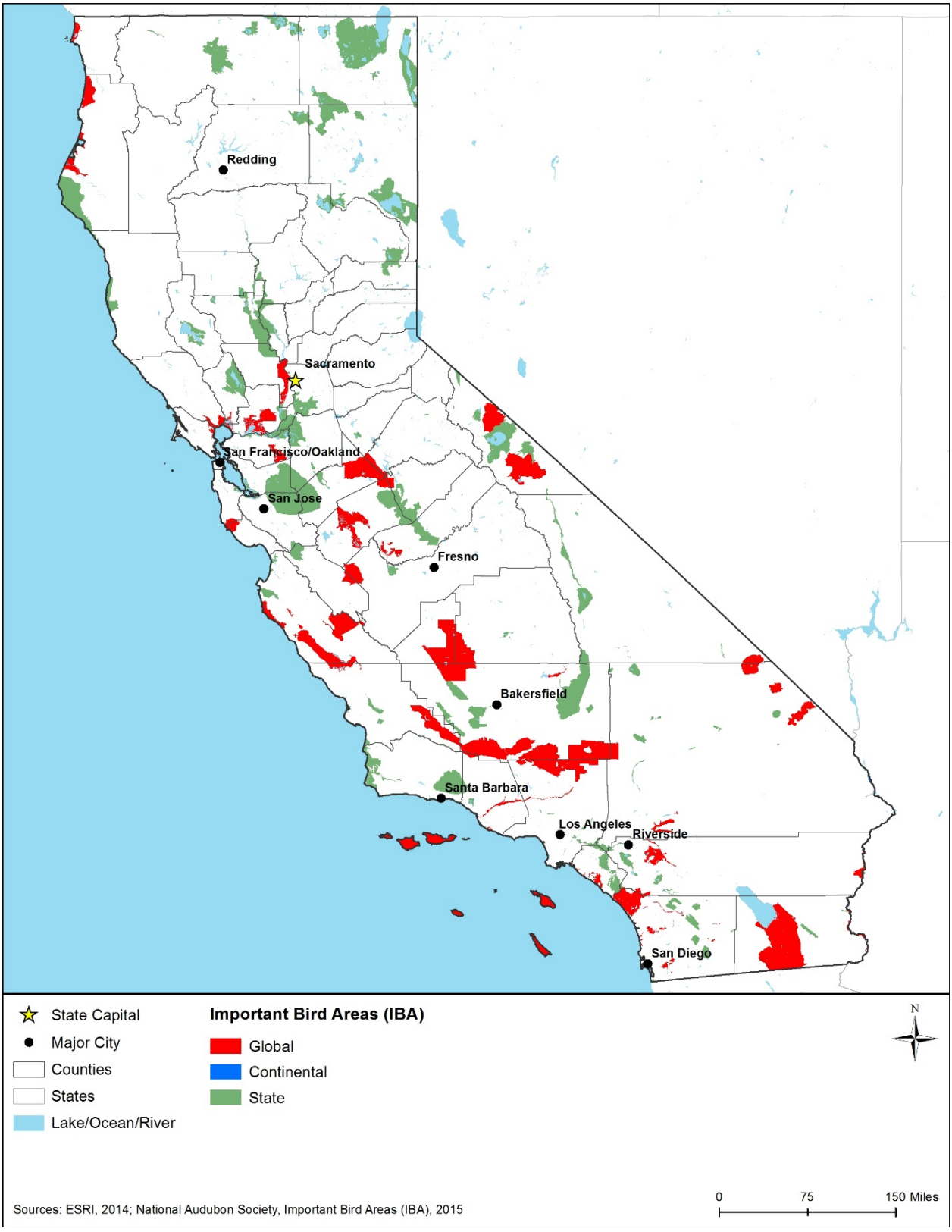


Figure 4.1.6-2. Important Bird Areas (IBA) of California

Reptiles and Amphibians

A total of 175 native reptile and amphibian species occur in California (CDFW, 2015a). Of the 175 native reptile and amphibian species, 48 SGCN have been identified, including 11 salamanders, 14 anurans,[91] 2 turtles, 12 lizards, and 9 snakes (CDFW, 2015a). These species occur in various habitats and provinces, including the North Coast and Klamath province in northern California, and the South Coast and Desert provinces in southern California. The state does not regulate the hunting and trapping of reptile and amphibian species (CDFW, 2015e).

A number of threatened and endangered reptiles and amphibians are in California. Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

Invertebrates

California contains thousands of species of invertebrates, including bees, hornets, wasps, butterflies, moths, beetles, flies, dragonflies, damselflies, spiders, mites, and nematodes. These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. In the U.S., one third of all agricultural output depends on pollinators.[92] In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity and plant diversity. "As a group, native pollinators are threatened by habitat loss, pesticides, disease, and parasites" (NRCS, 2009).

There are over 140,000 known invertebrates in the United States, and California is home to many of these butterfly, gastropod, moth, and insect species (NWF, 2015). Many of these invertebrate species occur in unique habitats along coastline marshes and estuaries, such as the Elkhorn Slough near Monterey Bay, which is home to more than 430 species of invertebrates (NOAA, 1998a). In addition, the vernal pools in the Central Valley and coastal central California are home to many fairy shrimp species (USFWS, 2016p). A total of 270 invertebrates have been identified in California as SGCNs, including 32 listed threatened or endangered species (CDFW, 2015e).

Several terrestrial invertebrate species are threatened and endangered in California. Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

Invasive Wildlife Species

California has adopted regulations that prohibit the importation, transportation, and possession of wild animals (CDFW, 2015f). California's Invasive Species Program has identified numerous actual and potential invasive species, some species that have established populations, and others that have not yet been observed in the state (CDFW, 2015f).

[91] Anuran: "Any of an order (Anura) of amphibians comprising the frogs, toads, and tree frogs all of which lack a tail in the adult stage and have long hind limbs often suited to leaping and swimming" (USEPA, 2015w).
[92] Pollinators: "Animals or insects that transfer pollen from plant to plant" (USEPA, 2015w).

While the California list of prohibited species is not comprehensive, there are several key invasive wildlife species tracked and prohibited (CDFW, 2016d). The prohibited species list includes two birds, including the Mute swan (*Cygnus olor)* and Brown-headed cowbird (*Molothrus ater)*; three reptiles, including the Southern watersnake (*Nerodia fasciata),* Northern watersnake (*Nerodia sipedon),* and Red-eared slider (*Trachemys scripta elegans);* and three amphibians, including the Common coqui (*Eleutherodactylus coqui),* American bullfrog (*Lithobates catesbeianus),* and African clawed frog (*Xenopus laevis).* The list also consists of 8 fish, including snakeheads (*Channidae),* piranhas (*Characidae),* Grass carp (*Ctenopharyngodon idella),* Northern pike (*Esox lucius),* Silver carp (*Hypophthalmichthys molitrix),* Bighead carp (*Hypophthalmichthys nobilis),* Gars (*Lepisoosteidae),* and Black carp (*Mylopharyngodon piceus*) (CDFW, 2016d); and 24 invertebrate species including, for example, the light brown apple moth (*Epiphyas postvittana*), Mexican fruit fly (*Anastrepha ludens*), guava fruit fly (*Anastrepha striata*), and the Oriental fruit fly (*Bactrocera dorsalis*) (CISAC, 2010).

Invasive wildlife species are important to consider when proposing a project since project activities may result in conditions that favor the growth and spread of invasive wildlife populations. These situations may result from directly altering the landscape or habitat to a condition that is more favorable for an invasive species, or by altering the landscape or habitat to a condition that is less favorable for a native species. (USFS, 2015a)

4.1.6.5 Fisheries and Aquatic Habitat

This section discusses the aquatic wildlife species in California, including freshwater fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented. Critical habitat for threatened and endangered fish species, as defined by the ESA, is discussed in Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Freshwater Fish

Approximately 67 native resident and anadromous[93] freshwater fish species can be found in Californian waters. Generally, native fish species richness (i.e., different species represented in an ecological community) is higher in low elevation rivers and lakes (CDFW, 2015g). Species identified in the California SWAP as SGCN are marked with an asterisk ("*").

These species are grouped into a variety of families, including: lampreys, sturgeons, herrings, cyprinidae, suckers, catfishes, gobys, silversides, smelt, trout and salmon, perches, livebearers, sculpin, sunfishes, killifish and pupfish, and sticklebacks. A brief description of those families that contain common species, notable sport fish species, or species of concern is listed below.

The lamprey family consists of the Pacific lamprey* (*Lampetra tridentata*) and river lamprey* (*Lampetra ayresi*) and several subspecies including Goose Lake lamprey* (*Lampetra tridentata ssp*.), Kern Brook lamprey (*Lampetra hubbsi*), Klamath River lamprey (*Lampetra similis*), Northern California brook lamprey (*Entosphenus folletti*), Pit-Klamath brook lamprey* (*Lampetra lethophaga*), and the western brook lamprey (*Lampetra richardsoni*). All lamprey

[93] Anadromous: "Ascending rivers from the sea for breeding." (USEPA, 2015w)

species listed are native and anadromous beginning in freshwater systems (University of California at Davis, 2014).

The sturgeon family consists of the white sturgeon* (*Acipenser transmontanus*), northern green sturgeon* (*Acipenser medirostris*), and southern green sturgeon (*Acipenser medirostris*). White sturgeon are anadromous fish fish that spend most of their lives within an estuary, usually returning to freshwater only to spawn. Green sturgeon are also anadromous though they are considered the most marine of the sturgeon species and their life in freshwater may be relatively limited (University of California at Davis, 2014).

The herring family consists of the American Shad (*Alosa sapidissima*) and threadfin shad (*Dorosoma petenense*). Both species are nonnative species and considered game fish in California (University of California at Davis, 2014). None of these fish species are SGCN.

The cyprinidae family consists of multiple species, including the speckled dace* (*Rhinichthys osculus*), chub (*Siphatales bicolor*), goldfish (*Carassius auratus*), minnow (*Phoxinus phoxinus*), roach (*Lavinia symmetricus*), Clear Lake hitch* (*Lavinia exilicauda*), and carp (*Cyprinus spp*.). Several subspecies have been documented in California waters including: Arroyo chub* (*Gila orcutti*), cow head tui chub* (*Siphatales thalassinus vaccaceps*), Eagle Lake tui chub* (*Siphateles bicolor ssp*.), Goose Lake tui chub* (*Siphatales thalassinus thalassinus*), High Rock Springs tui chub (*Siphateles bicolor* ssp.), Klamath tui chub (*Siphatales bicolor bicolor*), Lahontan Lake tui chub* (*Siphatales bicolor pectinifer*), Lahontan stream tui chub (*Siphatales bicolor obesus*), Mohave tui chub* (*Siphatales mohavensis*), Owens tui chub* (*Gila bicolor snyderi*), Pit River tui chub (*Siphatales thalassinus* ssp.), blue chub* (*Gila coerulea*), thicktail chub (*Siphatales crassicauda*), bonytail* (*Gila elegans*) (note: the bonytail has been extirpated), fathead minnow (*Pimephales promelas*), Sacramento pikeminnow (*Ptychocheilus grandis*), Colorado pikeminnow (*Ptychocheilus lucius*), grass carp (*Ctenopharyngodon idella*), common carp (*Cyprinus carpio*), Amargosa Canyon speckled dace* (*Rhinichthys osculus nevadensis*), Klamath speckled dace (*Rhinichthys osculus klamathensis*), Lahontan speckled dace (*Rhinichthys osculus robustus*), Long valley speckled dace (*Rhinichthys osculus ssp*.), Owens speckled dace* (*Rhinichthys osculus* ssp.), and Santa Ana speckled dace* (*Rhinichthys osculus* ssp.), central California roach (*Lavinia symmetricus symmetricus*), Clear Lake hitch* (*Lavinia exilicauda chi*), Clear Lake roach (*Lavinia symmetricus ssp*.), Gualala roach* (*Lavinia parvipinnus*), hardhead* (*Mylopharodon conocephalus*), Monterey hitch (*Lavinia exilicauda harengeus*), Monterey roach (*Lavinia symmetricus subditus*), Navarro roach* (*Lavinia symmetricus navarroensis*), pit roach* (*Lavinia mitrulus*), Red Hills roach (*Lavinia symmetricus* ssp.), Russian river roach (*Lavinia symmetricus* ssp.), Sacramento hitch (*Lavinia exilicauda exilicauda*), tomales roach (*Lavinia symmetricus* ssp.), Clear Lake splittail (*Pogonichthys ciscoides*), Sacramento splittail (*Pogonichthys macrolepidotus*), tench (*Tinca tinca*), golden shiner (*Notemigonus crysoleucas*), Lahontan redside (*Richardsonius egregius*), red shiner (*Cyprinella lutrensis*), and Sacramento blackfish (*Orthodon microlepidotus*) (University of California at Davis, 2014).

The sucker family consists of the flannelmouth sucker (*Catostomus latipinnis*), Goose Lake sucker* (*Catostomus occidentalis lacusanserinus*), Humboldt sucker (*Catostomus occidentalis*

humboldtianus), Klamath largescale sucker* (*Catostomus snyderi*), Klamath smallscale sucker (*Catostomus rimiculus*), Owens sucker (*Catostomus fumeiventris*), mountain sucker* (*Catostomus platyrhynchus*), Modoc sucker (*Catostomus microps*), Monterey sucker (*Catostomus occidentalis mnioltiltus*), Sacramento sucker (*Catostomus occidentalis occidentalis*), Santa Ana sucker* (*Catostomus santaanae*), shortnose sucker* (*Chasmistes brevirostris*), Lost River sucker* (*Deltistes luxatus*), razorback sucker (*Xyrauchen texanus*), staghorn sculpin (*Leptocottus armatus*), and Tahoe sucker (*Catostomus tahoensis*). The species prefers cool, clear streams and lakes with sandy bottom sand abundant vegetation. None of the species in the sucker family are listed as SGCN (University of California at Davis, 2014).

The goby family includes the longjaw mudsucker (*Gillichthys mirabilis*), shimofuri goby (*Tridentiger bifasciatus*), tidewater goby* (*Eucyclogobius newberryi*), and yellowfin goby (*Acanthogobius flavimanus*) and are most commonly found in shallow water areas with complex arrangements of rocks, tule root masses, logs, and other debris providing cover and mating territories (University of California at Davis, 2014).

The catfish species, most of which are common game fish in California include: channel catfish (*Ictalurus punctatus*), white catfish (*Ameiurus catus*), yellow bullhead (*Ameiurus natalis*), black bullhead (*Ameiurus melas*), flathead catfish (*Pylodictis olivaris*), and blue catfish (*Ictalurus furcatus*) (University of California at Davis, 2014). None of these fish species are SGCN.

The smelt family consists of the surf smelt (*Hypomesus pretiosus*), longfin smelt* (*Spirinchus thaleichthys*), delta smelt* (*Hypomesus transpacificus*), eulachon* (*Thaleichthys pacificus*), and wakasagi (*Hypomesus nipponensis*). Smelts species vary in habitat preference from open lakes, streams, and reservoirs to estuarine systems (University of California at Davis, 2014).

The silversides family consists of topsmelt (*Atherinops affinis*), and Mississippi silversides (*Menidia beryllina* ssp.) which are most common in shallow, warmwater lakes, reservoirs, and estuaries (University of California at Davis, 2014). None of these fish species are SGCN.

The trout and salmon family consists of several species including redband trout [Goose Lake* (*Oncorhynchus mykiss* ssp.), McCloud River* (*Oncorhynchus mykiss stonei*)], lake trout (*Salvelinus namaycush*), Volcano Creek golden trout* (*Oncorhynchus mykiss aguabonita*), Little Kern* (*Oncorhynchus aguabonita whitei*)], rainbow trout [Eagle lake* (*Oncorhynchus mykiss aquilarum*), Kern River* (*Oncorhynchus mykiss gilberti*)], cutthroat trout [Coastal* (*Oncorhynchus clarki clarki*), Colorado River (*Oncorhynchus clarkii pleuriticus*), Lahonton* (*Oncorhynchus clarkii henshawi*), Paiute* (*Oncorhynchus clarkii seleniris*)], bull trout (*Salvelinus confluentus*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), pink salmon (*Oncorhynchus gorbuscha*), Kokanee (sockeye) salmon (*Onchorynchus nerka*), mountain whitefish* (*Prosopium williamsoni*), and various runs of Steelhead* (*Oncorhynchus mykiss*) (note: steelhead trout on the SGCN include the southern steelhead, steelhead – Klamath Mountains Province Distinct Population Segment (DPS),[94] steelhead – Northern California DPS, steelhead – south/central California coast DPS, steelhead central California coast DPS, and

[94] Distinct population segment (DPS): "a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species." (NOAA, 2014a)

steelhead central valley DPS), Chinook* (*Oncorhynchus tshawytscha*) (note: Chinook salmon on the SGCN include the Chinook salmon – Central Valley fall/late fall-run Evolutionarily Significant Unit (ESU),[95] Chinook Salmon – spring-run Klamath-Trinity Rivers population, Chinook salmon – California coast ESU, Chinook salmon – Central Valley spring-run ESU, Chinook salmon – Sacramento River winter-run ESU), Chum (*Oncorhynchus keta*), and Coho* salmon (*Oncorhynchus kisutch*) (University of California at Davis, 2014) (note: Coho salmon on the SGCN include the coho salmon – southern Oregon/northern California ESU and the coho salmon – central California coast ESU.).

The livebearer family consists of four species, including the Porthole livebearer (*Poeciliopsis gracilis*), sailfin molly (*Poecilia latipinna*), Western mosquitofish (*Gambusia affinis*), and Shortfin molly (*Poecilia mexicana*) (University of California at Davis, 2014). None of these fish species are SGCN.

The sculpin family consists of the following 11 species bigeye marbled sculpin* (*Cottus klamathensis macrops*), Clear Lake prickly sculpin (*Cottus asper* ssp.), coastrange sculpin (*Cottus aleuticus*), lower Klamath marbled sculpin (*Cottus klamathensis polyporus*), Paiute sculpin (*Cottus beldingi*), Pacific staghorn sculpin (*Leptocottus armatus*), pit sculpin (*Cottus pitensis*), reticulate sculpin* (*Cottus perplexus*), riffle sculpin (*Cottus gulosus*), rough sculpin* (*Cottus asperrimus*), and upper Klamath marbled sculpin (*Cottus klamathensis klamathensis*). They are most common in cold slower moving waters and are typically found in areas with a significant amount of aquatic vegetation (University of California at Davis, 2014).

The killifish and pupfish family consists of 11 species and can be found in fresh or brackish permanent waters. Species include Bluefin killifish (*Lucania goodei*), California killifish (*Fundulus parvipinnis*), rainwater killifish (*Lucania parva*), the Amargosa river pupfish* (*Cyprinodon nevadensis amargosae*), desert pupfish* (*Cyprinodon macularius*), cottonball marsh pupfish* (*Cyprinodon salinus milleri*), Owens pupfish* (*Cyprinodon radiosus*), salt creek pupfish* (*Cyprinodon salinus salinus*), Saratoga springs pupfish* (*Cyprinodon nevadensis nevadensis*), Shoshone pupfish* (*Cyprinodon nevadensis shoshone*), and tecopa pupfish (*Cyprinodon nevadensis calidae*) (University of California at Davis, 2014).

Stickleback species include: brook stickleback (*Culaea inconstans*), coastal threespine stickleback (*Gasterosteus aculeatus aculeatus*), inland threespine stickleback (*Gasterosteus aculeatus microcephalus*), Shay Creek stickleback (*Gasterosteus aculeatus* ssp.), and unarmored threespine stickleback* (*Gasterosteus aculeatus williamsoni*). Sticklebacks prefer cool, clear waters with extensive aquatic vegetation (University of California at Davis, 2014).

The sunfish family consists of 13 species, including common fish species, such as the redear sunfish (*Lepomis microlophus*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), warmouth (*Lepomis gulosus*), redeye bass (*Micropterus coosae*), striped bass (*Morone saxatilis*), spotted bass (*Micropterus punctulatus*),

[95] Evolutionarily significant unit (ESU): a "population or group of populations that is substantially reproductively isolated from other conspecific populations and that represents an important component of the evolutionary legacy of the species." (NOAA, 2014a)

white bass (*Morone chrysops*), white crappie (*Pomoxis annularis*), and black crappie (*Pomoxis nigromaculatus*). Species are common in warm, shallow lakes, reservoirs, ponds, streams, and sloughs (University of California at Davis, 2014). None of these fish species are SGCN.

The perch family includes yellow perch (*Perca flavescens*), shiner perch (*Cymatogaster aggregata*), Clear Lake tule perch (*Hysterocarpus traskii lagunae*), Sacramento tule perch (*Hysterocarpus traskii traskii*), Russian river tule perch* (*Hysterocarpus traskii pomo*), and Sacramento perch* (*Archoplites interruptus*). Species can be found in cool well oxygenated lakes, streams, and estuarine habitats (University of California at Davis, 2014).

Other freshwater species include bigscale logperch (*Percina macrolepida*), California tilapia (*Oreochromis spp*.), striped mullet (*Mugil cephalus*), and starry flounder (*Platichthys stellatus*) (University of California at Davis, 2014). None of these fish species are SGCN.

Shellfish and Other Invertebrates

California is home to invertebrates including arthropods,[96] gastropods, abalone, lobster, bivalves (clams, mussels, oysters, and scallops), sea urchin, tidal invertebrates (subtidal snails, limpets, sea stars, sea cucumbers), and crabs.

Common species found include: spot prawns (*Pandalus platyceros*), coonstripe shrimp (*Pandalus danae*), Bay shrimp [California (*Crangon franciscorum*), blacktail (*C. nigricauda*), blackspotted (*C. nigromaculata*), oriental (*Palaemon macrodactylus*)], abalone [red (*Haliotis rufescens*), green (*H. fulgens*), pink (*H. corrugata*) and white (*H. sorenseni*)], purple sea urchin (*Strongylocentrotus purpuratus*), red sea urchin (*Strongylocentrotus franciscanus*), spiny lobsters (*Panulirus interruptus*), Pacific razor clam (*Siliqua patula*), Pacific gaper clam (*Tresus nuttalli*), fat gaper clam (*Tresus capax*), Washington clam (*Saxidomus nuttalli*), butter clam (*Saxidomus giganteus*), geoduck (*Panope generosa*), littleneck clams [banded (*Chione californiensis*), smooth (*C. fluctifraga*), wavy (*C. undatella*), rough-sided (*Protothaca laciniata*), common (*P. staminea*), thin-shelled (*P. tenerrima*), Manila (*Tapes philippinarum*)], California mussel (*Mytilus californianus*), blue mussel (*Mytilus edulis*), Mediterranean mussel (*Mytilus galloprovincialis*), whelks (*Busycon* spp.), wavy turban snail (*Megastrea undosa*), rock snail (*Codringtonia codringtonii*), moon snails (*Naticidae*), pismo clam (*Tivela stultorum*), rock scallop (*Crassadoma gigantea*), Pacific oyster (*Crassostrea gigas*), eastern oyster (*Crassostrea virginica*), Kumamoto oyster (*Crassostrea sikamea*), native oyster (*Ostreola conchaphila*), Dungeness crab (*Cancer magister*), rock crabs [yellow (*Cancer anthonyi*), brown crab (*C. antennarius*), red crab (*C. productus*)], sand crab (*Emerita analoga*), and sheep crab (*Loxorhynchus grandis*) (CDFW 2001).

SGCN species include pink (*Haliotis corrugata*), black (*H. cracherodii*), green (*H. fulgens*), pinto (*H. kamtschatkana*), white (*H. sorenseni*) and flat abalone (*H. walallensis*), and speckled (Bay) scallop *(Argopecten circularis*).

[96] Arthropods: "Any member of the phylum Arthropoda, which are characterized by jointed appendages, an exoskeleton, and segmented body parts. Arthropods are the most diverse group of animals on Earth and include insects, crustaceans, arachnids, myriapods, and onychophorans as well as extinct forms like trilobites." (Smithsonian Institution, 2016)

Invasive Aquatic Species

As discussed previously, federal, state, and local laws, rules and/or guidelines apply controlling and minimizing invasive aquatic species in California. In addition, several Aquatic Invasive Species interest groups may not have regulatory authority, but they can provide a framework for state and local regulations in the area. For example, the California Ocean Protection Council developed a strategic plan in 2006 to support the completion and implementation of the California Aquatic Invasive Species Management Plan, as well as the California Noxious and Invasive Weed Action Plan (CDFW, 2008b). Invasive plants are discussed above in Section 4.1.6.3, Terrestrial Vegetation, Nuisance and Invasive Species.

CDFW has conducted statewide surveys of California's waters and have identified at least 312 species of aquatic invasive species (CDFW, 2008b). Table 4.1.6-3 summarizes state and federally regulated aquatic invasive species.

Table 4.1.6-3 State and/or Federally Regulated Aquatic Invasive Animals and Plants

Scientific Name	Common Name
Mammals	
Mustelidae (Family)	All species except Oriental small-clawed otter (*Amblonyx cinerea),* African clawless otter (*Aonyx capensis),* giant otter (*Pteronura brasiliensis),* and all species of genus river otters (*Lutra spp.)*
Fish Species	
Amiidae (Family)	bowfins
Anguilla (Genus)	freshwater eels
Aplodinotus grunniens (Species)	freshwater drum
Astyanax fasciatus (Species)	banded tetra
Belonesox belizanus (Species)	pike killifish
Carcharhinus (Genus)	freshwater sharks
Cetopsidae (Family)	whalelike catfishes
Channidae (Family)	snakeheads
Clariidae (Family)	labyrinth catfishes
Ctenopharyngodon idella (Species)	grass carp (permits may be issued for possession of triploid grass carp)
Cyprinodon variegatus (Species)	sheepshead minnow
Dorosoma cepedianum (Species)	gizzard shad
Esocidae (Family)	pikes
Heteropneustidae (Family)	airsac catfishes
Hoplias malabaricus (Species)	tiger fish
Hypophthalmichthys molitrix (Species)	silver carp
Hypophthalmichthys nobilis (Species)	bighead carp
Ictiobus (Genus)	buffalo suckers

Scientific Name	Common Name
Lepisosteidae (Family)	gars
Leuciscus idus (Species)	Ide
Morone americana (Species)	white perch
Morone chrysops (Species)	white bass
Perca flavescens (Species)	yellow perch
Potamotrygonidae (Family)	river stingrays
Petromyzontidae (Family)	lampreys - all nonnative species
Salmo salar (Species)	Atlantic salmon - restricted in the Smith River watershed
Salmonidae (Family)	live or dead uneviscerated salmonid fish, live fertilized eggs, or gametes of salmonids are prohibited unless accompanied by a certification that the ensures they are free of *Onocorhynchus masou* virus and the viruses causing viral hemorrhagic septicemia and infectious hematopoietic necrosis, and meet the conditions in 50 CFR 16.13
Serrasalmus (Genus)	piranhas (including genera *Pygocentrus* and *Pygopristis*, and invalid genera *Serrasalmo, Taddyella, Rooseveltiella*)
Stizostedion vitreum (Species)	walleye
Tilapia aurea (Species)	blue tilapia
Tilapia nilotica (Species)	Nile tilapia
Tilapia sparrmani (Species)	banded tilapia
Tilapia zillii (Species)	redbelly tilapia (permits may be issued to a person or agency for importation, transportation, or possession in the counties of San Bernardino, Los Angeles, Orange, Riverside, San Diego, and Imperial)
Trichomycteridae (Family)	parasitic catfishes
Amphibian and Reptile Species	
Ambystoma (Genus)	tiger salamanders
Bufonidae (Family)	toads (including cane toad (*Bufo marinus)*, giant toad or marine toad; and invalid species, Cururu toad (*Bufo paracnemis),* and *Bufo horribilis*, other large toads from Mexico and Central and South America)
Xenopus (Genus)	clawed frog
Crocodilia (Order)	crocodiles, caimans, alligators and gavials
Chelydridae (Family)	snapping turtles
Invertebrates	
Cambaridae (Family)	crayfish - all species except *Procambarus clarkii* and *Orconectes virilis*
Eriocheir (Genus)	crabs
Dreissena (Genus)	zebra and quagga mussels
Potamopyrgus antipodarum (Species)	New Zealand mudsnail

Scientific Name	Common Name
Transgenic Aquatic Animals	Freshwater and marine fishes, invertebrates, crustaceans, mollusks, amphibians and reptiles
Plants	
Alternanthera philoxeroides	alligatorweed
Arundo donax	giant reed
Azolla pinnata	mosquito fern, water velvet
Cabomba caroliniana	fanwort
Caulerpa taxifolia	Caulerpa
Caulerpa cupressoides	Caulerpa
Caulerpa mexicana	Caulerpa
Caulerpa sertulariodes	Caulerpa
Caulerpa floridana	Caulerpa
Caulerpa ashmeadii	Caulerpa
Caulerpa racemosa	Caulerpa
Caulerpa verticillata	Caulerpa
Caulerpa scapelliformis	Caulerpa
Eichhornia azurea	anchored water hyacinth
Hydrilla verticillata	hydrilla
Hygrophila polysperma	Miramar weed
Ipomoea aquatica	Chinese water spinach
Lagarosiphon major	oxygen weed
Limnobium spongia	spongeplant
Limnophila indica	ambulia
Limnophila sessiliflora	ambulia
Lythrum salicaria	purple loosestrife
Melaleuca quinquenervia	broadleaf paper-bark tree
Monochoria hastata	monochoria
Monochoria vaginalis	heartshape false pickerelweed
Nymphaea mexicana	banana water lily
Ottelia alismoides	duck lettuce
Pistia stratiotes	water lettuce
Polygonum amphibium	swamp smartweed
Polygonum cuspidatum	Japanese knotweed
Sagittaria sagittifolia	arrowhead
Salvinia auriculata	salvinia
Salvinia biloba	salvinia

Scientific Name	Common Name
Salvinia herzogii	herzog salvinia
Salvinia molesta	giant salvinia
Sparganium erectum	exotic bur-reed

Source: (CDFW, 2008b)

Saltwater Fish

California contains approximately 550 species of marine fish. Species diversity is greatest in southern California and decreases towards the north. The most common species of marine fish include thornyheads (*Sebastolobus spp*.), scorpionfish (*Scorpaenidae*), rockfish (*Sebastes spp*.), sculpins (*Cottidae*), lanternfishes (*Myctophidae*), right-eye flounders (*Pleuronectidae*), perches (*Embiotocidae*), poachers (*Agonidae*), mackerels and tunas (*Scombridae*), jacks and pompanos (*Carangidae*), gobies (*Gobiidae*), clinids (*Clinidae*), and requiem sharks (*Carcharhinidae*) (Horn 1980). SGCN marine fish species include various runs of Coho salmon, chinook salmon, and steelhead, Pacific lamprey, river lamprey, white shark (*Carcharodon carcharias*), green and white sturgeon, delta smelt, longfin smelt, eulachon, unarmored threespine stickleback, Pacific ocean perch (*Sebastes alutus*), darkblotched rockfish (*Sebastes crameri*), bronzespotted rockfish (*Sebastes gilli*), cowcod (*Sebastes levis*), bocaccio rockfish (*Sebastes paucispinis*), yelloweye rockfish (*Sebastes ruberrimus*), giant sea bass (*Stereolepis gigas*), gulf grouper (*Mycteroperca jordani*), broomtail grouper (*Mycteroperca xenarcha*), tidewater goby, Bluefin tuna (*Thunnus orientalis*), and garibaldi (*Hypsypops rubicundus*). (CDFW, 2015e)

Common marine sportfish include croakers (*Sciaenidae*), flatfish (*Bothidae, Pleuronectidae*), rays (*Myliobatidae, Dasyatididae*), rockfish, seabass (*Serranidae*), sharks (*Rhinobatidae, Carcharhinidae, Lamnidae, Alopiidae, Squalidae*), perches, tuna, and mackerels. Table 4.1.6-4 lists game fish that are commonly caught in the state. (CDFW, 2013a)

Table 4.1.6-4: Popular Sportfish Species in California

Common Name	General Habitat
California Corbina	Bottomfish found along sandy beaches and in bays.
Queenfish	Queenfish are common during summer in shallow water around pier pilings on sandy bottoms. They are found at depths to 180 feet; however, occur more often from 4 to 27 feet.
Spotfin	They live along beaches and in bays over bottoms varying from coarse sand to heavy mud and at depths varying from 4 to 50 feet or more. They prefer depressions and holes near shore.
White Croaker	White croakers can be found in offshore waters at depths of 10 to 100 feet and occasionally aggregate in the surf zone or in shallow bays and lagoons with sandy bottoms.
White seabass	White seabass usually travel in schools over rock bottoms and prefer areas with kelp beds.
Yellowfin croaker	Frequent nearshore waters including bays, channels, and harbors with sandy bottoms. Move to deeper waters in winter.
California Halibut	Prefer shallow sandy areas.
Pacific Sanddab	Typically found in depths 120 to 300 feet and prefer a deep sandy environment.
Longfin sanddab	Found on sandy, muddy type sea bottoms at depths from 8 to 660 ft.

Common Name	General Habitat
Pacific Halibut	Found in depths from 20 to 3,600 feet; however, in California waters typically found in nearshore areas.
Starry flounder	Prefer sand, mud, and gravel bottoms of open waters, bays, sloughs in depths of a few inches to 900 feet.
Petrale sole	Prefer deep sandy environments at depths from intertidal to 1,815 feet.
Bat ray	Prefer shallow sandy environments but can be found from surface water to depths of 150 feet.
Round stingray	Prefer shallow sandy environments but can be found from surface water to depths of 70 feet.
Rockfish (black rockfish, blue rockfish, bocaccio, canary rockfish, chillipepper, copper rockfish, cowcod, greenspotted rockfish, olive rockfish, sculpin, starry rockfish, vermillion rockfish, widow rockfish, yellowtail rockfish)	Shallow rocky environments.
Striped bass	Found in bays in spring, winter, and fall; spawn in freshwater.
Kelp bass	Shallow rocky habitats.
Barred sand bass	Shallow sandy areas to depths of 600 feet.
Spotted sand bass	Large bays in southern California; found in depths to 200 feet.
Spiny dogfish	Common in nearshore sandy bottom waters at depths to 1200 feet.
Common thresher shark	Found in upper layers of deep offshore waters and are most abundant in areas of steep bottom contour along the edges of the continental shelf.
Shortfin Mako shark	Pelagic waters.
Gray smoothhound	Found in shallow waters to depths of 150 feet.
Brown smoothhound	Shallow sandy waters to depths of 300 feet.
Leopard shark	Bays and along sandy beaches.
Blue shark	Pelagic waters.
Shovelnose guitarfish	Sand or mud bottoms in colder, shallow coastal waters.
Silver surfperch	Shallow sandy habitats; frequent sand surf zones but can also be found among shallow rocks from piers and in bays.
Walleye surfperch	Found in dense schools along sandy beaches, near rocks and around piers.
Shiner perch	Prefer calm water and are most abundant in bays around eelgrass beds and the pilings of wharfs and piers. Have been found in depths to 480 feet but are more numerous in shallow inshore waters.
Redtail surfperch	Predominantly surf dwellers off sandy beaches, but have been taken in rocky areas adjacent to beaches. They are common in estuaries and protected embayments during the spawning season.
Rubberlip seaperch	Found in rocky areas, tide pools and kelp beds on the outer coast as well as bays and harbors.
Barred surfperch	Found in the surf zone along sandy beaches and to depths of 240 feet.
Pacific mackerel	Pelagic waters.
Skipjack	Pelagic waters.
Pacific Bonito	Pelagic waters.
Albacore	Typically found 20 to 100 miles offshore in central and southern California. Rarely observed near shore. Albacore have a preference for deep blue oceanic water and mild temperatures.
Bigeye tuna	Pelagic waters; rarely seen near the surface.
Bluefin tuna	Seasonally found in offshore California pelagic waters.

Common Name	General Habitat
Yellowfin tuna	Only enter California waters when ocean temperatures are warmer; Pelagic waters.
White sturgeon	Anadromous bottom feeder, and spends more of its time in the brackish waters of bays; spawn in freshwater streams.
Chinook salmon	Pelagic waters unless spawning. Adults spawn principally in large river systems.
California lizardfish	Prefers sandy bottoms in shallow water ranging from 30 to 180 feet.
Pacific Hake	Deep sandy water and can be found at depths exceeding 2,900 feet.
Pacific Tomcod	Prefers shallow sandy waters from near surface waters to a depth of over 900 feet.
California Grunion	Surf waters. Can be found in schools a short distance from shore in waters to 40 feet deep.
Jacksmelt	Bays with a preference of waters to 50 feet, but can be found in waters to 100 feet.
sablefish	Juveniles prefer inshore waters and surf; adults prefer deep sandy environments.
lingcod	Live at or near the bottom, generally near rocky areas and kelp beds, especially where there is a strong tidal movement. Occur most abundantly at depths ranging to about 350 feet.
Kelp Greenling	Live in shallow water along rocky coasts, around jetties and in kelp beds.
Pacific Staghorn Sculpin	Prefer bays, estuaries, lagoons, and shallow coastal waters, and are wide ranging from the intertidal zone to a depth of 906 feet; moving between fresh and salt water during their life cycle, but not for breeding.
Cabezon (*Scorpaenichthys marmoratus*)	Primarily found on rocky bottoms. Prefer rocky reefs and kelp beds in water less than 120 feet deep, although they are known to occur as deep as 300 feet.
Opaleye (*Girella nigricans*)	Rudderfish found in shallow waters; prefer rocky shorelines and kelp beds; pre-juveniles can be found in tide pools.
Halfmoon or Catalina blue perch (*Medialuna californiensis*)	Shallow rocky areas and kelp beds.
California sheephead	Generally prefer rocky kelp areas near shore, in water from 20 to 100 feet deep.
California barracuda	Palegic waters from near surface to depths of 60 feet.
Giant Kelpfish	Shallow rocky environments from near surface to depths of 100 feet. Prefers rocks covered with seaweed and kelp bed areas.
Swordfish	Pelagic waters.
Striped marlin	Pelagic waters.
Jack mackerel	Pelagic waters from surface depths to 150 feet.
Yellowtail	Pelagic waters from near surface depths to approximately 230 feet.
Sargo or White seabream (*Diplodus sargus)*	Found inshore and in bays, from the surface to depths of 198 feet, but are most common in water to 40 feet deep. Usually found in areas with rock or combination rock-sand bottoms, around pilings or similar submerged structures.

Source: (CDFW, 2013a)

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act identifies and protects those fish habitats that are necessary for spawning, breeding, feeding, or growth to maturity. These habitats are termed "Essential Fish Habitat" or EFH. NOAA provides an online mapping application[97] and website,[98] which illustrate representations of EFH and identify sensitive resources at specific locations.[99] California Appendix B2, Table B-2, Essential Fish Habitat Offshore of California, presents a summary of EFH for species of the California coast.

Under the Magnuson-Stevens Act, the National Marine Fisheries Service also considers a second, more limited habitat designation for each species in addition to EFH. Habitat Areas of Particular Concern (HAPC) are described as subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. In general, HAPCs include high value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and shellfish. HAPCs are not afforded any additional regulatory protection under the Magnuson-Stevens Act; however, federal actions with potential adverse impacts to HAPC will be more carefully scrutinized during the consultation process and will be subject to more stringent EFH conservation recommendations (NMFS, 2010a) (NOAA, 2015a). Table 4.1.6-5 presents a summary of HAPC along or near the California coast.

Table 4.1.6-5. Habitat Areas of Particular Concern for California

Category	Description of HAPC
Oil Platforms	Waters and substrate associated with the platform jackets of 13 specified oil production platforms in Southern California are designated groundfish HPACs.
Rocky Reefs	Includes those waters, substrates and other biogenic features associated with hard substrate (bedrock, boulders, cobble, gravel, etc.) to mean higher high water. Generally categorized as either nearshore or offshore in reference to proximity to the shoreline.
Seagrass	Includes eelgrass species (*Zostera* spp.), widgeongrass (*Ruppia maritima*), and surfgrass (*Phyllospadix* spp.) found in lower intertidal and subtidal areas.
Canopy Kelp	Kelp forest communities are found relatively close to shore along the open coast.
Estuaries	Protected nearshore areas such as bays, sounds, inlets, and river mouths, influenced by ocean and freshwater.
Areas of Interest	All seamounts including Gumdrop Seamount, Pioneer Seamount, Guide Seamount, Tancy Seamount, Davidson Seamount, and San Juan Seamount; Mendocino Ridge; Cordell Bank; Monterey Canyon; specific areas in the federal waters of the Channel Islands National Marine Sancturary; specific areas of the Cowcod Conservation Area.

[97] http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html.

[98] http://www.greateratlantic.fisheries.noaa.gov/hcd/list.htm.

[99] NOAA's Essential Fish Habitat Mapper v 3.0 was used to identify "EFH areas of particular concern" and "EFH areas protected from fishing". As of July 2016, the procedure to use this interactive tool is as follows: 1) Visit http://www.habitat.noaa.gov/protection/efh/habitatmapper.html. 2) Select "EFH Mapper" under Useful Links. 3) After closing the opening tutorial, select the "Region" of interest from the drop-down menu. 4) Select the species under "Essential Fish Habitat" to view the areas in the selected region protected for the various life states (i.e., eggs, larvae, juvenile, adult, or all).

Marine Aquatic Invertebrates

California contains numerous species of marine mollusks, crabs, and other marine invertebrates. Examples of California marine aquatic invertebrate listed as SGCN include the Speckled (Bay) scallop and Montane peaclam (CDFW, 2015e).

Marine Mammals

Diverse habitats along the California coast support one of the most diverse assemblages of marine mammals in the world. Marine mammals found in California include pinnipeds, otters, whales, dolphins, and porpoises (Marine Life Studies, 2012). A summary of marine mammal species is provided below. Species identified in the California SWAP as SGCN are marked with an asterisk ("*").

Pinniped species include: Guadalupe fur seal* (*Arctocephalus townsendi*), Northern fur seal (*Callorhinus ursinus*), Stellar sea lion* (*Eumetopias jubatus*), California sea lion (*Zalophus californianus*), ribbon seal (*Histriophoca fasciata*), northern elephant seal (*Mirounga angustirostris*), harbor seal (*Phoca vitulina*), and sea otter (*Enhydra lutris*). (CDFW, 1997)

Dolphin species include: Risso's dolphin (*Grampus griseus*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), Northern right whale dolphin (*Lissodelphis borealis*), spinner dolphin (*Stenella longirostris*), pantropical spotted dolphin (*Stenella attenuata*), long-beaked common dolphin (*Delphinus capensis*), short-beaked common dolphin (*Delphinus delphis*), Harbor porpoise (*Phocoena phocoena*), Dall porpoise (*Phocoenoides dalli*), striped dolphin (*Stenella coeruleoalba*), rough-toothed dolphin (*Steno bredanensis*), Pacific bottlenose dolphin (*Tursiops aduncus*), and Fraser's dolphin (*Lagenodelphis hosei*). (CDFW, 1997)

Whale species: Northern right whale* (*Eubalaena glacialis*), Fin whale* (*Balaenoptera physalus*), humback whale* (*Megaptera novaeangliae*), Minke Whale (*Balaenoptera acutorostrata*), sei whale* (*Balaenoptera borealis*), blue whale* (*Balaenoptera musculus*), gray whale (*Eschrichtius robustus*), Pacific pilot whale (*Globicephala macrorhyncus*), killer whale* (*Orcinus orca*), false killer whale (*Pseudorca crassidens*), sperm whale* (*Physeter macrocephalus*), pygmy sperm whale (*Kogia breviceps*), dwarf sperm whale (*Kogia sima*), Baird's beaked whale (*Berardius bairdii*), Bryde's whale (*Balaenoptera brydei*), Hubb's beaked whale (*Mesoplodon carlshubbi*), melon-headed whale (*Peponocephala electra*), pygmy beaked whale (*Mesoplodon peruvianus*), Blainvilles' beaked whale (*Mesoplodon densirostris*), Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*), and Cuvier's beaked whale (*Ziphius cavirostris*) (CDFW, 1997).

Detailed information on the marine mammal species listed under the ESA is presented in Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Sea Turtles

Five species of sea turtles occur in California, including the green turtle (*Chelonia mydas*), the leatherback turtle (*Dermochelys coriacea*), the loggerhead turtle (*Caretta caretta*), Olive Ridley turtle (*Lepidochelys olivacea*), and Pacific hawksbill sea turtle (*Eretmochelys imbricata*) (Herps, 2015). Four of these five sea turtle species are protected in California. For more information on

the sea turtles that are protected, refer to Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

4.1.6.6 Threatened and Endangered Species and Species of Conservation Concern

Federal status as a threatened or endangered species is derived from the Endangered Species Act (ESA) of 1973 and is administered by the USFWS and National Marine Fisheries Service (NMFS). The USFWS is responsible for administering the ESA (16 U.S.C. §1531 et seq.) in California. The USFWS has identified 222 federally endangered and 83 federally threatened species known to occur in California,[100] with 3 species being listed as both endangered and threatened, depending on population (USFWS, 2016a) (GPO, 2014a). Further, there are four species that are listed multiple times for populations that occur in different geographic locations in the state[101] (USFWS, 2016a). Hence, the number of distinct federally listed species in California is 300, of which 220 are listed as federally endangered species and 83 are listed as federally threatened species. Of these federally listed species, 112 have designated critical habitat in the state (USFWS, 2015c).

USFWS has identified five candidate species[102] within the state and one species is proposed as threatened (USFWS, 2016b). Candidate species are not afforded statutory protection under the ESA. However, the USFWS recommends consideration of these species during environmental planning because they could be listed in the future (USFWS, 2014t). The 300 distinct federally listed species include 29 mammals, 16 birds, 21 fish, 9 reptiles, 9 amphibians, 33 invertebrates, and 183 plants, and are discussed in detail under the following sections (USFWS, 2016a) (GPO, 2014a). The five candidate species include one bird, one invertebrate, one fish, and two plant species. Figures 4.1.6-3 and 4.1.6-4 depict the critical habitat in northern and southern California, respectively.

Federal land management agencies maintain lists of species of concern for their landholdings; these lists are not discussed below as they are maintained independently from the ESA. For future site-specific analysis on those lands, consultation with the appropriate land management agency would be required.

[100] The USFWS Environmental Conservation Online System (ECOS) list identifies species with DPS or geographically isolated populations as individual species in the total species count. This PEIS describes the ESA-listed species with descriptions for the geographic distinctions and does not count them as different types of list species unless distinct populations are listed as threatened and endangered. Therefore, this PEIS has ESA listed species totals that differ slightly than the reported ECOS total but covers the same species.

[101] The following species have multiple occurances on the USFWS ECOS list for different geographic locations within the state: Mountain yellow-legged frog (*Rana musccosa*), California tiger Salamander (*Ambystoma californiense*), Coho salmon (*Oncorhynchus kisutch*), and Steelhead (*Oncorhynchus mykiss*).

[102] Candidate species are plants and animals that the USFWS has "sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities" (USFWS, 2014s).

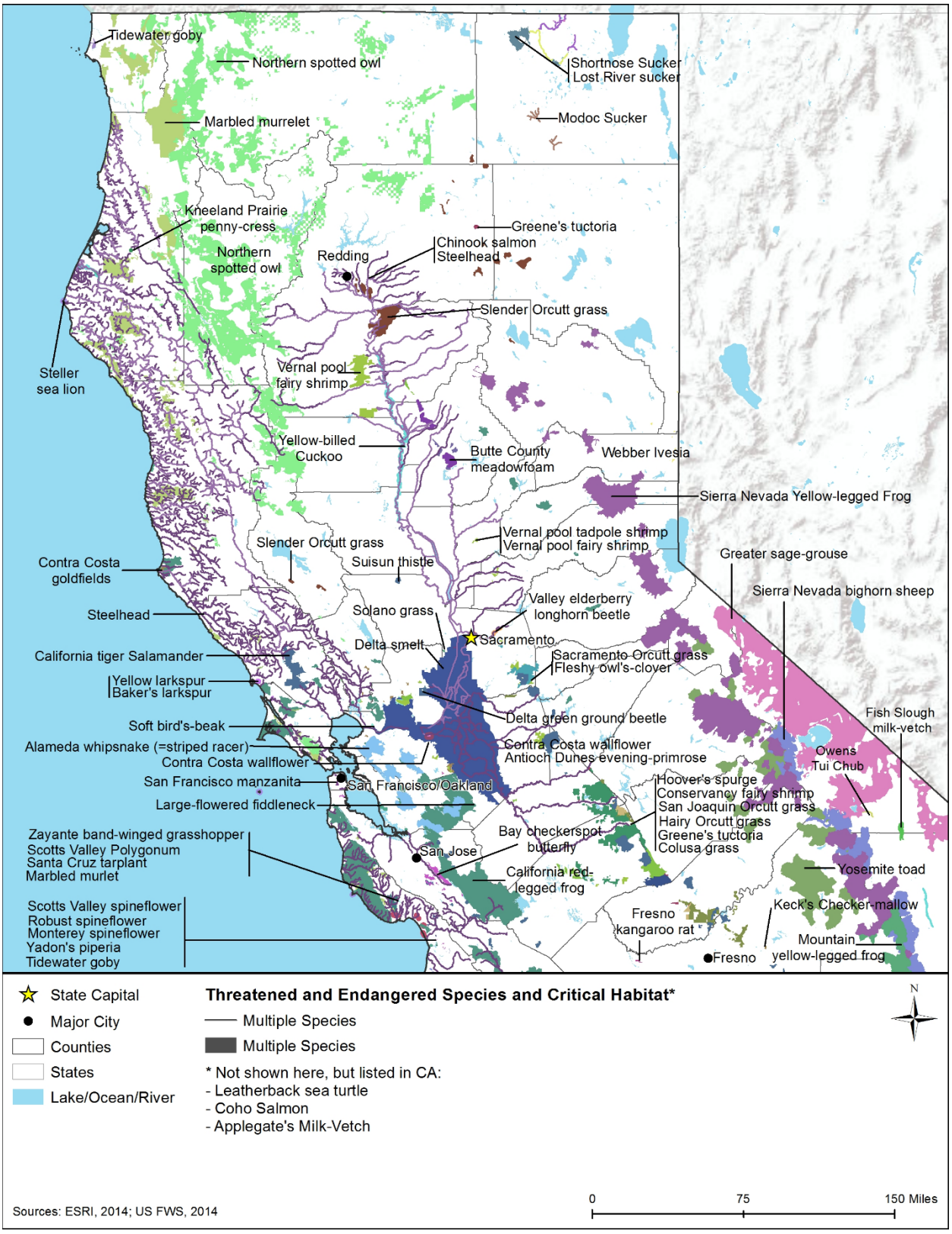


Figure 4.1.6-3. Federally Designated Critical Habitat in Northern California

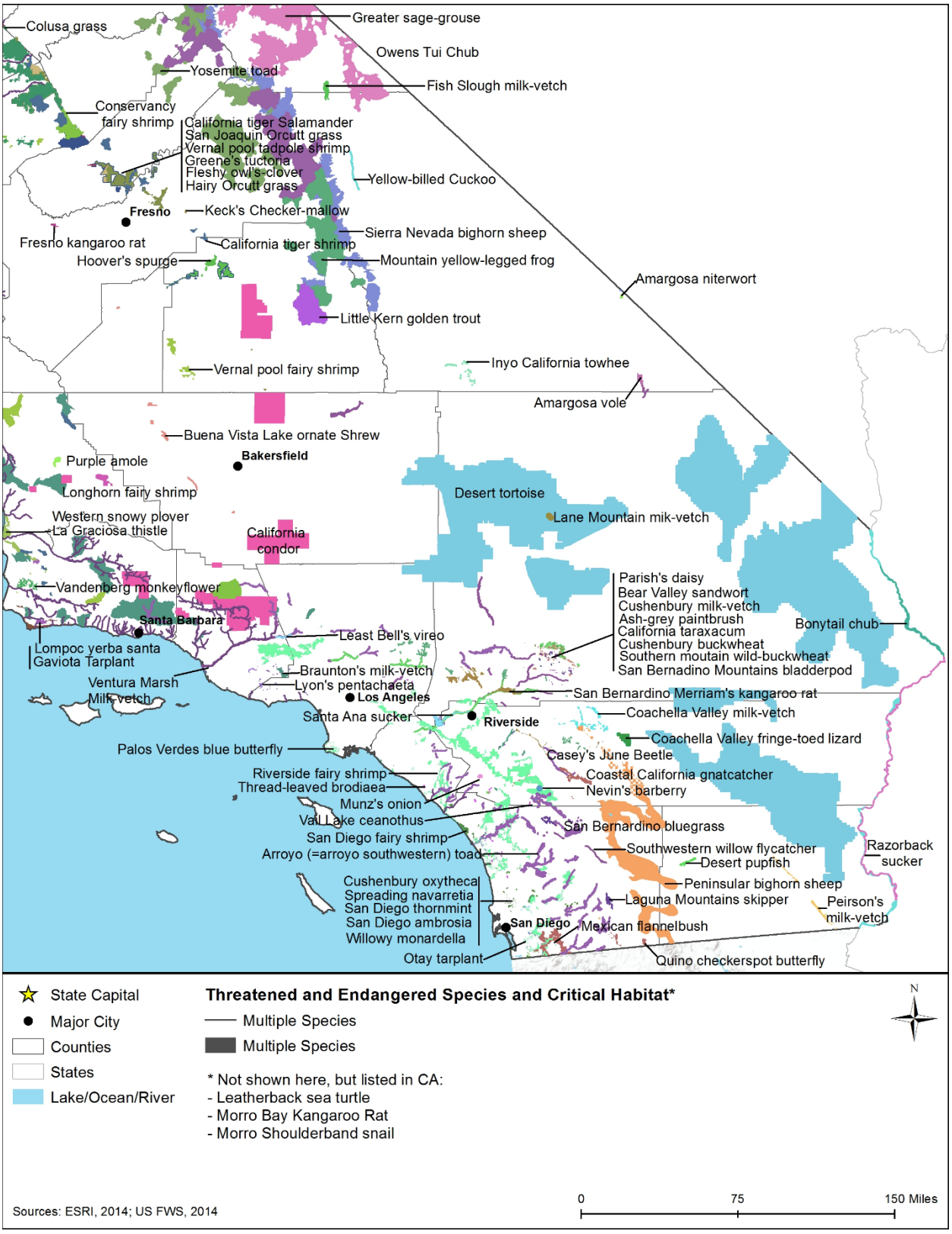


Figure 4.1.6-4: Federally Designated Critical Habitat in Southern California

Mammals

Table 4.1.6-6 identifies the 26 endangered and 3 threatened mammals that are federally listed for California. Seven species have designated critical habitat. The table includes information on the habitat, distribution, and threats to the survival and recovery of each of these species.

Table 4.1.6-6: Federally Listed Mammal Species of California

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Terrestrial Mammals				
Amargosa Vole	*Microtus californicus scirpensis*	E	Yes; a section of the Amargosa River north of Tecopa Hot Springs to the Amargosa Canyon, south of Tecopa.	Primarily in bulrush-dominated marshland along the Amargosa river. Found in Inyo County and San Bernardino County.
Buena Vista Lake Ornate Shrew	*Sorex ornatus relictus*	E	Yes; 7 units in Kern County.	Riparian and wetland communities where dense herbaceous plant growth and abundant leaf litter is present. Found in 5 counties in the central region of California.
Canada Lynx	*Lynx canadensis*	T	No	Subalpine coniferous forests and Sierra Nevada range in the eastern portion of California.
Fresno Kangaroo Rat	*Dipodomys nitratoides exilis*	E	Yes; in Fresno County.	Open shrublands, grasslands, and high areas within alkali plains with light, friable soils suitable for burrowing. Found in 8 counties in central California.
Giant Kangaroo Rat	*Dipodomys ingens*	E	No	Dry, open habitats, often within annual grasslands with few to no shrubs. Found in 10 counties in central California.
Gray Wolf	*Canis lupus*	E	No	Mountainous, forested habitat. Found in 5 counties in northernmost California.
Morro Bay Kangaroo Rat	*Dipodomys heermanni morroensis*	E	Yes; in San Luis Obispo County.	Restricted to a small area of Baywood Fine Sand soil associated with the stabilized dune system south of Morro Bay.
Pacific Pocket Mouse	*Perognathus longimembris pacificus*	E	No	Open grasslands and shrublands of the coastal plain, where suitable sandy loam soils occur. Found in 3 counties in southern California.
Peninsular Bighorn Sheep	*Ovis canadensis nelsoni*	E	Yes; 3 units in Riverside, San Diego, and Imperial Counties.	Steep, rocky slopes with sparse vegetation. Found in 3 counties in southern California.
Point Arena Mountain Beaver	*Aplodontia rufa nigra*	E	No	Moist, but well-drained soils, typically in wet areas with lush vegetation in northern California.
Riparian Brush Rabbit	*Sylvilagus bachmani riparius*	E	No	Riparian forests with a dense understory of shrubs. Found in 3 counties in central California.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Riparian Woodrat	*Neotoma fuscipes riparia*	E	No	Area along the Stanislaus River in Caswell Memorial State Park in Stanislaus County.
Salt Marsh Harvest Mouse	*Reithrodontomys raviventris*	E	No	Marshes dominated by plant species in the genus *Sarcocornia*. Found in 10 counties in central California.
San Bernardino Merriam's Kangaroo Rat	*Dipodomys merriami parvus*	E	Yes; in San Bernardino and Riverside Counties.	Sandy, well-drained soils associated with dry washes, river floodplains, or alluvial fan formations, generally with open alluvial scrub, coastal sage scrub, chaparral, or grasslands. Found in 3 counties in southern California.
San Joaquin Kit Fox	*Vulpes macrotis mutica*	E	No	Arid and desert habitats, usually in open, sparsely vegetated terrain. Found in 23 counties in the central and southern regions of California.
San Miguel Island Fox	*Urocyon littoralis littoralis*	E	No	Habitat generalist, occurring in a variety of habitats across the islands. Found on San Miguel Island in California.
Santa Catalina Island Fox	*Urocyon littoralis catalinae*	E	No	Habitat generalist, occurring in a variety of habitats across the islands. Found on Santa Catalina Island in California.
Santa Cruz Island Fox	*Urocyon littoralis santacruzae*	E	No	Habitat generalist, occurring in a variety of habitats across the islands. Found on Santa Cruz Island in California.
Santa Rosa Island Fox	*Urocyon littoralis santarosae*	E	No	Habitat generalist, occurring in a variety of habitats across the islands. Found on Santa Rosa Island in California.
Sierra Nevada Bighorn Sheep	*Ovis canadensis sierrae*	E	Yes; in Tuolumne, Mono, Fresno, Inyo, and Tulare Counties.	Open areas with steep and rocky slopes. Found in 7 counties in central California.
Stephens' Kangaroo Rat	*Dipodomys stephensi*	E	No	Sage scrub or grassland habitats that have sparse vegetation and have previously been disturbed. Found in 4 counties in southern California.
Tipton Kangaroo Rat	*Dipodomys nitratoides nitratoides*	E	No	Open shrublands, grasslands, or sparsely vegetated disturbed areas with light, friable soils suitable for burrowing. Found in 5 counties in central California.
Marine Mammals				
Blue Whale	*Balaenoptera musculus*	E	No	Coastal waters as well as oceanic waters. Found off the coast of Mendocino County in northern California.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Finback Whale	*Balaenoptera physalus*	E	No	Deep offshore water. Found off the coast of Mendocino County in northern California.
Guadalupe Fur Seal	*Arctocephalus townsendi*	T	No	Coastal shores and marine environments. Found along the coast of 4 counties in southern California.
Humpback Whale	*Megaptera novaeangliae*	E	No	Open ocean off the coast of California in the summer and fall.
Sei Whale	*Balaenoptera borealis*	E	No	Open ocean off the coast of Mendocino County in the summer and fall.
Southern Sea Otter	*Enhydra lutris nereis*	T	No	Rocky or sandy habitats that support kelp forests. Found in 7 counties along the coast of central California.
Sperm Whale	*Physeter catodon*	E	No	Coastal waters as well as oceanic waters. Found off the coast of Mendocino County in northern California.

Sources: (CDFW, 2016a) (USFWS, 2016de)

[a] E = Endangered, T = Threatened

Terrestrial Mammals

Amargosa Vole. The Amargosa vole (*Microtus californicus scirpensis*) is a subspecies of California vole endemic to a small area of California's Mojave Desert. Voles are mouse-like rodents, typically with very small eyes and ears and a short tail. The Amargosa vole subspecies has a gray body, a bi-colored tail that is brown above and gray below, and light colored feet. Adults can grow to nearly 8 inches in length and weights have been recorded at between just under an ounce and 2 ounces (USFWS, 2015d). Amargosa vole was federally listed as endangered in 1984, with critical habitat designated the same year (USFWS, 1984a) (USFWS, 2015d).

It occurs primarily in bulrush-dominated marshland along the river, but may also be associated with other nearby marsh habitat types (USFWS, 1984a) (USFWS, 2015e). This subspecies is endemic to southern Inyo County, and is known from only a small section of the Amargosa River from north of Tecopa Hot Springs to the Amargosa Canyon. Critical habitat has been established in this area (USFWS, 1984a).

Studies within the entire known range of the species in 2010 indicate that only an estimated 225 individuals may remain in the wild, with up to 85 percent of the population occurring in a single 2-hectare marsh (USFWS, 2015e). Threats to the species have included burning and livestock intrusion into habitat, development, and modifications of the springs feeding the marshes. These threats are made worse by the small size of the remaining habitat (USFWS, 1984a).

Buena Vista Lake Ornate Shrew. Buena Vista Lake Shrew (*Sorex ornatus relictus*) is a subspecies of the more widespread ornate shrew (*S. ornatus*). Ornate shrew are mouse-sized,

insect eating rodents with long snouts and tiny eyes, and weigh between 0.14 and 0.27 ounces as adults. "The Buena Vista Lake shrews back is mostly black with a buffy-brown speckled pattern" and a grey underside. The tail is long, with short hairs. The Buena Vista Lake ornate shrew was federally listed as endangered in 2002 (USFWS, 2002a), and a final rule designating critical habitat was issued in 2013 (USFWS, 2013w). A recovery plan for the upland species of the San Joaquin Valley that includes the subspecies was published in 1998 (USFWS, 1998b).

Buena Vista Lake ornate shrew occurs in riparian and wetland communities where dense herbaceous plant growth and abundant leaf litter is present. An overstory of willows (*Salix spp*.) or cottonwoods (*Populus spp*.) have been noted as favorable to the species (USFWS, 2011a). The historical distribution of the species was the riparian and wetland habitat associated with Tulare, Kern, and Buena Vista lakes and associated sloughs and marshes. It likely occurred throughout the Tulare Basin (USFWS, 2011a) (USFWS, 2013w). The loss of an estimated 95 percent of this riparian and wetland habitat had restricted its present range to four small populations at the time it was listed. There are now eight populations in the region: Goose Lake, Atwell Island, Main Drain Canal/Chicca & Sons Twin Farms South Field Ranch, Lemoore Wetlands preserve, Coles levee ecosystem preserve, Kern fan water recharge area, the Kern NWR, and the Kern Lake preserve. A total of 2,485 acres of critical habitat have been designated in 7 units within the historical range in Kern County (USFWS, 2013w).

Threats to the subspecies are typically due to the loss of riparian and wetland habitat. The majority of the Tulare basin was altered to less than 5 percent of its original habitat by the 1980's due to agricultural, urban, and infrastructure development (USFWS, 2011a) (USFWS, 2013w). Other potential threats include selenium toxicity, pesticide exposure, and the potential effects of climate change. Limited gene flow and risk from local random events are factors commonly affecting small, fragmented species populations (USFWS, 2002a) (USFWS, 2011a).

Canada Lynx. The Canada lynx (*Lynx canadensis*) "is an elusive forest-dwelling cat of northern latitudes. At 30 to 35 inches long, weighing 14-31 pounds, and with grizzled gray fur, lynx are similar to bobcats (Lynx rufus) in size and appearance. The lynx's large, wellfurred paws, long, black ear tufts, and short, black-tipped tail distinguish it from the bobcat. With its large paws and long hind legs, the lynx is highly adapted to hunting its primary prey, the snowshoe hare (*Lepus americanus*), in the deep snow typical throughout its range. Lynx have been documented to live up to 16 years in the wild. The lynx's range largely overlaps that of the snowshoe hare, and both species are widespread and relatively common in interior Canada and Alaska. Lynx are much rarer in the contiguous U.S., at the southern edge of their range" (USFWS, 2013r). The September 2014 revised designation of critical habitat for the contiguous United States distinct population does not include California, but does include the Greater

Canada lynx Photo Credit: USFWS

Yellowstone area, portions of the North Cascade mountains, Northern Rocky Mountains, areas of Minnesota around Lake Superior, and portions of Northern Maine (GPO, 2014b).

Fresno Kangaroo Rat. The Fresno kangaroo rat (*Dipodomys nitratoides exilis*) is one of three subspecies of San Joaquin kangaroo rat. Kangaroo rats are generally large-bodied, seed eating rodents with large, broad heads and long, kangaroo-like hind legs adapted for hopping. Pronounced, fur-lined cheek pouches are used in gathering and transporting seed. San Joaquin kangaroo rat has four toes on the hind feet. Fresno kangaroo rat is dark buff to dark brown above, with a white underside. The smallest of the three subspecies, adults reach 8.25 to 10.5 inches, including a 5 to 6 inch long tail. The subspecies was federally listed as endangered in 1985, with critical habitat designated in the same year (USFWS, 1985f). A recovery plan for upland species of the San Joaquin Valley was published in 1998 addresses the subspecies (USFWS, 1998b).

Habitat for the subspecies typically includes open shrublands, grasslands, and high areas within alkali plains with light, friable soils suitable for burrowing. Kangaroo rats hop, requiring open habitat for movement while foraging. This subspecies is endemic to Central California and was believed to have inhabited the San Joaquin Valley from "north to the San Joaquin River in the east to the town of Fresno, in the south to the Kings River, and in the west to the Fresno Slough" (USFWS 1985m). As of 1992 it was known from two small locations in Kings County. No Fresno kangaroo rats had been positively identified on the remaining patches since 1992, although San Joaquin kangaroo rat individuals have been captured in several locations within the historical range. A third population at Lemoore Air Force Station, at the boundary between the ranges of the Fresno (*D. n. exilis*) and Tipton (*D. n. nitratoides*) subspecies, and has not been conclusively identified. This population has been declining and has not been confirmed onsite, despite repeated trapping, since 2010 (CSU Stanislaus, Endangered Species Recovery Program, 2015) (USFWS, 2010a). Critical habitat for the subspecies has been designated within its historical range (USFWS, 1985f).

Threats to the subspecies have included loss of habitat through agricultural and urban development, water projects, roads, and habitat degradation from year-round livestock grazing. Other populations have been lost through habitat conversion and flooding. It was estimated that less than 10 percent of the historical habitat for the species still existed at the time of listing in 1985; the remainder had been converted to agricultural use and urban development. Much of the remaining potentially suitable habitat occurs in small and fragmented patches, with little connectivity (CSU Stanislaus, Endangered Species Recovery Program, 2015) (USFWS, 2010a). Small, widely separated populations face potential extirpation from random events such as flooding and lead to genetic isolation in remaining individuals.

Giant Kangaroo Rat. The giant kangaroo rat (*Dipodomys ingens*) is the heaviest of all kangaroo rats. Adults typically weigh between 4.6 to 6.4 ounces (USFWS, 1987a). Kangaroo rats are generally large-bodied, seed eating rodents with large, broad heads and long, kangaroo-like hind legs adapted for hopping. Pronounced cheek pouches are used in gathering and transporting seed. The giant kangaroo rat is distinguished by its large size, presence of five toes on the hind legs, and a broad skull. Coloration is "generally brown above and white below" (USFWS,

2015f). The species was originally proposed by the USFWS for listing in 1987 and was listed as endangered the same year (USFWS, 1987a).

Giant kangaroo rats form burrow colonies called "precincts" in dry, open habitats, often within annual grasslands with few to no shrubs. The species requires well-drained sandy loam soils for burrowing and generally occurs on flat land or gentle slopes (USFWS, 2010b). The species range is limited to six areas: "(1) the Ciervo-Panoche Region in western Fresno and eastern San Benito Counties; (2) Kettleman Hills in southwestern Kings County; (3) San Juan Creek Valley in eastern San Luis Obispo County; (4) the Lokern area, Elk Hills previously known as the National Petroleum Reserve Number One (NPR-1), that includes Buena Vista and McKittrick Valleys, National Petroleum Reserve Number Two (NPR-2), Taft, and Maricopa in western Kern County; (5) the Carrizo Plain in eastern San Luis Obispo County; and (6) the Cuyama Valley along the eastern Santa Barbara-San Luis Obispo County line" (USFWS, 2010b).

The primary threat to the species had been loss of habitat, with approximately less than five percent of its historical range remaining. Ongoing threats include large solar projects, transmission line construction, oil and gas exploration, off road vehicle use, predation by other species such as the San Joaquin kit fox, and urbanization (USFWS, 2010b).

Gray Wolf. The gray wolf (*Canis lupus*) ranges in color to black, white, or gray. Adults weigh between 70 and 110 pounds. Gray wolves are a highly social species and live in packs. Wolves hunt with their pack and feed primarily on deer, elk, and moose (USFWS, 2015g). Gray wolves were federally listed as endangered in 1978 (43 FR 9607 9615, March 9, 1978). The endangered population of this species is found in California, Michigan, Oregon, Washington, and Wisconsin. In California, it can be found in five counties in the northern part of the state (USFWS, 2015h).

Suitable habitat includes mountainous, forested areas. Wolves are considered "habitat generalists" and therefore can inhabit a wide range of habitats. Primary threats to this species include conflicts with humans such as unregulated hunting. This has resulted in eradication of gray wolves from most of its range within the continental U.S. (USFWS, 2015g)

Morro Bay Kangaroo Rat. The Morro Bay kangaroo rat (*Dipodomys heermanni morroensis*) is a subspecies of the more widespread Heerman's kangaroo rat, endemic to the Morro Bay area. Kangaroo rats are generally large-bodied, seed eating rodents with large, broad heads and long, kangaroo-like hind legs adapted for hopping. Pronounced fur-lined cheek pouches are used in gathering and transporting seed (USFWS, 2011b). Morro Bay kangaroo rat is smaller and darker than the other subspecies and an "incomplete or absent white hip stripe, and black stripe across the nose" (USFWS, 1999a) (USFWS, 2011b). The subspecies was listed federally listed as endangered in 1970, with critical habitat designated in 1977. A draft recovery plan was published in 1999 (USFWS, 1999a). Morro Bay kangaroo rat is restricted to a small area of Baywood fine sand soil associated with the stabilized dune system south of Morro Bay. Stabilized dunes differ from active, blowing dunes in that the soil is stabilized by plant growth. They dig burrow complexes in the sand and require open, sparse vegetation on the surface for hopping (USFWS, 1999a). The historical range of the species corresponds to the extent of the deposit of Baywood Fine Sand, measuring only 4.8 square miles (USFWS, 2011b). Threats to the species have included loss of historically occupied habitat to development, and habitat

conversion. The remaining natural open space within the range has become overgrown with vegetation as a result of fire suppression activities, which is believed to have excluded the species from much of its remaining habitat. The subspecies was last observed in the wild in 1986 despite extensive trapping efforts to locate additional individuals. The Morro Bay kangaroo rat is considered potentially extinct by the USFWS although the status has not been confirmed. Several areas of remaining potentially suitable habitat are located within private properties and are not accessible, and occasional sign such as possible burrows and tail drag marks have been observed as late as 2011 (USFWS, 2011b).

Pacific Pocket Mouse. The Pacific pocket mouse (*Perognathus longimembris pacificus*) is the smallest subspecies of little pocket mouse. This subspecies has silky, brownish pink fur, with white undersides and small white patches behind the small ears. The bottoms of their hind feet are hairy. Adults measure 4.3 to 6 inches in length, including tail, and weigh only 0.25 to 0.32 ounces (USFWS, 1994f) (USFWS, 2010c) (USFWS, 2015aj). Once thought to be extinct, this subspecies was federally emergency-listed as endangered in February 1994. The determination to list as federally endangered was filed in September 1994 (USFWS, 1994f). No critical habitat has been designated for the species (USFWS, 2010c) (USFWS, 2015aj).

Pacific pocket mouse spends much of its time in burrows, emerging to forage at night. It inhabits open grasslands and shrublands of the coastal plain, where suitable sandy loam soils occur. Historically, populations have been documented only within approximately 2.5 miles of the coast, often associated with river mouths or alluvial deposits (USFWS, 2010c).

The historical range of the subspecies included the coastal plain of California from Orange and San Diego Counties, into Baja California, Mexico, often in alluvial (stream deposited) soils associated with the larger river mouths, and terrace formations where suitable soils have been present. It now appears to be restricted to four small populations, one in an isolated lot surrounded by urban development at Dana Headlands in Orange County, and three on Marine Corps Base Camp Pendleton in San Diego County (USFWS, 2010c).

The subspecies has lost much of its historical habitat to the extensive development of the coastal plain. Urbanization, infrastructure, agriculture, channelization of floodplains have impacted or removed potential habitat. Current threats include the effects of military training, wildfires, predation by vertebrate predators such as domestic and feral cats, Remaining populations are small and fragmented, with the potential for local extirpation from random events and the effects of genetic isolation (USFWS, 1994f).

Peninsular Bighorn Sheep (*California DPS of Desert Bighorn Sheep****).*** Peninsular bighorn sheep (*Ovis canadensis nelsoni*) is a subspecies of bighorn sheep endemic to extreme Southern California and Baja California, Mexico. Bighorn sheep are medium-size bovids[103] with tan to dark brown hair and white patches on the belly, rump, back of legs, and muzzle. Adult females have small, curved, narrow horns and males have large curled horns, spreading to 33 inches (USFWS, 2015az).

[103] Bovid: Any of a family (Bovidae) of ruminants that have hollow unbranched permanently attached horns present in usually both sexes and that include antelopes, oxen, sheep, and goats (Merriam Webster Dictionary, 2016b).

The subspecies was federally listed as endangered in 1998 (USFWS, 1998q), and final designation of critical habitat was published in 2009 (USFWS, 2009bq). A recovery plan was published in 2000 (USFWS, 2000a). The listing of peninsular bighorn sheep was changed to reflect its status as a distinct population segment (DPS) rather than a subspecies, due to its currently accepted taxonomic placement with the publication of the final rule on critical habitat designation (USFWS, 2009bq).

Bighorn sheep spend much of their time on steep, rocky slopes with sparse vegetation. They will occasionally venture into flatter terrain in the foothills for foraging, watering, and dispersal. Peninsular bighorn sheep occupies habitat between 300 and 4,600 feet in California and northern Baja California, Mexico. The listed DPS occurs in the desert habitat of the Peninsular Ranges of California, from the San Jacinto Mountains south to the border with Mexico. Populations are known from San Jacinto Mountains, Santa Rosa Mountains, Coyote Mountain San Ysidro Mountains, Pinyon Mountains, Vallecito Mountains, Fish Creek Mountains, Tierra Blanca Mountains, Sawtooth Mountains, In-Ko-Pah Mountains, Coyote Mountains, and Jacumba Mountains (USFWS, 2011c). Critical habitat has been designated in 3 units in Riverside, San Diego, and Imperial Counties, totaling 376,542 acres.

Threats to the DPS include loss of habitat, habitat fragmentation, off-highway vehicle activity, hiking and recreation, and disease, among others. Habitat has been lost to urbanization, agriculture, mining, and other land uses, especially in the foothills and valley floors that are essential to dispersal and foraging and watering during the dry season. Likewise, development has fragmented and isolated populations. Normally shy bighorns are affected by human presence such as hiking, off-highway vehicle use, and other recreational activities within their habitats. Blue-tongue virus, contagious ecthyma virus, parainfluenza-3 virus, bovine respiratory syncytial virus, Anaplasma, Chlamydia, Leptospira, Pasteurella, Psoroptes, and Dermacentor are all pathogens that have been identified in causing disease in bighorn sheep, leading to population decreases. Many have been introduced from domestic livestock (USFWS, 2000a) (USFWS, 2011c). The recovery plan has designated nine recovery regions within the range of the DPS, and specific threats and recovery goals have been identified and set for each region (USFWS, 2000a).

Point Arena Mountain Beaver. The Point Arena mountain beaver (*Aplodontia rufa nigra*) is a small rodent reaching about one foot long as an adult, and weighing two to four pounds. Though not closely related to beavers (*Castor spp*.) they have a somewhat similar appearance with a barrel-shaped body, narrow head, rounded ears, long digging claws, and a short cylindrical tail. It is distinguished from other subspecies primarily by its black colored coat (USFWS, 1991) (USFWS, 1998c) (USFWS, 2015i).

The Point Arena mountain beaver was federally listed as endangered in 1991 (USFWS, 1991), and a recovery plan was published in 1998 (USFWS, 1998c). Critical habitat has not been designated for the subspecies (USFWS, 2015i).

Point Arena mountain beaver digs complex burrow systems in moist, but well-drained soils, typically in wet areas with lush vegetation. Burrow openings are often under dense vegetation on steep, north facing slopes or in the sides of gullies. It has been documented in coastal scrub,

coastal strand vegetation, conifer forest, and riparian communities, but rarely in heavily forested areas. Mountain beavers are native to the cold, wet coastal areas of Washington, Oregon, and Northern California. The Point Arena is restricted to a 24 square mile range in western Mendocino County (USFWS, 1991) (USFWS, 2009b) (USFWS, 1998c).

The vulnerabilities of the subspecies are its extremely limited range, limited number of populations within its range, and a low numbers of individuals within each population. Less than 500 individuals were thought to exist as of 1998 (USFWS, 1998c). Low population numbers in small and somewhat isolated populations make them vulnerable to local extirpation from disease, habitat loss or other factors, with a low probability of reestablishment. Factors impacting the remaining populations may include livestock grazing and recreational activities that alter habitat and crush burrows, development and habitat removal, and fire suppression activities that promote the succession of the open scrub habitats preferred by the specie, species, predation by dogs and cats and other predators, and climate change (USFWS, 1998c) (USFWS, 2009b)**.**

Riparian Brush Rabbit. The riparian brush rabbit (*Sylvilagus bachmani riparius*) is the smallest of 13 subspecies of brush rabbit. Adults are 11 to 14 inches long, weighs under two pounds, and are gray to brown with a white underbelly. The riparian subspecies is distinguished from other brush rabbits in the area by a smaller, more inconspicuous tail, lack of dark ear tips, and certain characteristics of the skull (USFWS, 2000b). The subspecies was federally listed as endangered in 2000 (USFWS, 2000b) and is addressed in a 1998 recovery plan for upland species of the San Joaquin Valley (USFWS, 1998a). No critical habitat has been designated (USFWS, 2015j).

Riparian brush rabbit is typically found in riparian forests with a dense understory of shrubs. The forest habitat must be open enough to allow enough light penetration for the development of the shrub layer, and support a variety of herbaceous vegetation for feeding. The rabbit lives in parts of the riparian areas that are not as likely to flood (USFWS, 2000b) (USFWS, 2015j). The historical range of the subspecies included the once extensive riparian and wetland areas of the lower San Joaquin Valley, but have been extirpated from the Sacramento-San Joaquin River Delta, Lower San Joaquin River, and Tuolumne, and Merced rivers. It has currently only been reported from only a small section of the Stanislaus River (USFWS, 2000b).

Threats to the species include loss of habitat to development, modification and woodcutting in the forests, reclamation and flood control activities, groundwater pumping, dam construction, river channelization, dam construction, and water diversions, all of which have drastically reduced the extent and quality of riparian habitat in the subspecies range. Additional threats include wildfires, disease, predation, and use of rodenticides. An estimated 89 percent of its range has been lost (USFWS, 2000b).

Riparian Woodrat. The riparian woodrat (*Neotoma fuscipes riparia*) is a subspecies of the more widely distributed dusky-footed woodrat. Adults are brown above with a light underside, a short tail, large eyes, and large ears. They can weigh 7 to 14 ounces. Riparian woodrats are slightly larger, grayer, and lighter colored than other subspecies, with white instead of dark coloration on the upper side of the feet (USFWS, 2000b) (USFWS, 2012b). The subspecies was listed as federally endangered in 2000 (USFWS, 2000b), and a recovery plan covering this and other San

Joaquin Valley species completed in 1998 (USFWS, 1998a). Critical habitat has not yet been designated (USFWS, 2015k).

The riparian woodrat is known to exist only within an approximately 250-acre area along the Stanislaus River in Caswell Memorial State Park, near the town of Vernalis. The historical range may have included the surrounding riparian areas of the San Joaquin Valley. Records show the historical range extending into at least Merced, San Joaquin, Fresno, and Contra Costa Counties (USFWS, 2000b) (USFWS, 2012b).

Because the subspecies is now reduced to a single small population, it is vulnerable to extinction from disease, flooding, wildfire, predation, inbreeding issues, and a number of other factors that put small populations at risk. Degradation of the surrounding riparian habitat continues in the region with agriculture, water diversions, development, and fragmentation of remaining habitat (USFWS, 2012b).

Salt Marsh Harvest Mouse. The salt marsh harvest mouse (*Reithrodontomys raviventris*) is a small mouse, with a body that is approximately 2.75 to 3.00 inches long (USFWS, 2010d). This species has a dark brown body with a lighter tawny or cinnamon colored belly (USFWS, 2010d) (USFWS, 2015l). The salt marsh harvest mouse was federally listed as endangered in 1970 (35 FR 16047 16048, October 13, 1970).

Regionally, this species is believed or known to occur in 10 counties in central California (USFWS, 2015l). The salt marsh harvest mouse is most commonly found in marshes dominated by plant species in the genus *Sarcocornia*. Threats to this species include habitat loss and degradation due to urban development, industrial development, changes in salinity, non-native plants, and pollution (USFWS, 2010d).

San Bernardino Merriam's Kangaroo Rat. San Bernardino Merriam's kangaroo rat (*Dipodomys merriami parvus*) is a subspecies of the more widespread Merriam's kangaroo rat, endemic to a narrow habitat range in Southern California. Kangaroo rats are generally large-bodied, seed eating rodents with large, broad heads and long, kangaroo-like hind legs adapted for hopping. Pronounced fur-lined cheek pouches are used in gathering and transporting seed. This is a small kangaroo rat species with a yellowish body, dark brown overcoat, and is the only species with only four toes on the hind foot. The subspecies *parvus* is the darkest of the three Southern California subspecies (USFWS, 2008a). The subspecies was emergency listed as endangered by the USFWS in January of 1998 and was listed as endangered in September 1998 (USFWS, 1998d). Critical habitat was designated in 2002, and revised in 2008, in San Bernardino and Riverside Counties (USFWS, 2008a).

San Bernardino Merriam's kangaroo rat occurs primarily on sandy, well-drained soils associated with dry washes, river floodplains, or alluvial fan formations, generally with open alluvial scrub, coastal sage scrub, chaparral, or grasslands. Habitat areas often include the more open vegetation associated with the active floodplain, and the more mature scrub in the adjacent uplands, potentially used as refugia during flood events (USFWS, 1998d).

The historical range of the species was from the San Bernardino Valley in San Bernardino County to the Menifee Valley in Riverside County. However, the majority of the remaining San

Bernardino kangaroo rat populations are primarily found in three areas: the Santa Ana Wash, San Jacinto Wash, and Lytle Creek and Cajon Wash. Other smaller populations of the San Bernardino kangaroo rat are documented in washes and hills in the areas surrounding the three main population centers. The primary threats to the subspecies have been habitat loss and degradation within their restricted habitat extent through development, off-highway vehicle use, floodplain alteration, and habitat fragmentation (USFWS, 2008a).

San Joaquin Kit Fox. The San Joaquin Kit fox (*Vulpes macrotis mutica*) is a subspecies of kit fox endemic to the Central Valley of the state. Adults measure 20 inches in length and weigh approximately 5 pounds. They are gray brown in the summer and silvery gray in the winter. Their underside is white and tail tip is black (USFWS, 2010e). The subspecies was added to the federal list of species faced with extinction in 1967 (USFWS, 1967) and is addressed in a recovery plan for upland species of the San Joaquin Valley (USFWS, 1998a). No critical habitat has been designated (USFWS, 2015m). It has been addressed in various habitat conservation plans within its historical range (USFWS, 2015m).

Kit fox occurs in arid and desert habitats across North America, usually in open, sparsely vegetated terrain. The San Joaquin subspecies historically occurred in alkali scrub and arid grassland habitats across the San Joaquin Valley floor. The kit fox digs burrows in sandy, level ground, and is absent from areas where soils are too hard for digging, or where water tables are near the surface. The subspecies historically ranged from southern Kern County north to Tracy in San Joaquin County, and into the foothills and valleys of the interior Coast Range to the west. The current range includes populations in 23 counties in California including areas of Kern, Tulare, Kings, Fresno, Madera, San Benito, and Merced Counties (USFWS, 2010e).

The primary threat to the subspecies has been the conversion of its historical habitat to agricultural uses, urbanization, and water and infrastructure projects which have resulted in small, scattered, fragmented populations. Current threats include development and degradation of habitat, pesticide and rodenticide use, predation by larger mammals such as the coyote, disease, off-highway vehicle activity, and habitat fragmentation which can lead to genetic isolation and the increased probability of local extirpations from random events (USFWS, 1998a) (USFWS, 2010e).

San Miguel Island Fox. The San Miguel Island fox (*Urocyon littoralis littoralis*) is one of six subspecies of the California Island fox. The California Island fox is endemic to the Channel Islands off the coast of California. Early research in the 1930s identified the island foxes under one species classification (*Urocyon littoralis*); each island population was assigned a subspecific designation based on its island range "(*U. l. catalinae* on Santa Catalina Island, *U. l. clementae* on San Clemente Island, *U. l. dickeyi* on San Nicolas Island, *U. l. littoralis* on San Miguel Island, *U. l. santacruzae* on Santa Cruz Island, and *U. l. santarosae* on Santa Rosa Island)." Studies conducted in the 1990s supported this separation of subspecies based on morphological and genetic characteristics with each subspecies exhibiting a range restricted to one island (USFWS, 2015fd). The California Island fox species is the smallest fox in the United States, with the larger male weighing only 2.4 pounds and measuring 23 to 31 inches long, including the tail. Females are somewhat smaller than the male. This subspecies of island fox has gray-white and

black with cinnamon underfur above, and is lighter underside. A thin, black stripe runs along the top of the tail (USFWS, 2016d). The USFWS *2015 Recovery Plan for Four Subspecies of Island Fox* (*Urocyon littoralis*) notes that "Morphologically, the species exhibits inter-island variability in size, nasal shape and projection, and the number of tail vertebrae." The report identifies that genetic studies conducted in the 1980s and 1990s confirm the division of species into six separate subspecies with the dispersal of each subspecies attributed to "archeology and geology." The isolation of each subspecies population on each island from the other islands indicates that these island fox subspecies have lower genetic variability as a result of inbreeding than mainland foxes (USFWS, 2015fd).

The San Miguel Island fox is endemic to San Miguel Island; this subspecies has been proposed for delisting (USFWS, 2016c). San Miguel Island foxes are distinguished from other subspecies of island fox by their "shorter tails, due to one less tail vertebra, and longer noses" (NPS, 2016h).The subspecies was federally listed as endangered in 2004 (USFWS, 2004a), and a determination was made in 2005 that none of the habitat on the island meets the criteria for critical habitat (USFWS, 2005a). A recovery plan was published for all four subspecies of federally endangered island fox in 2015 (USFWS, 2015n).

Island foxes are habitat generalists, occurring in a variety of habitats across the islands. It may use dense stands of nonnative grasses less than other habitat as it makes foraging more difficult. San Miguel Island fox is endemic to San Miguel Island, about 58 miles offshore from Ventura. As a small island population, San Miguel Island fox is vulnerable to incremental impacts to habitat and individuals, as well as catastrophic events and genetic issues associated with a small, isolated population. Four of six island fox subspecies were federally listed in 2004 after drastic declines in population numbers (USFWS, 2004a). San Miguel Island fox had been reduced to a population of only 15, when the remaining individuals were taken into captivity. A captive breeding program allowed for the reintroduction of 62 captive foxes into the wild between 2004 and 2007, the wild population had increased to about 550 in 2013 (USFWS, 2004a) (USFWS, 2015n).

Threats to the subspecies have been identified as predation by golden eagle. It is believed that the increase in golden eagle predation was a result of the extirpation of bald eagle from the island, as a result of DDT contamination and the conversion of shrublands to grassland on the island due to overgrazing. Bald eagle, which specialized in marine prey was replaced by golden eagle as the primary areal predator, which specializes in terrestrial (land based) prey. The original shrub cover may have given the subspecies better shelter from aerial predation than the current grass cover. Part of the recovery program for the subspecies includes golden eagle translocation and habitat restoration (USFWS, 2015n).

Santa Catalina Island Fox. The Santa Catalina Island fox (*Urocyon littoralis catalinae*) is one of 6 subspecies of island fox endemic to the Channel Islands off the coast of California, and occurs only on Santa Catalina Island (USFWS, 2015n). This subspecies has been proposed for downlisting (USFWS, 2016c). The California Island fox species is the smallest fox in the United States, with the larger male weighing only 2.4 pounds and measuring 23 to 31 inches long, including the tail. Females are somewhat smaller. This subspecies of island fox has gray-white

and black with cinnamon underfur above, and a lighter underside. A thin, black stripe runs along the top of the tail (USFWS, 2015o).

The Santa Catalina Island fox is endemic to Santa Catalina Island; this subspecies was federally listed as endangered in 2004 (USFWS, 2004a), and a determination was made in 2005 that none of the habitat on the island meets the criteria for critical habitat (USFWS, 2005a). A recovery plan was published for all four subspecies of federally endangered island fox in 2015 (USFWS, 2015n). Island fox is a habitat generalist, occurring in a variety of habitats across the islands. It may use dense stands of nonnative grasses less than other habitat as it makes foraging more difficult. Santa Catalina Island fox is endemic to Santa Catalina Island, about 32 miles off the coast of Southern California, where it occurs throughout most of the island.

As a small island population, Santa Catalina Island fox is vulnerable to incremental impacts to habitat and individuals as well as catastrophic events and genetic issues associated with a small, isolated population. Four of six island fox subspecies were federally listed in 2004 after drastic declines in population numbers. Santa Catalina Island fox had decreased from an estimated 1300 individuals to 103 in the 1999 – 2000 season. One of the primary threats to the subspecies was identified as canine distemper virus infection, introduced by domestic animals. Other factors were identified as a prevalence of ear cancer, incremental loss of habitat from development and habitat degradation, and vehicle strikes. Recovery efforts such as immunization against canine distemper virus had increased the population levels to an estimated 1852 individuals as of 2013 (USFWS, 2015n).

Santa Cruz Island Fox. The Santa Cruz Island fox **(***Urocyon littoralis santacruzae***)** is one of six subspecies of island fox endemic to the Channel Islands off the coast of California. This subspecies has been proposed for delisting (USFWS, 2016c). The California Island fox species is the smallest fox in the United States, with the larger male weighing only 2.4 pounds and measuring 23-31 inches long, including the tail. Females are somewhat smaller. This subspecies of island fox has gray-white and black with cinnamon underfur above, and is lighter underside. A thin, black stripe runs along the top of the tail (USFWS, 2016e). The subspecies was federally listed as endangered in 2004 (USFWS, 2004a), and a determination was made in 2005 that none of the habitat on the island meets the criteria for critical habitat (USFWS, 2005a). A recovery plan was published for all four subspecies of federally endangered island fox in 2015 (USFWS, 2015n).

Island foxes are a habitat generalists, occurring in a variety of habitats across the islands. It may use dense stands of nonnative grasses less than other habitat as it makes foraging more difficult. Santa Cruz Island fox is endemic to Santa Cruz Island, off the shore of Southern California (USFWS, 2004a). As a small island population, Santa Cruz Island fox is vulnerable to incremental impacts to habitat and individuals as well as catastrophic events and genetic issues associated with a small, isolated population. Four of six island fox subspecies were federally listed in 2004 after drastic declines in population numbers (USFWS, 2004a). Santa Cruz Island fox had been reduced from an estimated population of over 1400 in 1994 to only 55 in 2001. Eighteen individuals were taken into captivity and a captive breeding and reintroduction program

allowed the wild population had increased to about around 2500 individuals as of 2014 (USFWS, 2004a) (USFWS, 2015n).

Threats to the subspecies have been identified as predation by golden eagle. It is believed that the increase in golden eagle predation was a result of the extirpation of bald eagle from the island, as a result of DDT contamination and the conversion of shrublands to grassland on the island due to overgrazing. Bald eagle, which specialized in marine prey was replaced by golden eagle as the primary areal predator, which specializes in terrestrial (land based) prey. The original shrub cover may have given the subspecies better shelter from aerial predation than the current grass cover. Part of the recovery program for the subspecies includes golden eagle translocation and habitat restoration. All golden eagles had been removed from the island as of 2006 (USFWS, 2015n).

Santa Rosa Island Fox. The Santa Rosa Island fox (*Urocyon littoralis santarosae*) is one of six subspecies of island fox endemic to the Channel Islands off the coast of California, and occurs only on Santa Rosa Island. This subspecies has been proposed for delisting (USFWS, 2016c). The California Island fox species is the smallest fox in the United States, including this subspecies, with the larger male weighing only 2.4 pounds and measuring 23 to 31 inches long, including the tail. Females are somewhat smaller. This subspecies of island fox, has gray-white and black with cinnamon underfur above, and is lighter underside. A thin, black stripe runs along the top of the tail (USFWS, 2016f). The subspecies was federally listed as endangered in 2004 (USFWS, 2004a), and a determination was made in 2005 that none of the habitat on the island meets the criteria for critical habitat (USFWS, 2005a). A recovery plan was published for all four subspecies of federally endangered island fox in 2015 (USFWS, 2015n).

Island foxes are habitat generalists, occurring in a variety of habitats across the islands. It may use dense stands of nonnative grasses less than other habitat as it makes foraging more difficult. Santa Rosa Island fox is endemic to Santa Rosa Island, located 26 miles off the shore of Santa Barbara (USFWS, 2004a). As a small island population, Santa Rosa Island fox is vulnerable to incremental impacts to habitat and individuals, as well as catastrophic events and genetic issues associated with a small, isolated population. Four of six island fox subspecies were federally listed in 2004 after drastic declines in population numbers (USFWS, 2004a). Santa Rosa Island fox had been reduced from an estimated population of only 40 in 2001, at which time the remaining individuals were taken into captivity. A successful breeding and reintroduction program had increased the wild population to an estimated 894 in 2013. (USFWS, 2004a) (USFWS, 2015n).

Threats to the subspecies have been identified as predation by golden eagle. It is believed that the increase in golden eagle predation was a result of the extirpation of bald eagle from the island, as a result of DDT contamination and the conversion of shrublands to grassland on the island due to overgrazing. Bald eagle, which specialized in marine prey was replaced by golden eagle as the primary areal predator, which specializes in terrestrial (land based) prey. The original shrub cover may have given the subspecies better shelter from aerial predation than the current grass cover. Part of the recovery program for the subspecies includes golden eagle

translocation and habitat restoration. All golden eagles had been removed from the island as of 2006 (USFWS, 2015n).

Sierra Nevada Bighorn Sheep. The Sierra Nevada bighorn sheep (*Ovis canadensis sierrae*) has a coat that ranges from off-white to dark brown. The mouth, eyes, rump, and backs of the legs are all white. Both sexes have permanent horns, but the males have larger and more curled horns than the females. Males are approximately 3 feet tall and weigh up to 220 pounds (USFWS, 2015p). This subspecies was federally listed as endangered in 1999 (64 FR 19300 19309, April 20, 1999).

Regionally, this subspecies occurs in seven counties in central California (USFWS, 2015p). In 2008, critical habitat was designated in Tuolumne, Mono, Fresno, Inyo, and Tulare Counties (73 FR 45534 45604, August 5, 2008). Bighorn sheep typically inhabit open areas with steep and rocky slopes. Primary threats to this species include disease, predation, avalanches, and vehicle strikes (USFWS, 2008b).

Stephens' Kangaroo Rat. The Stephens' kangaroo rat (*Dipodomys stephensi*) is a medium-sized kangaroo rat, approximately 11 to 12 inches in total length. This species exhibits a large head, cheek pouches, small front legs, and long rear legs with five toes on each hind foot. Distinguishing features include a white lateral stripe along the tail, darker tail tuft, small ears, and broad head (USFWS, 1988). The Stephens' kangaroo rat was federally listed as endangered in 1988 (53 FR 38465 38469, September 30, 1988).

Regionally, this species is believed or known to occur in four counties in southern California (USFWS, 2015q). The Stephens' kangaroo rat inhabits sage scrub or grassland habitats that have sparse vegetation and have previously been disturbed. This species is commonly found in areas that lack shrubs and are dominated by filaree[104] (*Erodium cicutarium*). These kangaroo rats spend most of the day below ground in burrows and spend the night foraging (USFWS, 1988). Threats to this species include habitat loss and degradation, introduction of non-native plant species, climate change, off-highway vehicle use, rodent control programs, and predation from domestic cats (USFWS, 2011d).

Tipton Kangaroo Rat. The Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*) is one of three subspecies of San Joaquin kangaroo rat. Among the three subspecies, the Tipton kangaroo rat is larger than the Fresno kangaroo rat and smaller than the short-nosed kangaroo rat (*Dipodomys nitratoides brevinasus*) (USFWS, 2015r)

Kangaroo rats are generally large-bodied, seed eating rodents with large, broad heads and long, kangaroo-like hind legs adapted for hopping. Pronounced cheek pouches are used in gathering and transporting seed. San Joaquin kangaroo rats have four toes on the hind feet (USFWS, 1987b). The Tipton kangaroo rat is tawny-yellow above, with a white underside. A white stipe extends from the thigh to the tufted tip of the tail. Adults have a body length of approximately 9.25 inches with a tail length of approximately three inches (USFWS, 2010f). This subspecies was federally listed as endangered in 1988 (53 FR 25608 25611).

[104] Filaree: Filaree (*Erodium cicutarium*) "is an annual herb that is not native to California; it was introduced from elsewhere and naturalized in the wild." (Calflora, 2016f)

Regionally, this subspecies is believed or known to occur in five counties in the central region of California (USFWS, 2015r). Habitat typically includes very open shrublands, grasslands, or sparsely vegetated disturbed areas with soils suitable for burrowing. Kangaroo rats hop, requiring open habitat for movement while foraging. Threats to the subspecies have included loss of habitat through agricultural and urban development, water projects, roads, and habitat degradation from year-round livestock grazing. Other populations have been lost through habitat conversion (USFWS, 2010f).

Marine Mammals

Blue Whale. The blue whale (*Balaenoptera musculus*) is the largest animal on Earth, with a maximum total body length of 108 feet. Females are slightly larger than males. Blue whales have long and slender bodies with a dorsal fin that is set closer to the tail fin than to the middle of the body. The coloration of this species is mottled gray; however, the coloration will appear to be blueish when viewed through water (NMFS, 1998). The blue whale was federally listed as endangered in 1970 (35 FR 6069, April 14, 1970).

This species migrates toward the poles during spring and to subtropical waters during fall. In the North Pacific, the range of blue whales extends from southern Japan eastward to Alaska, California, and Costa Rica (NMFS, 1998). In California, the blue whale is believed or known to occur off the coast of Mendocino County (USFWS, 2015s). Threats to the blue whale include collisions with ships, disturbance caused by ship traffic, entanglement in fishing gear, reduced zooplankton due to habitat degradation, disturbance from low frequency noise, and hunting (NMFS, 1998).

Finback Whale. The finback whale (*Balaenoptera physalus*), also referred to as the fin whale, is the second largest whale in the world, reaching a length of 75 to 85 feet and weighing between 80,000 and 160,000 pounds (NOAA, 2013). The species was first federally listed as endangered under early endangered species legislation in 1970 (35 FR 8491 8498, June 02, 1970) and was incorporated into the ESA as an endangered species (16 U.S.C. § 1531 et seq.) (USFWS, 2015t). Finback whales are found in all of the world's oceans, are highly nomadic, move in social groups of two to seven individuals, and prefer high latitudes and cold currents where food concentrations are high (NOAA, 2013). In California, this species can be found off the coast of Mendocino County (USFWS, 2015t).

Finback whales primarily feed on krill, small fish, and squid, moving through the water at a fast speed averaging 14 miles per hour with bursts of speed reaching 35 miles per hour. In the late summer, finback whales migrate to equatorial waters where they spend the winter fasting and living off of their fat reserves. After an 11 to 12 month gestation period, birthing and mating occurs (New England Coastal Wildlife Alliance, 2007) (NOAA, 2013). The finback whale population had declined as a result of whaling. By 1987, commercial whaling ended in the Northern Pacific Ocean, Southern Ocean, and Northern Atlantic Ocean, although finback whales are still hunted in Greenland. Additional current threats to this species include vessel collisions, entanglement in fishing gear, reduced food supply, habitat degradation, and noise disturbance (NOAA, 2013).

Guadalupe Fur Seal. The Guadalupe fur seal (*Arctocephalus townsendi*) is a medium-sized member of the sea lion family (*otariids*) that has a thick layer of fur (NMFS, 1970). This species generally weighs between 110 and 353 pounds, with males being larger than females (NMFS, 1970) (The Marine Mammal Center, 2015). Guadalupe fur seals exhibit external ear flaps, long flippers, and pointed mussels (The Marine Mammal Center, 2015). This species was federally listed as threatened in 1967 (32 FR 4001, March 11, 1967).

Regionally, this species is believed or known to occur from California down to Mexico and Guadalupe Island (NMFS, 1970). In California, the Guadalupe fur seal is believed or known to occur along the coast of four counties in the northern region of the state (USFWS, 2015u). This species spends time on coastal shores from May to August in order to breed and give birth. The rest of the year is spent mostly in marine environments. Potential threats to the Guadalupe fur seal include oil spills and the expansion of fisheries adjacent to Guadalupe Island (NMFS, 1970).

Humpback Whale. The humpback whale (*Megaptera novaeangliae*) up to 60 feet in length and is distinguished from other whales by its robust, thick, and chunky body shape and very long (up to 15 feet) white flippers (NOAA, 2015l). The humpback whale was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970) and was incorporated into the ESA as an endangered species (16 U.S.C. § 1531 et seq.) (USFWS, 2015v).

Humpback whales are found in all of the world's oceans. In the North Pacific, humpback whales migrate seasonally from northern feeding areas in the summer to southern feeding habitats in the winter. Breeding areas are more geographically separated than the feeding area and the whales rarely move between the designed breeding regions. The California/Oregon/Washington stock of humpback whales spend their winters in coastal Central America and Mexico and migrate to areas ranging from the coast of California northward to southern British Columbia in the summer and fall (NOAA, 2015m).

Current threats to this species include entanglement in fishing gear, vessel strikes, harassment from whale watching, habitat degradation, and utilization from commercial, recreational, scientific, or educational purposes (USFWS, 2015v).

Sei Whale. The sei whale (*Balaenoptera borealis*) is a gray colored whale that can measure up to a maximum of 59 feet in length. This species exhibits a dorsal fin that curves backwards and is located slightly behind the middle of the body (NMFS, 2012a). The sei whale was federally listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970).

This species occurs in the North Pacific Ocean, North Atlantic Ocean, and Southern hemisphere (NMFS, 2012a). In California, this species is believed or known to occur along the coast of Mendocino County (USFWS, 2015w). This species migrates towards the poles in summer and migrates to temperate or subtropical waters in the winter. Potential threats to the sei whale include collisions with ships, entanglements in fishing gear, reduced prey due to climate change, and illegal whaling (NMFS, 2012a).

Southern Sea Otter. The southern sea otter (*Enhydra lutris nereis*) is a large member of the Mustelidae family. Sea otters exhibit water resistant fur that is typically brown in color. Males have an average body length of 50 inches and average weight of 64 pounds. Females have an

average body length of 46.5 inches and average weight of 46 pounds (USFWS, 2015x). This subspecies was federally listed as threatened in 1977 (42 FR 2965 2968, January 14, 1977).

Regionally, this subspecies in believed or known to occur in seven counties in central California (USFWS, 2015y). Southern sea otters are commonly found in rocky or sandy habitats that support kelp forests. Most sea otters in California can be found within approximately 1.2 miles of shore. Threats to this subspecies include pollution, disease, and predation from white sharks. (USFWS, 2015x)

Sperm Whale. The sperm whale (*Physeter catodon*) grow to be approximately 40 to 60 feet long, with males being slightly larger than females. This species exhibits a large head, narrow lower jaw, small eyes, 20 to 26 pairs of teeth, and a dorsal fin that is short and thick. The sperm whale typically has a dark gray body with white along the lips, belly, and sides (NMFS, 2010b). This species was federally listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970).

Globally, the sperm whale occurs in any deep waters where ice is not present (NMFS, 2010b). In California, this species is believed or known to occur along the coast of Mendocino County (USFWS, 2015z). This species inhabits and feeds in coastal waters as well as oceanic waters. Potential threats to the sperm whale include entanglement in fishing gear, reduced prey due to overfishing anthropogenic[105] noise, collisions with ships, and pollution (NMFS, 2010b).

Birds

Nine endangered and seven threatened species are federally listed for California, as summarized in Table 4.1.6-7, and eight species have designated critical habitat. The California clapper rail (*Rallus longirostris obsoletus*) can be found in central California. The California condor (*Gymnogyps californianus*), California least tern (*Sterna antillarum browni*), and Least Bell's vireo (*Vireo bellii pusillus*) can be found in central and southern California. The Coastal California gnatcatcher (*Polioptila californica*), Inyo California towhee (*Pipilo crissalis eremophilus*), light-footed clapper rail (*Rallus longirostris levipes*), Xantus's murrelet (*Synthliboramphus hypoleucus*) (candidate species), and Yuma clapper rail (*Rallus longirostris yumanensis*) can be found in the southern region of California. The marbled murrelet (*Brachyramphus marmoratus*), southwestern willow flycatcher (*Empidonax traillii extimus*), western snowy plover (*Charadrius alexandrinus nivosus*), and yellow-billed cuckoo (*Coccyzus americanus*) can be found throughout California. The northern spotted owl (*Strix occidentalis caurina*) can be found in northern California, while the short-tailed albatross (*Phoebastria albatrus*) can be found in both northern and central parts of the state. The San Clemente Loggerhead Shrike (*Lanius ludovicianus mearnsi*) and San Clemente Sage Sparrow (*Amphispiza belli clementeae*) can only be found on San Clemente Island off the coast of southern California. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in California is provided in Table 4.1.6-7.

[105] Anthropogenic: "Made by people or resulting from human activities. Usually used in the context of emissions that are produced as a result of human activities" (USEPA, 2016d).

Table 4.1.6-7: Federally Listed Bird Species of California

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
California Clapper Rail	*Rallus longirostris obsoletus*	E	No	Tidal and brackish marshes in central California.
California Condor	*Gymnogyps californianus*	E	Yes; the coastal mountains of California.	Large trees, snags, rocky outcrops, and cliffs in the central and southern regions of California.
California Least Tern	*Sterna antillarum browni*	E	No	Beaches in central and southern California.
Coastal California Gnatcatcher	*Polioptila californica*	T	Yes; habitat in San Diego, Orange, Riverside, San Bernardino, Los Angeles, and Ventura Counties.	Coastal sage scrub habitat in southern California.
Inyo California Towhee	*Pipilo crissalis eremophilus*	T	Yes; habitat in Inyo County.	Riparian habitats and adjacent upland habitats in Inyo and San Bernardino Counties in California.
Least Bell's Vireo	*Vireo bellii pusillus*	E	Yes; habitat in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego Counties.	Riparian woodlands in central and southern California.
Light-footed Clapper Rail	*Rallus longirostris levipes*	E	No	Coastal marshes and lagoons in southern California.
Marbled Murrelet	*Brachyramphus marmoratus*	T	Yes; habitat in Siskiyou, Del Norte, and Humboldt Counties.	Spends most of its time on the ocean, roosting and feeding, but moves inland to nest in old-growth forest stands. Found in 16 counties along the coast of California.
Northern Spotted Owl	*Strix occidentalis caurina*	T	Yes; 5 units of habitat in northern California.	Structurally complex older forests in the northern half of California.
San Clemente Loggerhead Shrike	*Lanius ludovicianus mearnsi*	E	No	Xeric woodland and scrub habitats on San Clemente Island in southern California.
San Clemente Sage Sparrow	*Amphispiza belli clementeae*	T	No	Xeric habitats in the northwestern region of San Clemente Island in southern California.
Short-tailed Albatross	*Phoebastria albatrus*	E	No	Marine habitats and coastal upwelling areas. Found in seven counties along the coast in northern and central California.
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E	Yes; habitat in Inyo, Kern, Los Angeles, Riverside, Santa Barbara, San Bernardino, San Diego, and Ventura Counties.	Dense, multistoried riparian vegetation. Found in 20 counties throughout California.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Western Snowy Plover	*Charadrius alexandrinus nivosus*	T	Yes, habitat in 15 counties throughout California.	Sparsely vegetated sandy beaches throughout California.
Yellow-billed Cuckoo	*Coccyzus americanus*	T	No	Riparian forested habitat dominated by cottonwood and willow trees. Found in 41 counties throughout California.
Yuma Clapper Rail	*Rallus longirostris yumanensis*	E	No	Along the edges of freshwater marshes, dominated by emergent wetland vegetation and overhead riparian vegetation. Found in four counties in southern California.

Sources: (CDFW, 2016a) (USFWS, 2016de)

[a] E = Endangered, T = Threatened

California Clapper Rail. The California clapper rail is a medium-sized marsh-dwelling bird, approximately 13 to 19 inches in length. This subspecies is olive-brown with a red-orange breast, white undertail, and white bars along its sides (USFWS, 2015aa). This subspecies also exhibits a decurved orange bill (USFWS, 2014b). The California clapper rail was federally listed as endangered in 1970 (35 FR 16047 16048, October 13, 1970).

Regionally, this subspecies is believed or known to occur in 16 counties in central California (USFWS, 2015aa). The majority of California clapper rail populations are found in marshes of the San Francisco Bay Estuary. The preferred habitat of this subspecies is tidal and brackish marshes where dense vegetation is present along the banks. Dense vegetation is important to this subspecies because it provides foraging habitat and cover (USFWS, 2014b).

Threats to the California clapper rail include habitat loss and degradation caused by urban and industrial development, the use of levees, wastewater discharges, invasive plants, and increased recreational activity (USFWS, 2014b).

California Condor. The California condor is a large, soaring, scavenging bird native to western North America. It is one of the largest flying birds in the world, weighing 17-24 pounds and having a wingspan of up to 9.5 feet. It is almost entirely black except for white lining under its wings and a bald head that is red-orange (USFWS, 2013c). This species nests in caves or crevices along cliffs and will roost in large trees, snags, rocky outcrops, and cliffs. For foraging, this species utilizes grasslands and savanna foothills (USFWS, 2015ab).

The species was first listed as endangered under early endangered species legislation in 1967 (32 FR 4001, March 11, 1967) (USFWS, 2015ab) and then incorporated into the ESA in 1973 (16 U.S.C. § 1531 et seq.). The species was afforded critical habitat as early as the 1930's and periodically thereafter through 1985 (40 FR 58308 58312; January 12, 1975) in the coastal mountains of California. Experimental populations were reintroduced into the Grand Canyon (Arizona) in 1992 and afforded different protection status (USFWS, 2015ab). In California, this species is believed or known to occur in 15 counties in the central and southern parts of the state (USFWS, 2015ac).

Primary threats to this species include lead poisoning, "micro-trash," and habitat modification. California condors are scavengers and will feed on carcasses that have been shot with lead bullets. Ingesting meat that contains fragments of lead bullets results in lead poisoning and ultimately death if the condor does not receive medical treatment (USFWS, 2015ad). Additionally, California condors will occasionally scavenge small items of trash which they then regurgitate and feed to their young. Young birds have trouble passing this trash and it can lead to a blockage in the gastrointestinal track that prevents them from digesting any other food (USFWS, 2015ad).

California Least Tern. The California least tern is a subspecies of least tern (*Sterna antillarum*) that is native to California and Baja California, with small numbers in Arizona (USFWS, 2015ae) (USFWS, 2006a). It is a small seabird with grey coloration above, white undersides, a dark cap, orange/yellow beak, and a distinctive forked tail (USFWS, 2015ae) (USFWS, 2006a). The California subspecies was first listed as endangered under early endangered species legislation in 1970 (35 FR 6069, April 14, 1970) and then incorporated into the ESA in 1973 with no critical habitat (USFWS, 2015ae). In California, it is found in 18 counties in central and southern parts of the state, primarily along the coast (USFWS, 2015ae).

The California least tern's breeding range is found from near San Francisco to Baja California (USFWS, 2006a). The species typically nest in colonies of around 25 pairs on open beaches within tidal zone that are clear of vegetation. Adults forage in the ocean near shore or in lagoons, usually within several miles of their nesting colony (USFWS, 2015af). The subspecies was listed as federally threatened in 19 93 (53 FR 16742 16757, March 30, 1993) and critical habitat was designated in 2000 and revised in 2007 (USFWS, 2010g) (USFWS, 2015af).

It occurs primarily in coastal sage scrub habitat and adjacent scrub vegetation types. Studies of habitat preferences in San Diego County indicate that California sagebrush (*Artemisia californica*) and flat-topped buckwheat (*Eriogonum fasciculatum*) are the primary plants used by gnatcatchers when foraging for insects (USFWS, 2007a). Territory size requirements vary with habitat quality and distance from the coast. Documented home ranges were between 2 to 39 acres. The majority documented localities for the species are below 984 feet elevation (USFWS, 2007a).

The range of the species is closely tied to the distribution of coastal sage scrub in the Pacific coastal areas from Ventura and San Bernardino Counties in California, south to northwestern Baja California, Mexico, and including Los Angeles, San Diego, Riverside, and Orange Counties (USFWS, 2015af). The primary threats to the species are loss and degradation of coastal sage scrub habitat and habitat fragmentation (USFWS, 2010g).

Inyo California Towhee. The Inyo California towhee is a medium-sized grey-brown passerine, approximately 7 to 10 inches long (USFWS, 1998e) (USFWS, 2015ag). This subspecies was federally listed as threatened in 1987 (52 FR 28787 28788, August 3, 1987), but in 2013 was proposed for delisting (78 FR 65938 65953, November 8, 2013). In California, this subspecies is only believed or known to occur in Inyo and San Bernardino Counties (USFWS, 2015ag). Critical habitat was designated in Inyo County for the Inyo California towhee in 1987 (52 FR 28780 28786, August 3, 1987).

The Inyo California towhee is typically found in riparian habitats and adjacent uplands in the southern Argus Mountains in the Mojave Desert. This subspecies utilizes dense riparian vegetation as nesting habitat and protection from predators and heat. The adjacent upland habitats are used for foraging. Potential threats to this subspecies include habitat loss and degradation due to grazing, recreational activities, mining activities, and water diversion. (USFWS, 2013d)

Least Bell's Vireo. The Least Bell's vireo is a small bird that has light grey-brown plumage and measures approximately 4 to 5 inches in length. This subspecies exhibits rounded wings, a short and straight bill, and a light white ring around each eye (USFWS, 2015ah). The Least Bell's vireo was federally listed as endangered in 1986 (51 FR 16474 16482, May 2, 1986). In 1994, critical habitat was designated for this subspecies in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego Counties (59 FR 4845 4867, February 2, 1994).

Regionally, this subspecies is believed or known to occur in 20 counties in central and southern California (USFWS, 2015ah). Populations are primarily concentrated in San Diego County and Riverside County in southern California (USFWS, 2006b). This subspecies inhabits riparian woodlands and prefers early successional habitats. The primary threats to this subspecies include habitat loss, habitat degradation, and brood parasitism[106] by brown-headed cowbirds (*Molothrus ater*) (USFWS, 1998f).

Light-footed Clapper Rail. The light-footed clapper rail is a medium-sized marsh-dwelling bird that is approximately 14 inches long. This subspecies has a streaked grayish-brown back, a red-orange breast, and has gray and white bars along its sides. This subspecies also exhibits a curved bill and an upturned tail (USFWS, 2015ai). The light-footed clapper rail was federally listed as endangered in 1970 (35 FR 16047 16048, October 13, 1970).

Regionally, the light-footed clapper rail is believed or known to occur in five counties in southern California. This subspecies can be found in the San Diego Bay NWR, Seal Beach NWR, and Tijuana Slough NWR (USFWS, 2015ai). This subspecies can typically be found in coastal marshes and lagoons. The light-footed clapper rail uses shallow water and mudflats as foraging habitat and uses nearby vegetation as cover and nesting habitat. Threats to this subspecies include habitat loss and degradation due to siltation and contamination (USFWS, 2009c).

Marbled Murrelet. The marbled murrelet is a small, chubby seabird with a short neck. In breeding season, its upperparts are dark brown to blackish in color, with a mottled white belly and throat. In winter, its upperparts become gray, dark marks appear on the sides of its breast, and a white ring forms around its eye (USFWS, 2015r). The marbled murrelet was federally listed as threatened in 1992 (57 FR 45328 45337, October 1, 1992). Critical habitat for this species was designated in 2011 (76 FR 61599 61621, October 5, 2011) in Washington, Oregon, and California (USFWS, 2011e). Critical habitat in California includes habitat in Siskiyou, Del

[106] Brood parasitism is a "reproductive strategy of laying their eggs in the nests of other species, leaving the "host" to raise the cowbird young, generally at the expense of the host's own young" (USFWS, 1998f).

Norte, and Humboldt Counties (USFWS, 2011e). In California, the marbled murrelet is believed or known to occur in 16 counties along the coast (USFWS, 2015r).

The marbled murrelet is a small seabird that feeds primarily on fish and invertebrates in near-shore marine waters. It spends most of its time on the ocean, roosting, and feeding, but moves inland to nest in old-growth forest stands. Nesting habitat is characterized by large trees with large branches or deformities for use as nest platforms. Larger, unfragmented stands of old-growth appear to be the highest quality habitat for marbled murrelet nesting. The primary threats to the marbled murrelet are habitat loss (primarily from logging), bycatch in gill net fisheries, and oil spills (USFWS, 2011e).

Northern Spotted Owl. The northern spotted owl is a medium-sized dark brown owl with light colored spots on its head and breast (USFWS, 2015ak). The owl was federally listed as threatened in 1990 (55 FR 26114 26194, June 26, 1990). Critical habitat was designated in 2012 (77 FR 71875 72068, December 4, 2012) in California, Oregon and Washington including areas west and east of the Cascades (USFWS, 2012c). In California, it can be found in 18 counties in the northern half of the state (USFWS, 2015ak).

The Northern Spotted Owl inhabits structurally complex older forests because they contain the required features for nesting, roosting, and foraging. Northern spotted owls are highly territorial and maintain large home ranges. They primarily prey on small mammals. Threats to this species include habitat loss which has occurred as a result of forest conversion, timber harvest, fires, and insect infestation and from the competition from the barred owl (USFWS, 2012c).

San Clemente Loggerhead Shrike. The San Clemente loggerhead shrike is a medium-sized passerine with a black, white, and gray plumage (USFWS, 2015al). This subspecies has a "tooth" at the end of its bill that allows it to prey on insects, small reptiles, small mammals, and occasionally small birds (USFWS, 2009d). The San Clemente loggerhead shrike was federally listed as endangered in 1977 (42 FR 40682 40685, September 12, 1977).

In California, this subspecies is only known to occur in Los Angeles County (USFWS, 2015al). This subspecies is a non-migratory bird that is endemic to San Clemente Island. This subspecies can be found in xeric woodland and scrub habitats throughout the island. The San Clement loggerhead shrike utilizes shrubs and trees for nesting and perching (primarily *Prunus spp.* and *Rhus spp*.). The primary threat to this subspecies is predation from feral cats, black rats, raptors and foxes (USFWS, 2009d).

San Clemente Sage Sparrow. The San Clemente sage sparrow is a small-sized passerine with a dark gray, brown, and white plumage. This subspecies exhibits white and black stripes along the sides of the face (malar stripes) and white rings around the eyes (USFWS, 2009e). The San Clemente sage sparrow was federally listed as threatened in 1977 (42 FR 40682 40685, September 12, 1977).

In California, this subspecies is only known to occur in Los Angeles County (USFWS, 2015am). This subspecies is a non-migratory bird that is endemic to San Clemente Island. This subspecies can be found in xeric habitats in the northwestern region of the island. Preferred habitat for this species is maritime desert scrub habitat where California boxthorn (*Lycium californicum*) is also

present. The San Clemente sage sparrow builds nests in spiny vegetation approximately 10 inches above the ground. The primary threat to this subspecies is predation by invasive wildlife (black rats and feral cats) and native wildlife (foxes and larger birds) (USFWS, 2009e).

Short-tailed Albatross. The short-tailed albatross is a large pelagic bird with long wings. It has a large hooked pink bill with a black border around the base. The short-tailed albatross is distinguished by its all white back (USFWS, 2000c) (USFWS, 2015an). The short-tailed albatross was federally listed as endangered in 2000 (65 FR 46643 46654, July 31, 2000). The species uses the marine habitat along the coast for foraging. In California, this species is believed or known to occur in seven counties along the coast in the northern and central parts of the state (USFWS, 2015an).

Short-tailed Albatross nest in isolated off shore islands that have flat or sloped ground and sparse or full ground vegetation. Females lay one egg per breeding season. They feed in marine waters off fish, squid, and crustaceans in areas coastal upwelling. Threats to the short-tailed Albatross include loss of nesting habitat, pollution, and incidental loss due to off-shore fishing (USFWS, 2000c).

Southwestern Willow Flycatcher. The southwestern willow flycatcher is a subspecies of the willow flycatcher (*Empidonax traillii*) that is native to the southwestern U.S. and northern Mexico. It is a small grey-brown bird with a relatively large bill, white throat, and a yellowish belly. It is typically six inches in length (including tail) and is characterized by its sharp whistling call. The southwestern willow flycatcher was federally listed as endangered in 1995 (60 FR 10695 10715, February 27, 1995) and afforded critical habitat in 2013 (78 FR 343 534 January 3, 2013). In California, critical habitat was designated in Inyo, Kern, Los Angeles, Riverside, Santa Barbara, San Bernardino, San Diego, and Ventura Counties. (USFWS, 2014c) (USFWS, 2015ao)

In California, this subspecies is believed or known to occur in 20 counties (USFWS, 2015ao). The southwestern willow flycatcher breeds in riparian communities associated with rivers, lakes, swamps and other wetlands. The subspecies prefers dense, multistoried riparian vegetation and is typically associated with willow (*Salix spp*.) and/or tamarisk (*Tamarix spp*.) (USFWS, 2015ao).

Threats to subspecies are primarily based on changes in riparian vegetation from damming of rivers and streams, livestock grazing, the establishment of invasive non-native plants and insects, a modified fire regime, and climate change. Other threats include parasitism from brown-headed cowbirds (*Molothrus ater*), disease, and habitat fragmentation (USFWS, 2002b) (USFWS, 2014c).

Western Snowy Plover. The western snowy plover is a small shorebird, approximately six inches long. It has a thin, dark bill, white forehead and eyebrow line, with black patches above the forehead and behind the eye. Its upper parts are pale brown to gray in color, its belly is white or buff colored, and it has darker patches on its shoulders and head. Its dark gray to black colored legs distinguish the western snowy plover from other plovers (USFWS, 2014d). The subspecies was listed as federally threatened in 1993 (58 FR 12864 12874, March 5, 1993) and

critical habitat was federally designated in 2012 (77 FR 36727 36869, June 19, 2012). In California, critical habitat was designated in San Diego, Orange, Los Angeles, Ventura, Santa Barbara, San Luis Obispo, Monterey, Santa Cruz, San Mateo, Alameda, Napa, Marin, Mendocino, Humboldt, and Del Norte Counties (77 FR 36727 36869, June 19, 2012) (USFWS, 2014d).

In California, the western snowy plover is believed or known to occur in 30 counties throughout the state (USFWS, 2015ap). The Pacific coast population breeds on coastal beaches from southern Washington down to southern Baja California, Mexico (USFWS, 2014d). Its breeding and nesting habitat is above the high tide line on coastal beaches, sand spits, dune-backed beaches, sparingly vegetated dunes, beaches at the mouths of creeks and rivers, and salt pans at lagoons and estuaries. Nesting habitat occurs throughout its range, but could be separated by expanses of rocky shoreline (USFWS, 2015ap).

The main threats to the western snowy plover are its poor reproductive success due to human disturbance, predation, and inclement weather, as well as the introduction of nonnative plants and urban development. Human disturbances to nesting sites, like "walking, jogging, running pets, horseback riding, and vehicle use," are big reasons for the decline in breeding sites and western snowy plover populations, resulting in abandonment of nest sites and reductions in nesting density and success (USFWS, 2014d).

Yellow-billed Cuckoo (Western). The western yellow-billed cuckoo is a relatively large, long, and slim-bodied bird. The thick, down curved bill is mostly yellow in color and almost as long as the head. It has a flat head, thin body, and long tail, with pointed swept back wings when in flight. It is warm brown in color above, and a clean whitish color below. It has a blackish face mask with a yellow ring around its eye (USFWS, 2015ar). This shy migrant bird winters in South America and breeds in the western U.S. The western yellow-billed cuckoo is considered a separate population from its eastern counterpart (USFWS, 2014e) (USFWS, 2015ar). Currently, the western yellow-billed cuckoo is only known to breed in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming (USFWS, 2015ar) (Johnson, 2009). This species was federally listed as threatened in 2014 (79 FR 67154 67155, November 12, 2014). The western population occurs from the West coast to the Midwest, as well as some portions of the South and Pacific Northwest (USFWS, 2015ar). In California, it can be found in 41 counties throughout the state (USFWS, 2015ar).

Yellow-billed cuckoo Photo Credit: USFWS

Preferred habitat consists of riparian forested habitat dominated by cottonwood and willow trees, and in particular large contiguous riparian habitat for their nests. This species does not tend to breed in forested areas with minimal canopy cover and invasive species. Loss of suitable forested habitat along streams and rivers due to "residential development, ground-water pumping, agriculture, flood control," and invasion of nonnative plants are considered the primary threats to this species (Johnson, 2009) (USFWS, 2014e).

Yuma Clapper Rail. The Yuma clapper rail is a subspecies of the clapper rail (*Rallus longirostris*) that is native to the lower Colorado River watershed in the southwestern U.S. and northwestern Mexico. It is a small, brown water-bird with a grey head and a dark grey upper mandible that fades to orange. The side of the neck and underneath the head are brown and orange. Standing males are on average 8 inches tall and weigh 270 grams (USFWS, 2010h). The Yuma subspecies was first listed as endangered by the USFWS on the Endangered Species List of 1967 (32 FR 4001, March 11, 1967*)* and was later incorporated into the Endangered Species Act of 1973. No critical habitat has been designated for the Yuma clapper rail (USFWS, 2015as). In California, this species is believed or known to occur in four counties in the southern region of the state (USFWS, 2015as).

The historic distribution to the Yuma clapper rail is unknown, but it likely was well distributed throughout the lower Colorado River watershed. The subspecies currently has a spotty distribution throughout the watershed. The Yuma clapper rail is typically found along the edges of freshwater marshes, dominated by emergent wetland vegetation and overhead riparian vegetation. Ideal marsh vegetation for the subspecies is over six feet in height. Damming of the Colorado River and its tributaries has severely altered the vegetation regime along the riverbanks; this large-scale habitat alteration was likely the greatest cause of the Yuma clapper rail's population decline. Current threats to the species include continued destruction or alteration of habitat, environmental contaminants, habitat fragmentation, and climate change (USFWS, 2010h).

Fish

Twenty-one fish species are federally listed as threatened and endangered in California as summarized in Table 4.1.6-8. One species, the Longfin Smelt *(Spirinchus thaleichthys)*, is listed as a candidate species. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in California is provided below.

Table 4.1.6-8: Federally Listed Fish Species of California

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Bonytail Chub	*Gila elegans*	E	Yes, Colorado River in lower basin of Colorado River System	River channels and flooded, ponded, or inundated river eddies and pools. Found in two counties is southern California.
Chinook Salmon	*Oncorhynchus tshawytscha*	T	Yes, Sacramento River and coastal California	Freshwater rivers for spawning and young, juveniles found in estuaries, non-spawning adults found in ocean. Found in Mendocino County.
Coho Salmon	*Oncorhynchus kisutch*	E	Yes, the Central California Coast ESU in all rivers between Punta Gorda and the San Lorenzo River in California.	Freshwater rivers for spawning and young, remainder spent in estuaries and oceans. Found in two counties in northern California.
Colorado Pikeminnow	*Ptychocheilus lucius*	E	No	Pools, deep runs, and eddies maintained by high spring flows. Found in San Bernardino County.
Delta Smelt	*Hypomesus transpacificus*	T	Yes; in Suisun Bay, Montezuma Slough, and waters in Delta in California.	Smelt inhabit estuarine waters and move into freshwater to spawn. Found in 47 counties throughout California.
Desert Pupfish	*Cyprinodon macularius*	E	Yes; in San Felipe Creek, Carrizo Wash, and Fish Creek Wash, Imperial County.	Springs, marshes, streams, and shallow portions of rivers and lakes, all within arid desert settings. Found in two counties in southern California.
Green Sturgeon	*Acipenser medirostris*	T	No	Coastal waters and estuaries in 24 counties in northern and central California.
Lahontan Cutthroat Trout	*Oncorhynchus clarkii henshawi*	T	No	Lakes and streams throughout the Lohantan Basin. Found in 12 counties central California.
Little Kern Golden Trout	*Oncorhynchus aguabonita whitei*	T	Yes; in the Little Kern River above the barrier falls, one mile below the confluence with	Found only in Little Kern River tributaries in Tulare County.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
			Trout Meadows Creek.	
Lost River Sucker	*Deltistes luxatus*	E	Yes; lakes and reservoirs in Modoc County.	Inhabits the deeper water of lakes and spawns in springs or tributary streams upstream of its home lake. Found in five counties in northern California.
Mohave Tui Chub	*Gila bicolor ssp. mohavensis*	E	No	Deep pools and sloughs in Kern and San Barnardino Counties.
Owens Pupfish	*Cyprinodon radiosus*	E	No	Found only in refuges at Fish Slough, BLM Spring, and Warm Springs.
Owens Tui Chub	*Gila bicolor ssp. snyderi*	E	Yes; in Hot Creek in Mono County.	Slow-moving water were submerged vegetation, rocks, and undercut banks are present. Found in three counties in central California.
Paiute Cutthroat Trout	*Oncorhynchus clarkii seleniris*	T	No	Cool, well oxygenated waters with undercut banks and abundant vegetation. Found in six counties in central California.
Razorback Sucker	*Xyrauchen texanus*	E	Yes; in San Bernardino, Riverside, and Imperial Counties.	Deep runs, eddies, backwaters, and pools. Found in three counties in southern California.
Santa Ana Sucker	*Catostomus santaanae*	T	Yes; in San Bernardino, Riverside, and Orange Counties.	Smaller rivers and creeks, typically in shallow water that can be fast moving or slow. Found in five counties in southern California.
Shortnose Sucker	*Chasmistes brevirostris*	E	Yes; in Klamath and Lake Counties, Oregon, and Modoc County.	Shallow, cloudy, productive lakes that are cool in the summer, have enough dissolved oxygen, and are somewhat alkaline. Found in five counties in northern California.
Steelhead	*Oncorhynchus mykiss*	E/T	Yes; in San Francisco Bat, San Pablo Bay, Suisun Bay.	Freshwater streams and ocean habitat. Found in three counties in northern and southern California.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Tidewater Goby	*Eucyclogobius newberryi*	E	Yes; in 15 counties in California.	Shallow coastal waters with low salt content, and clean, relatively coarse sandy bottoms. Found in 20 counties throughout California.
Unarmored Threespine Stickleback	*Gasterosteus aculeatus williamsoni*	E	No	Slow-moving streams with relatively adequate aquatic vegetation. Found in four counties in southern California.
Warner Sucker	*Catostomus warnerensis*	T	No	Streams with aquatic vegetation, deep pools, and protective cover from vegetation or overhanging banks, and lakes with uniform depths and mud bottoms. Found in Modoc County.

Sources: (CDFW, 2016a) (USFWS, 2016de)

[a] E = Endangered, T = Threatened

Bonytail Chub. The bonytail chub is an extremely rare, long lived fish, once prevalent in the Colorado River basin. The species has a streamlined body and concave skull, growing over two feet in length (USFWS, 2002c). The species was federally listed as endangered in 1980, *(*45 FR 27710 27713, April 23, 1980*)* and in California has critical habitat designated in the Colorado River *(*59 FR 13374 13400, March 21, 1994). In California, it is found in Inyo and San Bernardino Counties, (USFWS, 2015at). The bonytail chub is the rarest native fish in the Colorado River Basin and has been observed infrequently in the last decades. Historically, the fish's range was widespread and abundant throughout the Colorado River Basin in the warmer waters from Mexico to Wyoming. Today, few populations are known to exist in the upper Colorado and Green Rivers, and Lake Mohave (USFWS, 2002c).

Though little is known about this rare fish, it is speculated that spawning occurs in eddies during June and July, and that habitats required for conservation include, river channels, and flooded, ponded, or inundated river eddies and pools. Threats to the species include changes to water temperatures, flow rates, and sedimentation. Since 1905, in the lower Colorado River Basin, there have been more than 14 dams which impede migration, decrease the variability of the genepool, and introduce non-native competition from other species. Additional threats include pesticides and pollutants, disease and predation. (USFWS, 2002c)

Chinook Salmon. *(Coastal California and Sacramento River Evolutionarily Significant Units).* The Chinook salmon is the largest of the Pacific salmon, averaging 40 pounds and 3 feet when full grown. When at sea, it is blue-green in color on its back, with silver sides. It can be distinguished from the similar looking coho salmon by its larger size, small black spots on the tail, and black coloration along the base of the teeth. They spend approximately 3 to 24 months in freshwater as juveniles, before migrating to estuarine habitats as smolts, and then to the ocean

to feed and mature for approximately 2 to 4 years, before returning to the freshwater streams and rivers where they were born, where they mate and then die. Chinook prefer deeper and larger streams than other Pacific salmon. Adult female Chinook nest in stream areas that have suitable gravel type, water depth, and current. Chinook spawning areas have larger gravel and more water flow than other Pacific salmon spawning areas. In the U.S., this species occurs from the Bering Strait off of Alaska, south to Southern California (NOAA, 2015d).

Species of Chinook are divided into ESUs. Nine Chinook ESUs are listed for protection under the ESA, two of which are located in California: the Sacramento River winter-run (where the species is considered endangered) (55 FR 49623, November 30, 1990) and California Coastal ESU (where the species is considered threatened), with critical habitat in both ESUs. (USFWS, 2015au). Current threats to this species include human induced changes to habitats caused by poor forestry practices, dams, water diversions, and pollution (NOAA, 2015d).

Coho Salmon *(Central California Coast and Southern Oregon – Northern California Coast Evolutionarily Significant Units).* The coho salmon, also called silver salmon, can grow more than 2 feet in length and, on average, weigh approximately 8 pounds. According to NOAA, it has a "dark metallic blue or greenish colored back with silver sides and a light belly and there are small black spots on the back and upper lobe of the tail while in the ocean. The gumline in the lower jaw has lighter pigment than does the Chinook salmon" (NOAA, 2015e). When spawning in inland rivers, coho salmon turn dark in color with reddish-maroon sides. Usually at around three years old, adults migrate from the ocean into the freshwater streams and rivers where they were born in order to mate; they spawn once and then die. Some males known as "jacks" spawn when they are two years old. When spawning, males develop a hooked snout and large teeth. Coho salmon spend approximately the first half of their lives in freshwater streams and small tributaries rearing and feeding. The spawning habitat consists of small streams with substrates of stable gravel where females can make nests. The rest of their lives are spent foraging in the estuarine and marine waters of the Pacific Ocean. (NOAA, 2015e)

This species historically ranged throughout the North Pacific Ocean, from central California to Point Hope Alaska. Coho salmon's current range North American range is in the North Pacific Ocean and tributary drainages, with the southernmost stream that contains coho salmon is Aptos Creek in Santa Cruz County, California (CDFW, 2016c). In northern California, the Coho salmon is known or believed to occur in Mendocino County and Siskiyou Counties (USFWS, 2016dl). The Central California Coast ESU was federally listed as endangered in 1996 (50 CFR 224.101, November 20, 1996) and the Southern Oregon – Northern California Coast ESU was federally listed as threatened in 1997 (50 CFR 223.102, June 18, 1997). Critical habitat was designated in 1999 (64 FR 24049, May 5, 1999) for the Central California Coast ESU in all rivers between Punta Gorda and the San Lorenzo River in California, and for the Southern Oregon – Northern California Coast ESU in all rivers between the Mattole River in California and the Elk River in Oregon (NOAA, 1999). Threats to the Coho salmon include human and natural factors including habitat degradation (including hydropower development), genetic and ecological effects from hatchery production, and losses from harvest and predation (NOAA, 2014c).

Colorado Pikeminnow. The Colorado pikeminnow, or also known as the Colorado squawfish, is the largest American minnow, reaching up to 6 feet in length and weighing up to 80 pounds. The speckled, greenish fish has an elongated body, long slender head, and teeth occurring in its throat and gills (USFWS, 2014f). The pikeminnow was listed as endangered in 1967 (32 FR 4001, March 11, 1967) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.). In 1994, the species was designated with critical habitat (59 FR 13374 13400, March 21, 1994) (USFWS, 2015av).

Historically, the species was endemic throughout the Colorado River Basin, though today, populations occur only in portions of the Green River, upper Colorado River and a small numbers of individuals in the San Juan River. The Colorado pikeminnow migrate long distances, swimming hundreds of miles to and from spawning areas. Species habitat requirements include "pools, deep runs, and eddy habitats maintained by high spring flows. Threats to the species include streamflow regulation, habitat modification, competition with and predation by nonnative fish species, and pesticides and pollutants." (USFWS, 2002d)

Delta Smelt. The delta smelt is a small, slender fish endemic to the upper Sacramento-San Joaquin estuary in California. The species is nearly translucent with a blue sheen; they have large eyes and small mouths with small, pointed teeth. Delta smelt inhabit estuarine waters and move into freshwater to spawn (USFWS, 1996a). The delta smelt was federally listed as threatened in 1993 (58 FR 12854 12864, March 5, 1993) with critical habitat in Suisun Bay; Goodyear, Suisun, Cutoff, First Mallard, and Montezuma Slough; and the Delta designated in 1994 *(*59 FR 65256 65279, December 19, 1994*).*

This species is known or believed to occur in 47 California counties (USFWS, 2015aw). Within the Sacramento-San Joaquin estuary, Delta smelt inhabit estuarine waters and move into freshwater to spawn. Spawning occurs in the sloughs and shallow waters in the upper portions of the San Joaquin and Sacramento River systems (USFWS, 1996a).

Delta smelt populations are threatened by habitat degradation (via reductions in freshwater outflows from the upper river systems, high outflows during unusually wet years, and pollution) entrainment in water diversions, changes in food organism populations, and hybridization Japanese pond smelt (USFWS, 1996a).

Desert Pupfish. The desert pupfish is a small, silver- or blue- colored fish endemic to the southwestern U.S. and northwestern Mexico. Adults grow to approximately two inches in length. Males have an iridescent blue coloration with yellow tails, while females and juveniles are silver in color. Both males and females have dark vertical stripes on their sides. The species was federally listed as endangered in 1986 (51 FR 10842 10851; March 31, 1986) with critical habitat established in Quitobaquito Springs, Pima County, Arizona and San Felipe Creek, Carrizo Wash, and Fish Creek Wash, Imperial County. In southern California, it is found in two counties (USFWS, 2015ax).

The desert pupfish was historically abundant in the waterways of southern Arizona, southeastern California, and northwestern Mexico. Natural populations of the species within the U.S. are now limited to Quitobaquito Springs (Arizona) and several small tributaries of the Salton Sea

(California). The species' natural habitat is varied and includes springs, marshes, streams, and shallow portions of rivers and lakes, all within arid desert settings. The desert pupfish is a hardy species and can withstand habitats with high temperatures, high levels of salinity, and low dissolved oxygen. Primary threats to the species include habitat loss, habitat alteration, pollution, and competition or predation from non-native species. (USFWS, 1993a)

Green Sturgeon. The green sturgeon (*Acipenser medirostris*) is a widely distributed species found in nearshore waters from Baja California to Canada that is anadromous and ocean-dwelling for a considerable portion of their life, more than any other sturgeon species. According to the USFWS, "Green Sturgeon are among the largest and longest living species found in freshwater, living up to 70 years and weighing up to 350 pounds. They resemble some sort of prehistoric creature, possessing a skeleton that is more cartilage than bone and rows of bony plates for protection rather than scales. Green Sturgeon are olive green in color and have a vacuum cleaner-like mouth that is used to siphon food" (USFWS, 2015fe). The NMFS has identified two green sturgeon DPSs ─ a northern DPS consisting of populations spawning from the Eel River, northward, and a southern DPS consisting of coastal and Central Valley populations south of the Eel River, with only one known spawning population, in the Sacramento River (Adams, Grimes, Hightower, Lindley, & Moser, 2002). The southern DPS of green sturgeon was listed as federally threatened in 2006 (71 FR 17757 17766, April 7, 2006); the northern DPS is not currently listed. NMFS designated critical habitat for the southern DPS in 2009 (74 FR 52300 52351, October 9, 2009), including the Sacramento River, Lower Feather River, Lower Yuba River, Sacramento-San Joaquin Delta, San Francisco Bay, San Pablo Bay, Suisun Bay, and Humboldt Bay, in California (NOAA, 2009). The principal factor in the decline of the southern DPS is the reduction of spawning habitat to a limited section of the Sacramento River. The potential for catastrophic events to affect such a limited spawning area increases the risk of the green sturgeon's extirpation.

Green sturgeon congregate in coastal waters and estuaries. The estuarine distribution and seasonality of the species is largely unknown, but green sturgeon are known to enter estuaries in the Pacific Northwest during summer, when estuarine water temperatures are warmer than adjacent coastal waters (Moser & Lindley, 2007). Green sturgeon begin to enter the Columbia River at the end of spring, with their numbers increasing through June. The greatest numbers are caught in the estuary in July through September. One study determined that approximately 80 percent of green sturgeon occurring in the Columbia River Estuary during late-summer and early fall months were of southern DPS origin (Israel & May, 2007).

Lahontan Cutthroat Trout. The Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*) is a subspecies of cutthroat trout (*Oncorhynchus clarkii*), endemic to the Lahontan Basin of northern Nevada, eastern California, and southern Oregon. The Lahontan cutthroat trout was federally listed as endangered in 1970 (35 FR 13519 13520, August 25, 1970) and was later incorporated in to the ESA of 1973 (USFWS, 2015ay) and downlisted to threatened in 1975 (40 FR 29863 29864). The Lahontan Basin is an isolated watershed which has lent to the subspecies diverging genetically from other cutthroat trout in the western U.S. It is a medium- to large-sized fish, with potential to grow four feet long in lake habitats. It is brown to olive green in color with a lighter underside, a reddish lateral stripe, and red coloration around its gills. The Lahontan subspecies is

distinguished from other cutthroat trout by dark spots on the top of its head (USFWS, 1995a). The listing was amended in 1975 to allow for legal sport fishing of the subspecies (40 FR 29863 29864, July 16, 1975). No critical habitat has been designated (USFWS, 2015ay).

The Lohantan cutthroat trout inhabits lakes and streams throughout the Lohantan Basin. The subspecies is an obligate river spawner, with lake populations spawning in tributary streams. Preferred spawning habitats are slow-moving pools with stable banks, vegetative cover, and rocky substrate. As of the most recent recovery plan, the Lohantan cutthroat trout occurs in between 155 and 160 streams and 6 lakes. The subspecies has been reintroduced beyond its historic range for the purpose of sport fishing. While historically widespread throughout their range, the subspecies began to decline in the mid-1800s with the introduction of non-native salmanoids, commercial fishing of lakes within the Lohantan Basin, and alteration of waterways for agriculture. Current threats include livestock grazing, overdevelopment, habitat alteration, pollution, hybridization, and competition with non-native species (USFWS, 1995a).

Little Kern Golden Trout. The Little Kern golden trout, a subspecies of rainbow trout, are brightly colored with red to red-orange bellies and cheeks, green backs, and golden sides. They have orange and white tipped fins and are distinguished from other rainbow trout subspecies by their unique spots and parr marks[107] (USFWS, 2011f). In 1978, the Little Kern golden trout was federally listed as threatened and critical habitat was designated in the Little Kern River (main channel and all tributaries) above the barrier falls, one mile below the confluence with Trout Meadows Creek in the same Federal Register Notice (43 FR 15427 15429, April 13, 1978).

The Little Kern golden trout is found only in Little Kern River tributaries in Tulare County. The upper Little Kern River system is a high gradient system of bedrock canyons; alluvial sections are found in the lower portions of this system. Historically, the species was found over 99.4 miles of the Little Kern and its tributaries. The main threat to this species has been hybridization with rainbow trout; however, habitat degradation and competition with non-native fish have also contributed to the decline of this species (USFWS, 2011f).

Lost River Sucker. The Lost River sucker, locally known as mullet, is a large, long-lived fish that can live for up to 43 years. It can grow up to approximately 3.3 feet in length and weigh up to approximately 10 pounds. It has dark brown to black colored backs and brassy sides that fade to yellow or white on the belly (USFWS, 2015ca) (USFWS, 2007b). "It has unique triangular-shaped gill structures which are used to strain a diet of detritus (decomposing organic matter), zooplankton (tiny floating aquatic animals), algae, and aquatic insects from the water" (USFWS, 2015ca). Adults migrate from lakes into fast moving streams to spawn, usually starting at around nine years of age. They migrate at night and stay in the shallow areas of shorelines and in aquatic vegetation during daytime (USFWS, 2015ca).

Historically, the Lost River sucker was widespread and abundant in the upper Klamath Basin of Oregon and California. Now, it is found in only a fraction of its former range and occurs in a few areas in the Upper Klamath Basin, such as the drainages of Upper Klamath Lake, Tule Lake, and Clear Lake (USFWS, 2015ca). The Lost River sucker was federally listed as endangered in

[107] Parr marks: "One of the dark traverse bands on the side of a young salmon." (Merriam Webster Dictionary, 2016c)

1988 (53 FR 27130 27134, July 18, 1988). Regionally, it is now found in California and Oregon. In California, it can be found in five counties (USFWS, 2015ba). Critical habitat was designated in 2012 (77 FR 73739 73768, December 11, 2012) in approximately 146 miles of streams and 117,848 acres of lakes and reservoirs in Klamath and Lake Counties, Oregon, and Modoc County, California (USFWS, 2012e).

The Lost River sucker inhabits the deeper water of lakes and spawns in springs or tributary streams upstream of its home lake. It prefers areas with gravel or cobble bottoms in springs or in moderate to fast-flowing springs for spawning. The streams used for spawning also have a shallow shoreline with plenty of aquatic vegetation to that provides cover for the young migrating larvae (USFWS, 2015ca). Threats to the Lost River sucker include poor water quality, reduced suitable habitat, and the impacts of nonnative fishes (USFWS, 2015ca).

Mohave Tui Chub. The Mohave Tui chub is the only native species of fish in California's Mohave River basin. This chub species grow to 2.1 to 3.6 inches long and have large heads, short fins, and a thick bodies. Coloring ranges from bright brassy-brown to dusky olive with fine gold specks and silver-blue undersides. Males and females appear similar and the shield shaped scales are one feature that distinguishes this species from other tui chubs (USFWS, 1984b). The Mohave Tui chub was listed as endangered in 1970 (October 13, 1970, 35 FR 16047 16048).

This species is known or believed to occur only in Kern and San Bernardino Counties (USFWS, 2016q). In the Mohave River basin, this chub species are found in deep pools and sloughs and are well-adapted to the Mohave's alkaline and hard water. Historically, introduced species have been the primary threat to Mohave chub. Other threats include habitat degradation, pollution, and water diversions (USFWS, 1984b).

Owens Pupfish. Male Owens pupfish are bright blue and females are dusky, olive green. The species grows to 2.4 inches (6 cm) and is deep-bodied.[108] This species prefers warm waters with plentiful food. The Owens pupfish was listed as endangered in 1967 (March 11, 1967, 32 FR 4001). Critical habitat for this species has not been designated (USFWS, 1998g).

In California, the Owens pupfish is known or believed to occur only in Inyo and Mono Counties (USFWS, 2015bb). Currently, Owens pupfish are found only in refuges at Fish Slough, BLM Spring, and Warm Springs. Owens pupfish display little habitat preference, though adults tend to occupy deeper water more frequently than juveniles. Threats to this species include competition from and predation by nonnative fish species and water diversions that altered the Owens River. (USFWS, 1998g)

Owens Tui Chub. Owens tui chub range from 0.6 to 7.0 inches in total body length. Their heads are golden and their bodies are dusky-olive above with blue and gold sides (USFWS, 2009f). The Owens tui chub was federally listed as endangered in 1985 (50 FR 31592 31597,

[108] Deep-bodied: Deep-bodied fish are laterally flattened (compressiform) fish, with a body depth usually at least one-third that of the standard length (distance from snout to structural base of caudal fin). The dorsal and anal fins are typically long, and the pectoral fins are located high on the body, with the pelvic fins immediately below. The mouth is usually small and protrusible, the eyes large, and the snout short. (Moyle & Cech, 2004)

August 5, 1985). Critical habitat was designated at the time of listing for this subspecies in Hot Creek in Mono County (50 FR 31592 31597, August 5, 1985).

Regionally, the Owens tui chub is believed or known to occur in three counties in central California (USFWS, 2015bc). The Owens tui chub is endemic to the Owens Basin. This fish is typically found in slow-moving water where submerged vegetation, rocks, and undercut banks are present. Major threats to this subspecies include habitat loss and destruction due to dams, groundwater pumps, canals, and non-native plants. Other threats include hybridization with Lahontan tui chub and competition with native and non-native fish (USFWS, 2009f).

Paiute Cutthroat Trout. The Paiute cutthroat trout is coppery to pinkish-purple in color and has little to no spots on its body. The coloration and lack of spots make the Paiute cutthroat trout easy to distinguish from other cutthroat trout subspecies (USFWS, 2004b). This subspecies was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967) and later downlisted to threatened in 1975 (40 FR 29863 29864, July 16, 1975).

Regionally, the Paiute cutthroat trout is believed or known to occur in six counties in central California (USFWS, 2015bd). The Paiute cutthroat trout requires cool, well oxygenated waters, and adults are commonly found in areas with undercut banks and abundant vegetation. This subspecies prefers stream pool habitats. This subspecies utilizes pools during the winter months when water is lower. Pools also act as important habitat for juveniles (USFWS, 2013e).

The primary threat Paiute cutthroat trout are non-native salmonid species. Through competition non-native trout species have reduced the amount of habitat available to the Paiute cutthroat trout. Hybridization with non-native species is also a threat to the survival of this subspecies. Other threats include grazing practices, recreational fishing, and climate change (USFWS, 2013e).

Razorback Sucker. The razorback sucker (*Xyrauchen texanus*) is a long, slender fish growing to 39 inches and weighing up to 12 pounds. The species is marked with dark head and dorsal fins with a yellowish white underbelly and fins (USFWS, 2014f). The razorback sucker was federally listed as endangered in 1991 (56 FR 54957 54967, October 23, 1991) and was given designated critical habitat in 1994 (59 FR 13374 13400, March 21, 1994). In California, this species can be found in Imperial, Riverside, and San Bernardino Counties (USFWS, 2015be).

Razorback sucker Photo credit: USFWS

Historically, the razorback sucker was widely distributed in warm-water reaches of larger rivers of the Colorado River Basin from Mexico to Wyoming. Habitats include features such as “deep runs, eddies, backwaters, and flooded environments in spring; runs and pools often in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools, and eddies in winter. Spawning in rivers occurs over bars of cobble, gravel, and sand substrates during

spring runoff at widely ranging flows and water temperatures" (USFWS, 2002e). Threats to the species include changes in streamflow, habitat, and introduction of competitive or predatory non-native fish species, and pesticides and pollutants (USFWS, 2014f).

Santa Ana Sucker. Santa Ana sucker (*Catostomus santaanae*) is a freshwater fish endemic to southern Calfifornia, known from only a few river systems. Adults are typically 6 inches long, but can grow to over 9 inches. They are dark gray above and light colored below, with a speckling of gray and black scales or a faint pattern. Distinct notches where the upper and lower lips meet are characteristic of the species (USFWS, 2000d).

Santa Ana sucker was federally listed as threatened in 2000 (65 FR 19686, May 12, 2000) (USFWS, 2000d) and 9,331 acres of critical habitat was designated San Bernardino, Riverside, Los Angeles, and Orange Counties in 2010 (75 FR 77962, January 13, 2011) (USFWS, 2010i). Santa Ana sucker inhabits smaller rivers and creeks, typically in shallow moving water. They are most often found in cool (below 70°F), clear water, though they can tolerate periods of seasonal turbidity. They feed mostly on algae, scraping material from hard surfaces (USFWS, 2000d) (USFWS, 2010i).

The historical range of the species included the Los Angeles River basin, the San Gabriel River basin, and the Santa Ana River basin, including areas of Los Angeles, Orange, Riverside, and San Bernardino Counties. It is now believed to be restricted to three widely separated populations: Lower Big Tujunga Creek, The East, West, and North forks of the San Gabriel River, and the lower and middle Santa Ana River, all in Los Angeles County. A fourth population, thought to be introduced, is documented in the Santa Clara River in Ventura County. (USFWS, 2010i).

The species is threatened by habitat and degradation, predation by exotic species, and water quality issues. Santa Ana sucker's historical range largely corresponds the extent of the metropolitan area of Los Angeles, where much of its habitat has been channelized, dammed, or degraded by development. The species has likewise been affected by degradation of water quality from urban runoff, wastewater discharge, agricultural and golf course runoff, and sedimentation from streamside construction. Introduced aquatic predators, particularly game fish, are thought to be responsible for the extirpation of several populations and continue to prey on the species. There is concern that the remaining small, isolated populations may also be vulnerable to the effects of genetic isolation and random events such as wildfire related ash or sediment flows that can quickly eliminate the population of a reach of creek without an adjoining population to repopulate the area (USFWS, 2000d).

Shortnose Sucker. The shortnose sucker is distinguished by its large head and its mouth that is situated at the very end of its head, with thin but fleshy lips. It can grow to approximately 20 inches, and can live up to 33 years. It is dark on its back and sides, and silvery or white on its belly (USFWS, 2007c). The shortnose sucker was federally listed as endangered in 1988 (53 FR 27130 27134, July 18, 1988). Regionally, this species is found in California and Oregon, in Upper Klamath Lake and its tributaries, the Lost River, Clear Lake, and the Klamath River and its reservoirs. Within northern California, it can be found in five counties (USFWS, 2007c) (USFWS, 2015bf).

Critical habitat was designated in 2012 (77 FR 73739 73768, December 11, 2012) in approximately 136 miles of streams and 123,590 acres of lakes and reservoirs in Klamath and Lake Counties, Oregon, and Modoc County, California (USFWS, 2012e). The shortnose sucker prefers shallow, cloudy, productive lakes that are cool in the summer, have enough dissolved oxygen, and are somewhat alkaline. They spawn in the larger tributaries of inhabited lakes, in riffles or runs over gravel or cobble substrates, and moderate current. The main threat to the shortnose sucker is habitat degradation due to reduced water quality. Another threat could be hybridization with other species (USFWS, 2007c).

Steelhead Trout. *(Central California Coast, Northern California, South-Central California Coast, and Southern California Distinct Population Segments).* Steelhead trout (*Oncorhynchus mykiss*) are a part of the taxonomic family Salmonidae. They are typically dark-olive in color with shading to silvery-white on the underside (NOAA, 2015f). Steelhead then return to the rivers of their birth to spawn. Steelhead do not necessarily die after spawning and are able to spawn more than once (USFWS, 2015bg). Species of Steelhead are divided in to Distinct Population Segments (DPSs). Eleven Steelhead DPSs are listed for protection under the ESA, three of which are located in California including the Central California Coast, Northern California, and Southern California. As of 2005, Steelhead Trout have been designated stream channels and lakes as critical habitat in California, Idaho, Oregon, and Washington (USFWS, 2015bg).

Steelhead trout can handle a wide range of water temperatures. Spawning habitat consists of gravel substrates that are free of excessive silts. Current threats to this species include human induced changes to habitats caused by poor forestry practices, dams, water diversions, and pollution (NOAA, 2015f).

Tidewater Goby. Tidewater goby (*Eucyclogobius newberryi*) is a small fish of coastal lagoons and estuaries, with adults reaching less than two inches in length. Adults are grey to brown in color with large pectoral (side) fins and pelvic fins (at the rear of the underside) fused into a sucker-like structure. Males are more transparent and females have a darker pattern (USFWS, 1994b).

The species was federally listed as endangered in 1994 (59 FR 5494 5499, February 4, 1994) (USFWS, 1994b), and critical habitat was designated in 2000 (65 FR 69693 69717, November 20, 2000) with the most recent revisions in 2013 (78 FR 8745 8819, February 6, 2013) (USFWS, 2013f). A petition to reclassify the species from federally endangered to threatened by the USFWS was accepted in 2014 and is currently under review (USFWS, 2014g).

Habitat for the species includes shallow coastal waters with low salt content, and clean, relatively coarse sandy bottoms of for digging breeding burrows. These conditions typically occur at larger stream and river mouths where estuaries form and sand is deposited as sediment. They are most often found in the upper reaches of the lagoons with water depths of less than 3.3 feet, where the salt content is less than half that of seawater (USFWS, 2007d). They can breed in salinity levels between 2 and 27 parts per thousand (ppt) (seawater is typically 28 ppt) but generally prefer lower end of the salinity range in the fresher water. They prefer relatively calm areas without strong currents. However, Tidewater gobies have survived a salinity tolerance

tests in hypersaline water (45 to 54 ppt) for 6 months, with no mortality. (USFWS, 2007e) (USFWS, 2013f).

The species is known from the coastline of California from Del Norte County at the mouth of the Smith River near the Oregon state border south to Cockleburr Lagoon in San Diego County, where river mouths and estuaries are present. The historical range extended south to Agua Hedionda Lagoon in San Diego County (USFWS, 2007e).

The potential habitat of the species is naturally limited by their preference for the freshwater-saltwater interface, restricting them to freshwater sources along the shoreline such a rivers, creeks, and bays. The populations are naturally fragmented by coastal topography, but also artificially fragmented within bays and estuaries by human development. It is estimated the fish has been extirpated from 17 percent of its original 134 localities along the California coast and that up to half of the remaining locations are too small or degraded to sustain the species in the long term (USFWS, 2007d). The species is believed to be especially sensitive to population fragmentation because it lacks the marine dwelling life phase of many other coastal fish, restricting its ability to disperse between population centers and recolonize areas after what would otherwise be temporary extirpation events (USFWS, 2013f). Other threats include predation and competition by introduced species, channelization and marina construction, and water diversion (USFWS, 2007e).

Unarmored Threespine Stickleback. Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) is a small freshwater fish endemic to a few creeks in California. Adults reach lengths of 2 inches and are scaleless with bony plates and are patterned green-brown above and silver below. Males develop a bright red coloration during the breeding season. The unarmored threespine stickleback is a subspecies of the more widespread threespine stickleback (USFWS, 2009g). Unarmored threespine stickleback was listed as federally endangered in 1970 (35 FR 16047 16048) (USFWS, 2015bh) (USFWS, 1970) and critical habitat proposed in 1980, but a decision not to designate critical habitat for the species was published in 2002 (67 FR 58580 58582) (USFWS, 2002f). A recovery plan was published in 1985 (USFWS, 1985b).

The threespine stickleback, as a species, are anadromous, meaning that they breed in freshwater streams but may return to the sea as they disperse from the breeding areas and spend time in the marine environment. The unarmored subspecies, however, is thought to spend their entire lives in fresh-water and inhabit slow-moving streams with relatively dense aquatic vegetation or algae for shade and cover and build a hollow nest of plant material within densely vegetated areas (USFWS, 1985b) (USFWS, 2009g).

Threespine stickleback as a species is widely distributed across the Northern Hemisphere, with the federally endangered unarmored threespine stickleback subspecies *williamsoni* presently restricted to three drainage systems in Southern California, including the counties of Los Angeles, San Bernardino, San Diego, Santa Barbara. They are currently documented in the upper Santa Clara River system in Los Angeles County, San Antonio Creek on Vandenberg Air Force Base, and the Shay Creek area of San Bernardino County. In other areas, the subspecies has been replaced or has hybridized with other introduced subspecies. It has been artificially transplanted into a number of other creeks but the efforts have failed. The status of transplanted

population introduced into San Felipe Creek in San Diego County is unknown (USFWS, 2009g) (USFWS, 2015bh).

Threats to the threespine unarmored stickleback include loss of habitat through stream alteration, streamside development, changes in flow regimes, and competition and predation by introduced species. Water impoundments and dams, stream channelization, and changes in water quality have been identified as factors impacting the species. The introduction of exotic species such as bullfrogs, African clawed frog, crayfish, various gamefish such as sunfish, bass, and catfish, and aquarium species have led to predation on sticklebacks or competition for food and shelter. Habitat fragmentation and dilution of the subspecies genetic makeup through hybridization with other introduced subspecies have likely also led to its decline (USFWS, 2009g).

Warner Sucker. The Warner sucker is a long, slender fish that is dark brown or tan in color with a creamy white underbelly. Males have a prominent red stripe across their bodies during spawning season. The species reaches a maximum of 18 inches (USFWS, 1998h). It was federally listed as threatened and designated critical habitat in 1985 (50 FR 39117 39123, September 27, 1984) (USFWS, 2015bi). Regionally, this species is found in California, Nevada, and Oregon. In California, the Warner sucker is believed or known to occur in Modoc County (USFWS, 2015bi).

With adequate conditions, the Warner sucker is able to inhabit all natural waterbodies within the Warner Basin. Habitats include streams with aquatic vegetation, deep pools, and protective cover from vegetation or overhanging banks, and lakes with uniform depths and mud bottoms for foraging. The species feeds on a variety of invertebrates, algae, and organic plant material found on the bottoms of lakes and streams. Primary threats to the species include habitat alteration, introduction of predatory or competitive non-native fish species, and water pollution. (USFWS, 1998h)

Amphibians

Nine amphibian species are federally listed for California as summarized in Table 4.1.6-11. The Arroyo toad (*Anaxyrus californicus*) and desert slender salamander (*Batrachoseps aridus*) can be found in southern California. The California red-legged frog (*Rana draytonii*) can be found throughout California, while the Oregon spotted frog (*Rana pretiosa*) can only be found in the north region of the state. The California tiger salamander (*Ambystoma californiense*) can be found in central and southern California, while the Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) can only be found in central California. The mountain yellow-legged frog (*Rana muscosa*) can be found in northern and southern California, while the Sierra Nevada yellow-legged frog (*Rana sierrae*) and Yosemite toad (*Anaxyrus canorus*) can be found in eastern California (USFWS, 2016a). Four listed species have designated critical habitat. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in California is provided below.

Table 4.1.6-9: Federally Listed Amphibian Species of California

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Arroyo Toad	*Anaxyrus californicus*	E	Yes; along the larger waterways of Santa Barbara, Ventura, Los Angeles, Riverside, San Bernardino, Orange, and San Diego Counties.	Sections of streams with braided channels and clean, course sandy or gravely substrate and surrounding upland habitat. Found in 8 counties in southern California.
California Red-legged Frog	*Rana draytonii*	T	Yes; units in 27 counties throughout the state.	Clean, slow-flowing streams and pools with adequate streamside vegetation. Found 50 counties throughout California.
California Tiger Salamander	*Ambystoma californiense*	E/T	Yes; in northern Santa Barbara County, Sonoma County, and 20 counties in central California.	Inhabit small burrows and breed in seasonal ponds and vernal pools. Found in 34 counties in central and southern California.
Desert Slender Salamander	*Batrachoseps aridus*	E	No	Burrows, limestone crevices, bed-rock fractures, and porous soils. Found in Riverside County.
Mountain Yellow-legged Frog	*Rana muscosa*	E	Yes; in Los Angeles, San Bernardino, and Riverside Counties.	Mountain streams, ponds, lakes, and shorelines. Found in 6 counties in northern and southern California.
Oregon Spotted Frog	*Rana pretiosa*	T	No	Wetlands associated with lakes, ponds, or slow moving streams. Found in Siskiyou County in northern California.
Santa Cruz Long-toed Salamander	*Ambystoma macrodactylum croceum*	E	No	Inhabits burrows, areas beneath woody debris, and root systems within upland scrub and woodland habitats. Migrates to nearby ponds in breeding season. Found in 2 counties in central California.
Sierra Nevada Yellow-legged Frog	*Rana sierrae*	E	No; Critical Habitat was proposed in 2013 for Plumas, Butte, Lassen, Sierra,	Streams, lakes, ponds, and meadow wetlands at high elevations in the Sierra Nevada mountain range. Found in 19

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
			Placer, Alpine, Tuolumne, Calaveras, Amador, El Dorado, Mono, Mariposa, Fresno, Inyo, and Madera Counties	counties in the eastern region of California.
Yosemite Toad	*Anaxyrus canorus*	T	No; Critical Habitat was proposed in 2013 for Alpine, Tulumne, Mono, Mariposa, Madera, Fresno, and Inyo, Counties.	Wet meadow habitats and adjacent upland habitats. Found in 11 counties in the east-central region of California.

Sources: (CDFW, 2016a) (USFWS, 2016de).

[a] E = Endangered, T = Threatened

Arroyo Toad. The Arroyo toad *(*formerly arroyo southwestern toad *[Bufo microscaphus californicus])* grows to 2 to 3 inches and varies in color from light gray to light brown with brown mottling. The anterior (front) surface of the protruding parotid glands[109] behind the eyes and sacral humps[110] on the back are light colored, and the toads are light colored below. A white, V-shaped mark is present on the top of the head between the eyes. Young tadpoles are inky black, becoming mottled brown-green as they grow (USFWS, 1994c) (USFWS, 1999b). Arroyo toad was federally listed as endangered in 1994 (USFWS, 1994c). Critical habitat was designated for the species in 2005 (USFWS, 2005b) with a final revision published in 2011 (USFWS, 2011g). Critical habitat for the species includes 98,366 acres of habitat in 23 units, primarily along the larger waterways of Santa Barbara, Ventura, Los Angeles, Riverside, San Bernardino, Orange, and San Diego Counties (USFWS, 2011g). A proposal to reclassify the species as federally threatened was withdrawn in 2015 (USFWS, 2015bj). The Arroyo toad is known or believed to occur in eight counties in California: Los Angeles, Monterey, Orange, Riverside, San Bernardino, San Diego, Santa Barbara, and Ventura (USFWS, 2016dh).

The Arroyo toad is adapted for breeding in the shallow backwaters of the floodplains of larger streams and rivers. Eggs are typically laid in shallow, still pools that remain after floodwaters of the rainy season subside. Breeding takes place is sections of streams with braided channels and clean, course sandy or gravely substrate. Young emerge and mature partly burrowed in the moist sand of stream banks. Adults are primarily terrestrial, spending the dry season burrowed into the upper stream terraces or surrounding upland habitat, and returning to the breeding pools and stream areas for breeding and foraging during the wet season. Upland habitat includes open vegetation associations such as coastal sage scrub, open grasslands, or other open habitats. The

[109] Parotid Gland: Salivary gland (Merriam Webster Dictionary, 2016d).

[110] Sacral Hump: In toads, a Sacral hump is formed from the rigid pelvic girdle (USEPA, 2015w).

USFWS considers habitat to be potentially occupied by adults for up to one kilometer from breeding pools, limited primarily by dense ground cover of vegetation or topography that limits movement (USFWS, 1994c) (USFWS, 1999b) (USFWS, 2015bj).

The historical range of the species included the larger streams and rivers coastal areas of California from the upper Salinas River system in Monterey County south into San Diego County, and into Baja California, Mexico. The current distribution includes spotty occurrences within this range (USFWS, 2015bj). Threats to the species have been identified as loss of habitat due to water projects, urbanization, and other human development; degradation of breeding habitat including water quality degradation associated with prospecting, mining, urban runoff, and off-road vehicular activities; alterations in hydrological functions of rivers associated with dams/water projects, live stream discharges and other factors that alter seasonal flows; and the introduction of nonnative predators such as game fish, bullfrog, African clawed frog, mosquitofish, and crayfish (USFWS, 1994c) (USFWS, 1999b) (USFWS, 2015bj).

California Red-legged Frog. California red-legged frog (*Rana draytonii*) is a medium-sized ranid (true) frog species endemic to southern California and Baja California, Mexico. "The California Red-legged Frog is the largest native frog in the western United States" according to the revised critical habitat plan (USFWS, 2010j). Adult frogs can reach nearly 5.4 inches and range in color from light brown to reddish brown with dark spots on the back. The hind legs can be pink to reddish and dorsolateral folds (ridges along the sides of the back) are present. Tadpoles can grow to 3.3 inches and are brown to olive with gold flecks (USFWS, 1996b).

The California red-legged frog was originally listed as a subspecies of red-legged frog (*Rana aurora draytonii)* as federally threatened in 1996 and was later upgraded to full species status (*Rana draytonii*) which is now adopted by the USFWS (USFWS, 2010j). Critical habitat for the species was designated in 2001, with a final, revised designation published in 2010 after multiple intermediate exclusions and revisions (USFWS, 2010j). A recovery plan was published in 2002 (USFWS, 2002g).

California red-legged frog inhabits clean, slow-flowing streams and pools with adequate streamside vegetation to provide shade and shelter. The frogs breed in the water but also forage and disperse through the adjacent streamside habitat. Because of the intermittent nature of the pools, it is often necessary that corridors of suitable dispersal habitat remain between pool locations to allow individuals to follow the water as certain pools empty during the dry season. Dispersal corridors[111] are also necessary for the long term survival of populations (USFWS, 2002g) (USFWS, 2010j).

The California red-legged frog occurs in 50 California counties, from the state border with Oregon south to Riverside County, which is east of Los Angeles. Critical habitat has been designated in Alameda, Butte, Calaveras, Contra Costa, El Dorado, Kern, Kings, Los Angeles, Marin, Mendocino, Merced, Monterey, Napa, Nevada, Placer, San Benito, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus, Ventura, and Yuba Counties (USFWS, 2010j) (USFWS, 2016g).

[111] Corridor: Dispersal route that permits the movement of many or most taxa from one region to another (USEPA, 2015w).

Threats to the species include loss and degradation of habitat through development, infrastructure projects water projects and diversions; predation and competition with exotic species, particularly American bullfrog (*Lithobates catesbeianus*), overgrazing by cattle, diseases, and mining (USFWS, 2016dq). It was estimated in 2002 that nearly 70 percent of its original habitat has been lost (USFWS, 2010j) (USFWS, 2016g).

California Tiger Salamander *(Santa Barbara County DPS, Sonoma County DPS, and Central CA DPS* California tiger Salamander (*Ambystoma californiense*) is a large, dark salamander with white to pale yellow spots or stripes on the upper surface and a white to pale underside. Adults average 7 to 8 inches long, with rounded snouts, stocky body, and small eyes (USFWS, 2015ff). This species is believed or known to occur in 35 counties in California (USFWS, 2015bk).

Three populations in California are federally listed as threatened or endangered. The Santa Barbara County population was federally listed as endangered in 2000 (65 FR 3096 3109, January 19, 2000). The Sonoma County population was federally listed as endangered in 2002 (67 FR 47726 47740, July 22, 2002), and the Central California DPS was federally listed as threatened in 2004 (69 FR 47212 47248, August 4, 2004). Critical habitat was designated for all three of these populations. In 2004, critical habitat was designated in northern Santa Barbara County for the Santa Barbara County population (69 FR 68568 68609, November 24, 2004). In 2005, critical habitat was designated in 20 counties in central California for the Central California DPS population (70 FR 49380 49458, August 23, 2005). In 2011, critical habitat was designated throughout Sonoma County (76 FR 54346 54372, August 31, 2011).

California tiger salamanders typically inhabit small burrows and breed in seasonal ponds and vernal pools. The primary threat to this species is habitat loss and degradation due to urban development and conversion to agricultural lands. Other threats to this species include competition with non-native species, predation, loss of suitable burrows through rodent control programs, disease, environmental contaminants, and viruses (USFWS, 2009h) (USFWS, 2014h) (USFWS, 2016h).

Desert Slender Salamander. The desert slender salamander (*Batrachoseps aridus*) typically measures less than 4 inches in length and exhibits grooves along its tail and body, a broad head, long legs, and a short tail (USFWS, 2014i) (USFWS, 2015bl). The upper body is "blackish maroon" with shiny flecks that are silvery-brass and golden-orange in color (USFWS, 1982a). This species can be distinguished by the coloration of its underside, which displays a dark colored belly and light colored tail (USFWS, 2014i). The desert slender salamander was federally listed as endangered in 1973 (38 FR 14678, June 4, 1973).

In California, this species in only known or believed to occur in Riverside County, California (USFWS, 2015bl). Populations of this species have been located in Hidden Palm Canyon and Guadalupe Canyon. The desert slender salamander is a subterranean species that can be found inhabiting burrows, limestone crevices, bed-rock fractures, and porous soils (USFWS, 2014i).

The primary threat to this species is habitat loss. Habitat loss within the Hidden Palm Canyon and Guadalupe Canyon can be caused by erosion, reduction of groundwater and surface water, fire, and climate change (USFWS, 2014i).

Mountain Yellow-legged Frog *(Northern California and Southern California Distinct Population Segments).* The mountain yellow-legged frog (*Rana muscosa*) is a medium-sized frog, approximately 1 to 3 inches in length, with females being slightly larger than males. Coloration of the upper body of this is typically brown mixed with yellow, gray, red, or greenish brown. The skin pattern of this species ranges from small numerous blotches to a few large patches, although "some individuals may be dark brown with little pattern" (USFWS, 2012g). The underside of this species is typically pale yellow or bright yellow (USFWS, 2012f). The mountain yellow-legged frog has longer legs than the Sierra Nevada yellow-legged frog.

The mountain yellow-legged frog has two DPS in California. The southern California DPS was federally listed as endangered in 2002 (67 FR 44382 44392, July 2, 2002). The northern California DPS was federally listed as 2014 (79 FR 24255 24310, June 30, 2014). In 2006, critical habitat for the southern California DPS of mountain yellow-legged frogs was designated in Los Angeles, San Bernardino, and Riverside Counties (71 FR 54344 54386, September 14, 2006).

The southern California DPS can be found in the San Gabriel, San Bernardino, and San Jacinto Mountains and is known or believe to occur in Inyo, Los Angeles, Riverside, San Bernadino, Tulare, and Ventura Counties in California (USFWS, 2016dr) (USFWS, 2012g). The northern California DPS can be found in the Sierra Nevada Mountains and is known or believed to occur in San Bernadino and Los Angeles National Forests in California (USFWS, 2013g). The mountain yellow-legged frog is highly aquatic and can be found inhabiting mountain streams, ponds, and lakes. Mountain yellow-legged frogs will also utilize shorelines as habitat but typically will not be found more than a few feet from the water. Primary threats to the southern California DPS include predation by non-native trout species, disease, genetic isolation (causing in-breeding), habitat degradation due to recreational activities, and habitat modification (USFWS, 2012g) (USFWS, 2013g).

Oregon Spotted Frog. The Oregon spotted frog (*Rana pretiosa*) is a "medium-sized frog, growing from 1.7 to 4.0 inches in body length, and is the most aquatic native frog in the Pacific Northwest. It gets its name from "the black spots that cover its head, back, sides, and legs." Juveniles are usually brown in color, but can sometimes be olive green in color on the back, and white or cream colored with reddish pigments under its legs and abdomen. Adults are brown to reddish brown in color, and become redder with age. "Red (coloring) increases on the abdomen with age, with under the legs becoming a vivid orange-red." This red coloring distinguishes the Oregon spotted frog from other native frogs (USFWS, 2014j). The Oregon spotted frog was federally listed as threatened in 2014 (79 FR 51657 51710, August 29, 2014). Regionally, this species can be found in Canada, California, Oregon, and Washington. In northern California, the Oregon spotted frog is believed or known to occur in Siskiyou County (USFWS, 2015bm).

This species inhabits emergent wetlands in or near perennial bodies of water such as springs, ponds, lakes, wetlands, slow-moving streams, irrigation canals, or roadside ditches. It needs areas of shallow water for eggs and tadpoles, and plentiful aquatic vegetation for basking and cover (USFWS, 2014k). Threats to the Oregon spotted frog include habitat loss due to changes in hydrology and water quality, development, and livestock overgrazing; invasion of nonnative

plants; "succession of plant communities from marsh to meadow" habitat; and the introduction of exotic predators such as bullfrogs and nonnative fishes (USFWS, 2014j).

Santa Cruz Long-toed Salamander. The Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) is a small salamander (four to six inches in length) with a grayish black body with orange to yellow markings along its back and blueish white flecks along its sides (USFWS, 2015bn) (USFWS, 2013h). The Santa Cruz long-toed salamander was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967).

The Santa Cruz long-toed salamander is known to occur in Santa Cruz and Monterey Counties (USFWS, 2015bn). This salamander is typically found in burrows, beneath woody debris, and in root systems within upland scrub and woodland habitat for most of the year. During breeding season these salamanders migrate to nearby ponds (USFWS, 2009i).

Primary threats to the Santa Cruz long-toed salamander include habitat loss, degradation, and fragmentation. These threats are caused by agricultural practices, road construction, and urban development. Other threats include chytrid fungus[112] (*Batrachochytrium dendrobatidis*) and predation by native and non-native species (USFWS, 2009i).

Sierra Nevada Yellow-legged Frog. The Sierra Nevada yellow-legged frog (*Rana sierrae*) is a medium-sized frog, approximately 1 to 3 inches in length, with females being slightly larger than males. Coloration of the upper body this species is typically brown mixed with yellow, gray, red, or greenish brown. The skin pattern of this species ranges from small numerous blotches to a few large patches. The underside of this species is typically pale yellow or bright yellow-orange. The Mountain yellow-legged frog has longer legs than the Sierra Nevada yellow-legged frog (USFWS, 2013g).

This species was federally listed as endangered in 2014 (79 FR 24255 24310, June 30, 2014). Historically, this species was known to occur in Nevada and California (USFWS, 2013g). Currently, this species is believed or known to occur in 19 counties in eastern California (USFWS, 2015bo). This species can be found in high elevations within streams, lakes, ponds, and meadow wetlands in the Sierra Nevada mountain range. The primary threat to Sierra Nevada yellow-legged frogs is predation by non-native species, primarily trout. Other threats include disease (specifically the chytrid fungus), predation by bullfrogs and introduced species (particularly trout), habitat modification, and climate change (USFWS, 2013g) (79 FR 24273 24724, April 29, 2014).

Yosemite Toad. The Yosemite toad (*Anaxyrus canorus*) is a medium-sized toad, approximately 1.2 to 2.8 inches in length, with females being larger and having more conspicuous warts than males. Females have grey, tan, or brown bodies with dark blotches outlined in white. Males typically lack blotches and have yellow-green, olive, or dark greenish-brown bodies (USFWS, 2013g). This species was federally listed as threatened in 2014 (79 FR 24255 24310, June 30, 2014).

[112] Chytrid fungus, or Bd, mostly affects the skin of amphibians, making it difficult for them to breathe and take up water through their skin (Amphibian Ark, 2016).

This species is believed or known to occur in 11 counties in the east-central region of California (USFWS, 2015bp). The Yosemite toad can be found in wet meadow habitats and adjacent upland habitats. This species prefers flat sites with low climate variation. The primary threats to the Yosemite toad include habitat loss and degradation, livestock grazing, and climate change. Habitat loss has occurred in some areas due to meadow dewatering, heavy grazing, road construction, and timber harvest activities. Habitat degradation has occurred due to recreational activities and non-native species (USFWS, 2013g).

Reptiles

Three endangered and six threatened reptile species are federally listed for California as summarized in Table 4.1.6-10. The green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), and olive ridley sea turtle (*Lepidochelys olivacea*) can be found along the coast of California. The Alameda whipsnake (*Masticophis lateralis euryxanthus*) and San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) can be found in the west-central region of California. The blunt-nosed leopard lizard (*Gambelia silus*) can be found in central California. The Coachella Valley fringe-toed lizard (*Uma inornata*) and the desert tortoise (*Gopherus agassizii*) can be found in the southern region of the California. The giant garter snake (*Thamnophis gigas*) can be found throughout the state. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in California is provided below. (USFWS, 2016a)

Table 4.1.6-10: Federally Listed Reptile Species of California

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Terrestrial Reptiles				
Alameda Whipsnake	*Masticophis lateralis euryxanthus*	T	Yes; in Contra Costa, Alameda, San Joaquin, and Santa Clara Counties.	Scrub/shrub habitats and rocky habitats. Found in 10 counties in the west-central region of California.
Blunt-nosed Leopard Lizard	*Gambelia silus*	E	No	Sparsely vegetated habitats or open areas in San Joaquin Valley. Found in 15 counties in central California.
Coachella Valley Fringe-toed Lizard	*Uma inornata*	T	Yes; in the central region of Riverside County.	Windblown dune habitats in Coachella Valley. Found in Riverside County.
Desert Tortoise	*Gopherus agassizii*	T	Yes; in Los Angeles, San Bernardino, Imperial, and Riverside Counties.	Sandy flats, rocky foothills, or alluvial fans in Mojave Desert scrub plant communities. Found in 8 counties in southern California.
Giant Garter Snake	*Thamnophis gigas*	T	No	Marshes, sloughs, ponds, lakes, streams, rice fields, and canals. Found in 30 counties throughout California.
San Francisco Garter Snake	*Thamnophis sirtalis tetrataenia*	E	No	Ponds, lakes, marshes, and sloughs and their adjacent upland habitats. Found in 5 counties in the west-central region of California.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Sea Turtles				
Green Sea Turtle	*Chelonia mydas*	T	No	Shallow waters (except during migration) of shoals, bays, lagoons, reefs, and inlets, often where submerged aquatic vegetation exists. Rarely seen off the coast of California, increasing south of San Diego.
Leatherback Sea Turtle	*Dermochelys coriacea*	E	Yes; along the coast of California.	Open oceans but can also occur in coastal waters. Found off the coast of California.
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	T	No	Tropical and warm temperate ocean waters worldwide, spending most of its time in the open ocean. Found in 16 counties along the coast of California.

Sources: (CDFW, 2016a) (USFWS, 2016de)

[a] E = Endangered, T = Threatened

Terrestrial Reptiles

Alameda Whipsnake. The Alameda whipsnake (*Masticophis lateralis euryxanthus*) is a slender snake that grows to be approximately 3 to 4 feet long (USFWS, 2015bq). This species exhibits a broad head and large eyes (USFWS, 2011h). The Alameda whipsnake has a dark brownish black back with a yellow-orange stripe down each side. The underside of this species is pinkish at the rear, cream at the midsection, and orange to brownish red at the front (USFWS, 2015bq). This species was federally listed as threatened in 1997 (62 FR 64306 64320, December 5, 1997).

The Alameda whipsnake is believed or known to occur in 10 counties in west-central California (USFWS, 2015bq). This species is semi-arboreal, and splits its time within trees or shrubs, rock piles, or small burrows. The Alameda whipsnake is commonly found in scrub/shrub habitats and habitats largely covered by rocks (USFWS, 2011h). In 2000, critical habitat for this species was designated in Contra Costa, Alameda, San Joaquin, and Santa Clara Counties (65 FR 58933 58962, October 3, 2000). Threats to the Alameda whipsnake include habitat loss and degradation due to urban development, livestock grazing, and fire suppression activities (USFWS, 2011h).

Blunt-nosed Leopard Lizard. The blunt-nosed leopard lizard (*Gambelia silus*) is a medium-sized lizard, with males being slightly larger and heavier than females. Males are approximately 3.4 to 4.7 inches long (excluding tail), while females are approximately 3.4 to 4.4 inches long. The coloration of the upper body can range from yellowish brown to gray-brown to dark brown. Distinguishing features include a white underside and dark spots along the back that alternate with light colored bands (USFWS, 2015br). The blunt-nosed leopard lizard was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967).

Regionally, this species is believed or known to occur in 15 counties in the central California (USFWS, 2015br). This species is endemic to the San Joaquin Valley and commonly found inhabiting sparsely vegetated habitats or open areas along the valley floor. For cover, the blunt-nosed leopard lizard utilizes abandoned burrows or constructs shallow tunnels. Threats to this

species include habitat loss and degradation due to commercial, residential, and agricultural development, livestock grazing, off-road vehicle use, and pesticide use (USFWS, 2010k).

Coachella Valley Fringe-toed Lizard. The Coachella Valley fringe-toed lizard (*Uma inornata*) is a medium-sized lizard, approximately 6 to 9 inches long. This species has a sand-colored body with dark "eye-like" markings along the back (USFWS, 2010l). Distinguishing features include elongated scales on the hind feet and over the ears, a broad and pointed head, and internal nostrils (USFWS, 2015bs). This species was federally listed as threatened in 1980 (45 FR 63812 63820, September 25, 1980).

Regionally, the Coachella Valley fringe-toed lizard is believed or known to occur in Riverside County in southern California (USFWS, 2015bs). This species is endemic to the Coachella Valley and is restricted to windblown dune habitats on the floor of the valley. The Coachella Valley fringe-toed lizard prefers deeper dune habitats over flatter stretches of sand. This species spends most of the day burrowed beneath sand and is most active above ground in the early morning and late afternoon (USFWS, 2010l).

In 1980, critical habitat was designated in the central region of Riverside County (45 FR 63812 63820, September 25, 1980). Threats to the Coachella Valley fringe-toed lizard include habitat loss and degradation due to urban development, agricultural land conversion, non-native plant species, construction of windbreaks, groundwater pumping, and recreational activities (USFWS, 2010l).

Desert Tortoise. The desert tortoise has a domed shell with yellowish scute centers that have grooved, concentric rings. This species has round, stumpy hind legs and flattened front limbs for digging. The desert tortoise has a small, rounded head, small greenish-yellow eyes and a small tail. Mature adults typically weigh between 8 and 15 pounds and are approximately 4 to 6 inches in height (USFWS, 2014l). This species was federally listed as threatened in 1980 (45 FR 55654 55666, August 20, 1980). In 1994, critical habitat was designated for this species in Los Angeles, San Bernardino, Imperial, and Riverside Counties (59 FR 5820 5866, February 8, 1994).

Desert tortoise Photo Credit: USFWS

The desert tortoise occurs in Utah, Arizona, and California. Per the recovery plan, "The desert tortoise occurs in the Mojave and Sonoran deserts in southern California, southern Nevada, Arizona, and the southwestern tip of Utah in the United States, as well as in Sonora and northern Sinaloa in Mexico." (USFWS, 2011m) In southern California, this species is believed or known to occur in nine counties (USFWS, 2015bt). The desert tortoise spends the majority of its life underground and prefers to live in a variety of desert habitats that include sandy flats, rocky foothills, and alluvial fans where suitable soils for digging can be found. This species depends on bushes and shrubs for shade and protection from predators, such as coyotes. Primary threats to this species include habitat loss, degradation, and fragmentation (USFWS, 2014l).

Giant Garter Snake. The giant garter snake (*Thamnophis gigas*) is approximately 5.3 feet long (USFWS, 2012h). This species has a brownish olive back that exhibits a dark checkered pattern and yellow stripe. There are two light stripes along the sides of the body and the belly is cream, olive, or brown. Coloration and body markings will vary slightly based on geographic location (USFWS, 2015bu). This species was federally listed as threatened in 1993 (53 FR 54053 54066, October 20, 1993).

The giant garter snake is believed or known to occur in 30 counties throughout California (USFWS, 2015bu). This species is endemic to wetland habitats in Sacramento Valley and San Joaquin Valley. The giant garter snake is typically found inhabiting marshes, sloughs, ponds, lakes, streams, rice fields, and canals. Threats to this species include habitat loss and degradation due to urban development, changes to wetland hydrology, agricultural practices, and road mortalities (USFWS, 2012h).

San Francisco Garter Snake. The San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) is a slender snake, approximately 3 to 4 feet long (USFWS, 1985c) (USFWS, 2015bv). This snake has a dark orange head and greenish blue belly. Along the top of the back is a greenish stripe which is commonly bordered by black, then red, then black again on each side (USFWS, 2015bv). The San Francisco garter snake was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967).

The San Francisco garter snake is believed or known to occur in five counties in west-central California (USFWS, 2015bv). This snake is typically found near ponds, lakes, marshes, and sloughs and their adjacent upland habitats. Primary threats to the San Francisco garter snake include habitat loss and degradation due to residential development, commercial development, illegal collection, and competition from introduced species (specifically the California Bullfrog) (USFWS, 2016dn) (USFWS, 2006c).

Sea Turtles

Green Sea Turtle. The green sea turtle (*Chelonia mydas*) occurs throughout tropical and subtropical oceans and is among the largest of the hard-shelled sea turtles growing to as much as 440 pounds and 4 feet in length (USFWS, 2015bw) (NOAA, 2015g). The breeding populations in Florida were listed as endangered, whereas all other populations, including California, were listed as threatened in 1978 (43 FR 32800 32811, July 28, 1978). In the eastern North Pacific, they primarily occur south of San Diego and rarely extend northward. Per the Recovery Plan, they do not nest on the West Coast of the United States (NOAA, 1998b). In California, they are occasionally seen off the coast, increasing south of San Diego (USFWS, 2015bw).

Green sea turtles are found in the shallow waters (except during migration) of shoals, bays, lagoons, reefs, and inlets, often where submerged aquatic vegetation exists. They use three primary types of habitat: beaches for nesting, open ocean convergence zones, and coastal areas for bottom feeding. Hatchlings consume both plants and animals, while adult green sea turtles are herbivorous feeding on seagrasses and algae (NOAA, 2015g). Breeding takes places in subtropical to tropical oceans every 2 to 4 years between June and September, with peak nesting in June and July (NOAA, 2015g) (USFWS, 2015bw). Hatching usually occurs at night, and

many green sea turtle hatchlings seek refuge and food in masses of floating sea plants (USFWS, 2015bw). Current threats include disease, loss or degradation of nesting habitat, disorientation of hatchlings by lighting, nest predation, marine pollution, watercraft strikes, and incidental take from channel dredging and commercial fishing operations (NOAA, 2015g) (NOAA, 2015j).

Leatherback Sea Turtle. The leatherback sea turtle (*Dermochelys coriacea*) is the deepest-diving and most wide-ranging sea turtle found in all of the world's oceans. It is the largest of all sea turtles, reaching 4 to 8 feet long and weighing 500 to 2000 pounds (USFWS, 2015bx). The leatherback sea turtle was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970) and was incorporated into the ESA as an endangered species (16 U.S.C. § 1531 et seq.) (USFWS, 2015by). A broad range of water temperatures is tolerated by this species, which is notable as having the most extensive distribution of all reptiles (NOAA, 2015i). This species is known to occur in the Atlantic, Pacific, and Indian Oceans as well as in some locations as far away as Newfoundland and Argentina. In the eastern Pacific, leatherback sea turtles can be found as far north as Washington state, and as far south as Chile (USFWS, 2015by). Critical habitat was established in 2012 along the coast of California, Oregon and Washington (NMFS, 2012b).

The preferred habitat for this species includes open oceans, and occasionally coastal waters. The leatherback sea turtle diet consists of jellyfish, salps, and other soft-bodied animals (NOAA, 2015i). For reproduction the female leatherback sea turtles nest at 2 to 3 year intervals during the months of March to July. Creation of a nesting site occurs during the night, and each turtle will nest up to 11 nests per nesting season (USFWS, 2015bx). Current major threats to the species include harvesting of their eggs, hunting, incidental capture in fishing gear, and consumption of plastics that were mistaken for jellyfish (NOAA, 2015i).

Olive Ridley Sea Turtle. The olive ridley sea turtle (*Lepidochelys olivacea*) gets its name from its olive colored heart-shaped shell. It is one of the smallest sea turtles, reaching from 2 to 2.5 feet in length and weighing from 80 to 110 pounds. It can be identified by the high numbers of bony plates on the shell. The olive ridley sea turtle was federally listed as threatened in 1978 (43 FR 32800 32811, July 28, 1978) (USFWS, 2015cb).

In California, this species is believed or known to occur in 16 counties along the coast (USFWS, 2015cb). In the East Pacific, it nests on beaches from Mexico all the way down to Colombia, but during feeding migrations can travel up the U.S. Pacific coast as far north as Oregon (USFWS, 2015cc).

The olive ridley sea turtle inhabits tropical and warm temperate ocean waters worldwide, spending most of its time in the open ocean. This species annually migrates from foraging habitat in the open ocean, to coastal breeding and nesting grounds, back to open ocean foraging. Threats to the olive ridley sea turtle include collection of turtle eggs, incidental capture in fishing gear, and loss of nesting habitat (NOAA, 2014b).

Invertebrates

Twenty-seven endangered, six threatened, and one candidate invertebrate (Hermes copper butterfly, *Lycaena hermes*) species are federally listed for California as summarized in Table 4.1.6-11. Fifteen listed species have designated critical habitat. Information on the habitat,

distribution, and threats to the survival and recovery of each of these species in California is provided below.

Table 4.1.6-11: Federally Listed Invertebrate Species of California

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Bay Checkerspot Butterfly	*Euphydryas editha bayensis*	T	Yes; in San Mateo and Santa Clara Counties.	Grasslands with shallow soils that are nutrient poor and contain magnesium or other heavy metals. Found in 9 counties in central California.
Behren's Silverspot Butterfly	*Speyeria zerene behrensii*	E	No	Grassland habitats that occur on coastal terraces and dunes. Found in Mendocino County and Sonoma County in north-central California.
California Freshwater Shrimp	*Syncaris pacifica*	E	No	Freshwater streams with submerged aquatic vegetation, undercut banks with fine root material, and overhanging vegetation. Found in 8 counties in west-central California.
Callippe Silverspot Butterfly	*Speyeria callippe callippe*	E	No	Hilly grassland habitats that are influenced by coastal fog. Found in 8 counties in west-central California.
Carson Wandering Skipper	*Pseudocopaeodes eunus obscurus*	E	No	Lowland grassland habitats, less than 5,000 feet in elevation. Found in Lassen County and Plumas County in northern California.
Casey's June Beetle	*Dinacoma caseyi*	E	Yes; in Riverside County.	Desert wash and alluvial areas. Found in Riverside County.
Conservancy Fairy Shrimp	*Branchinecta conservatio*	E	Yes; units in 34 counties in California.	Large seasonal pools (called playa pools) that contain a lot of suspended matter. Found in 36 counties throughout California.
Delhi Sands Flower-loving Fly	*Rhaphiomidas terminatus abdominalis*	E	No	Fine sands of the Delhi series, with open habitat and nectaring sources available. Found in

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
				three counties in southern California.
Delta Green Ground Beetle	*Elaphrus viridis*	T	Yes; two areas in south-central Solano County.	Smaller vernal pools and larger playa pools occurring in a grassland matrix. Found in Solano County.
El Segundo Blue Butterfly	*Euphilotes battoides allyni*	E	No	El Segundo sand dunes in Los Angeles County.
Kern Primrose Sphinx Moth	*Euproserpinus euterpe*	T	No	Sandy washes in five counties of southern California.
Laguna Mountains Skipper	*Pyrgus ruralis lagunae*	E	Yes; in San Diego County.	Mountain meadow habitat where the host plant occurs. Found in San Diego County.
Lange's Metalmark Butterfly	*Apodemia mormo langei*	E	No	Patches of naked stemmed buckwheat in Antioch Dunes of Contra Costa County.
Longhorn Fairy Shrimp	*Branchinecta longiantenna*	E	Yes; units in 34 counties in California.	A variety of seasonally flooded pools. Found in three counties in west-central California.
Lotis Blue Butterfly	*Lycaeides argyrognomon lotis*	E	No	Believed to inhabit wet meadows and sphagnum bogs. Found in Mendocino County.
Mission Blue Butterfly	*Icaricia icarioides missionensis*	E	No	Coastal grassland habitats that experience natural disturbances. Found in four counties in west-central California.
Morro Shoulderband Snail	*Helminthoglypta walkeriana*	E	Yes; in San Luis Obispo.	Found in coastal dune habitats in San Luis Obispo County.
Mount Hermon June Beetle	*Polyphylla barbata*	E	No	Maritime coast range ponderosa pine forest, northern maritime chaparral, and northern maritime chaparral. Found in Santa Cruz County.
Myrtle's Silverspot Butterfly	*Speyeria zerene myrtleae*	E	No	Coastal dune, coastal scrub, and coastal prairie habitats. Found in six counties in west-central California.
Ohlone Tiger Beetle	*Cicindela ohlone*	E	No	Coastal terraces where patches of native grassland habitat are

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
				present. Found in Santa Cruz County.
Oregon Silverspot Butterfly	*Speyeria zerene hippolyta*	T	No	Three types of grasslands, including coastal terrace and headland "salt spray" meadows, coastal dune systems, and montane grasslands. Found in Del Norte County.
Palos Verdes Blue Butterfly	*Glaucopsyche lygdamus palosverdesensis*	E	Yes; three units on Palos Verdes Peninsula, Los Angeles County.	Disturbed areas within coastal sage scrub communities. Found on Palos Verdes Peninsula in Los Angeles County.
Quino Checkerspot Butterfly	*Euphydryas editha quino wrighti*	E	Yes; in San Diego and Riverside Counties.	Native grasslands, coastal sage scrub, chaparral, and vernal pool edges. Found in six counties in southern California.
Riverside Fairy Shrimp	*Streptocephalus woottoni*	E	Yes; in Ventura, Orange, and San Diego Counties.	Vernal pools and other temporary ponded areas, generally associated with clay or hardpan soils. Found in five counties in southern California.
San Bruno Elfin Butterfly	*Callophrys mossii bayensis*	E	No	Habitat is typically in the fog belt of the coastal Bay Area, where the larval host plant occurs. Found in 13 counties in central California.
San Diego Fairy Shrimp	*Branchinecta sandiegonensis*	E	Yes; in Orange and San Diego Counties.	Vernal pool complexes along the coastal slope of Orange and San Diego Counties in southern California.
Shasta Crayfish	*Pacifastacus fortis*	E	No	Clear spring-fed bodies of waters where large lava rocks are present. Found in six counties in northern California.
Smith's Blue Butterfly	*Euphilotes enoptes smithi*	E	No	Coastal dune systems, serpentine grasslands, and ancient beach deposits, in scrub and grassland habitats. Found in Monterey and Santa Cruz Counties in central California.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Valley Elderberry Longhorn Beetle	*Desmocerus californicus dimorphus*	T	Yes; in Sacramento County.	Moist valley oak woodlands with elderberry thickets in the understory, or other habitats with an elderberry component. Found in 26 counties throughout California.
Vernal Pool Fairy Shrimp	*Branchinecta lynchi*	T	Yes; units in 34 counties in California.	Grassy and mud bottomed pools and swales, rock pools in sandstone and basaltic flows, as well as alkaline pools. Found in 41 counties in California.
Vernal Pool Tadpole Shrimp	*Lepidurus packardi*	E	Yes; units in 34 counties in California.	Mud or grassy-bottomed vernal pools and swales. Found in 30 counties in California.
White Abalone	*Haliotis sorenseni*	E	No	Flat rock surfaces in areas with boulders on the sea floor. Found in four counties in west-central California.
Zayante Band-winged Grasshopper	*Trimerotropis infantilis*	E	Yes; in Santa Cruz County.	Maritime coast range ponderosa pine forest, northern maritime chaparral, and northern maritime chaparral. Found in Santa Cruz County.

Sources: (CDFW, 2016a) (USFWS, 2016de)

[a] E = Endangered, T = Threatened

Bay Checkerspot Butterfly. The Bay checkerspot butterfly is a member of the brush-foot butterfly family. This subspecies is medium in size with black banded forewings and bright red, yellow, and white spots (USFWS, 2009j). This subspecies is endemic to central California and believed or known to occur in nine counties (USFWS, 2015cd). It was federally listed as threatened in 1987 (52 FR 35366 35378, September 18, 1987).

This subspecies can be found grasslands with shallow soils that are nutrient poor and contain magnesium or other heavy metals. Host plants for this subspecies include the California plantain (*Plantago erecta*), purple owl's-clover (*Castilleja densiflora*), and exserted Indian paintbrush (*Castilleja exserta*). (USFWS, 2009j) In 2008, critical habitat was designated for the Bay checkerspot butterfly in San Mateo and Santa Clara Counties (73 FR 50406 50452, August 26, 2008).

Major threats to the Bay checkerspot butterfly include habitat loss and degradation due to non-native plants, development, grazing practices, collection, pesticide use, wildfires, and climate change. Other threats include pesticides, wildfire, and climate change (USFWS, 2009j).

Behren's Silverspot Butterfly. The Behren's silverspot butterfly is a medium-sized butterfly with a wingspan of approximately 2.2 inches. The top side of the wings are yellow-brown in color with black spots and lines. The underside of the wings are light brown, brown, or orange brown in color with silver and black spots and lines (USFWS, 2012i). This subspecies was federally listed as endangered in 1997 (62 FR 64306 64320, December 5, 1997).

In California, this subspecies is only believed or known to occur in Mendocino County and Sonoma County (USFWS, 2015ce). The Behren's silverspot butterfly can be found in grassland habitats that occur on coastal terraces and dunes. The larval host plant for this subspecies is the early blue violet (*Viola adunca*). Adult butterflies utilize thistles (*Cirsium* spp.), the false dandelion (*Hypochaeris radicata*), the gumplant (*Grindelia stricta*), and lupines (*Lupinus* spp.) for nectar (USFWS, 2012i).

Major threats to the Behren's silverspot butterfly include habitat loss and degradation due to increased development, collection, and fire suppression (USFWS, 2012i).

California Freshwater Shrimp. The California freshwater shrimp is a crustacean that is approximately 2 inches or less in total length. Males and juvenile females are typically translucent or transparent. Adult females are typically brown and exhibit a light brown dorsal stripe. (USFWS, 2011i) This species was federally listed as endangered in 1988 (53 FR 43884 43889, October 31, 1988).

Regionally, this species is believed or known to occur in eight counties in west-central California (USFWS, 2015cf). The California freshwater shrimp can be found in freshwater streams with submerged aquatic vegetation, undercut banks with fine root material, and overhanging vegetation. Threats to this species include habitat loss and degradation due to urban development, water pollution, agricultural practices, water diversion, siltation, and channelization (USFWS, 2011i).

Callippe Silverspot Butterfly. The Callippe silverspot butterfly is a medium-sized butterfly in the brush-foot family, with a wingspan of approximately 2.2 inches. The body of this butterfly is brown in color and densely covered in hair. The top side of the wings exhibit black spots and lines and are typically brown in color, getting darker at the base of the wing. The underside of the wings are light brown, brown, or orange brown in color with black spots and lines, as well as silver spots. (USFWS, 2009k) The Callippe silverspot butterfly was federally listed as endangered in 1997 (65 FR 64306 64320, December 5, 1997).

Regionally, this subspecies is believed or known to occur in eight counties in west-central California (USFWS, 2015cg). The Callippe silverspot butterfly can be found in hilly grassland habitats. The larval host plant for this subspecies is the California golden violet (*Viola pedunculata*). Major threats to this species include habitat loss and degradation due to recreational activities, grazing practices, development, and non-native plants (USFWS, 2009k).

Carson Wandering Skipper. The Carson wandering skipper (*Pseudocopaeodes eunus obscurus*) subspecies of the wandering skipper (*Pseudocopaeodes eunus*), is endemic to a portion of the Sierra Nevada Mountains in northwestern Nevada and northeastern California. It averages 0.5 inches in length, with dull orange/brown wings bordered with a thin dark line. The Carson subspecies is distinguishable from other subspecies by its duller, browner color. (USFWS, 2007f). It was federally listed as endangered in 2002 (67 FR 51116 51129, August 7, 2002) (USFWS, 2015ch).

The Carson wandering skipper uses lowland grassland habitats at less than 5,000 feet ASL in a small portion of the northeastern Sierra Nevada Mountains. The subspecies appears to be dependent on the succulent leaves of saltgrass (*Distichlis spicata*) for larval feeding. Adults require a flowering nectar source from March through June. Species occupy different meadows from year to year depending on the availability of food. As saltgrass requires a high water table, the Carson wandering skipper has declined severely from historic populations due to natural drying and groundwater pumping. Current threats include habitat alteration, over-collection, disease and predation, pesticide use, and a limited range (USFWS, 2007f).

Casey's June Beetle. Casey's June beetle is a scarab beetle that has been described as "dusty brown or whitish coloring, and brown and cream longitudinal stripes on the elytra (wing covers and back)" (USFWS, 2015ci). Adults range in size from 0.55 to 0.71 inches. This species develops in underground burrows as larvae, emerging as adults between March and June, with peak abundance in April and May. Males fly and females are flightless (USFWS, 2015ci).

This species was federally listed as endangered in 2011, with critical habitat designated at the same time (76 FR 58954 58998, October 24, 2011). Critical habitat was designated for this species in Riverside County (USFWS, 2011j). An outline for a recovery plan was published in 2013. The species is endemic to California and the extent of its range is currently believed to be in Riverside County, in the Coachella Valley, and in and around Palm Canyon Wash (USFWS, 2013m).

Casey's June beetles occur in desert wash and alluvial areas and have been observed under vegetation in semi-disturbed areas. The requirements for the larval stage are not well known. Threats to this species include habitat loss, degradation, and fragmentation due to flood events, flood control activities, and urban development. (USFWS, 2013m)

Conservancy Fairy Shrimp. The conservancy fairy shrimp is a small freshwater crustacean that lacks a hard shell (USFWS, 2012j). Males are approximately 0.6 to 1.1 inches long, while females are approximately 0.6 to 0.9 inches in length (USFWS, 2006d). This species exhibits 11 pairs of swimming legs and an elongated body shape (USFWS, 2012j) The conservancy fairy shrimp was federally listed as endangered in 1994 (59 FR 48136 48153, September 19, 1994).

This species is believed or known to occur in 36 counties throughout California (USFWS, 2015cj). Conservancy fairy shrimp are typically found in large seasonal pools (called playa pools) that contain a lot of suspended matter. In 2005, critical habitat was designated for this species within 34 counties in California (70 FR 46924 46999, August 11, 2005). Threats to this species include habitat loss and degradation due to urban development, grazing practices, non-

native plant species, climate change, and contaminants. Another threat to this species is the current isolation and small size of existing populations, which can increase the risk of localized extinction due to stochastic events. (USFWS, 2012j)

Delhi Sands Flower-loving Fly. Delhi Sands flower-loving fly is a large fly in the family Mydidae with a tubular tongue for drinking nectar from flowers. Adults can grow to a length of 1.6 inches, with a long orange and brown abdomen, large compound eyes, and orange legs. Adults begin flying as early as July, but are most active in August and September. Larvae hatch in fine sandy soils and remain underground until the flight season. (USFWS, 2008d)

The subspecies was federally listed as endangered in 1993 (58 FR 49881 49887, September 23, 1993). No critical habitat has been designated for the species. Habitat Conservation Plans for specific projects have resulted in three permanently conserved recovery units within the remaining habitat (USFWS, 2008d) (USFWS, 2015ck).

Delhi Sands flower-loving fly is closely tied to the fine sands of the Delhi series, with open habitat and nectar sources available for the adults. Little is known about the larval phase of the fly, although it is suggested that they likely occur in the upper foot of moist soil for larvae, based on observations of similar species. The species was historically associated with the Colton Dune system in San Bernardino and Riverside Counties. As of 1997, only 12 small patches of potential habitat were thought to remain in the in the Banning, Cabazon, Topanga, and San Joaquin Valley areas totaling 180 acres, of which only a portion has been found to be occupied. (USFWS, 2008d) The species is believed to occur in San Bernardino, Riverside, and Orange Counties, although the range within the state still needs to be refined (USFWS, 2015ck).

The primary threats to the species have been identified as loss of habitat and fragmentation of the remaining habitat. At the time of listing, it was estimated that 97 percent of the original Colton Dunes area had been developed, with much of the remaining habitat in degraded condition. The remaining patches are not well connected, making dispersal difficult in many cases. (USFWS, 2008d).

Delta Green Ground Beetle. The delta green ground beetle is metallic green, with some adults also having bronze spots. The brilliant metallic colors of this species distinguish it from other ground beetles. In California, this species is the only known member of its genus to be active in the winter (USFWS, 2005c). The delta green ground beetle was listed as federally threatened in 1980 (45 FR 52807 52810, August 8, 1980). Critical habitat was also designated in 1980 and consisted of 960 acres over two areas in south-central Solano County. These areas, which include the Jepson Prairie Reserve, contain vernal pools and surrounding lands draining into these pools. (USFWS, 1980a)

Little is known about the historical distribution, life history, or habitat requirements of this species. Delta green ground beetles are now found only in Solano County, specifically in the greater Jepson Prairie area; the smaller vernal pools and larger playa pools appear to be important habitat areas for delta green ground beetles. Threats to this species include any threats to the grassland/vernal pool habitats, changes in vegetation management and grazing practices, and the lack of knowledge about the species. (USFWS, 2005c)

El Segundo Blue Butterfly. Adult El Segundo blue butterflies have a wingspan ranging from 0.75 to 1.25 inches. Males have bright blue wigs with an orange border on the hindwings. Females are dull brown (USFWS, 1998i). The species was listed as endangered in 1976 (41 FR 22041 22044, June 8, 1976). Critical habitat in the vicinity of the Los Angeles airport was proposed in 1977 (42 FR 7972 7976, February 9, 1977).

The El Segundo blue butterfly is endemic to California and historically, it likely occurred throughout the El Segundo sand dunes. These sand dunes are a unique and biologically sensitive environment supporting a variety of rare plants and animals. The vegetation of these dunes belongs to the Sand verbena-beach bursage series. This species is currently found only in four locations within the El Segundo sand dunes in Los Angeles County. These four locations are identified as recovery units (RU) and include: Ballona RU, Airport Dunes RU, El Segundo RU, and Torrance RU. (USFWS, 1998i).

A variety of external factors influence the life history of this species; adult activity is closely tied to the flowering of the coast buckwheat. Egg populations are regulated by a parasitic wasp, and larvae maintain a symbiotic relationship with ants. Threats to the El Segundo beach butterfly include diminished habitat quality and quantity caused by development, introduction of invasive species, loss of native plant species, and degradation from human incursion. (USFWS, 1998i)

Kern Primrose Sphinx Moth. Kern primrose sphinx moth is a relatively large, day-flying moth with a stout body and a brown, mottled bark-like pattern on the upper forewing surfaces. The abdomen has a broad, white band and the inner rear margins of the forewings are convex (USFWS, 2007g). The species was thought to be extinct, but was federally listed as threatened in 1980 after its rediscovery in 1974 (USFWS, 1980b). A recovery plan was published in 1984 (USFWS, 1984c). Critical habitat was proposed in 1978, but has not been designated for the species (USFWS, 2015cl).

Kern primrose sphinx moth is closely tied to its larval host plants evening primrose (*Camissonia contorta epilobiodes*) and likely field primrose (*Camissonia campestris*). Larvae (caterpillars) of the species feed exclusively on these plants after emerging from eggs. The known populations have been observed in sandy washes. The loose, coarse alluvial sand in these washes is thought to be essential for larva to bask in the sun, and to burrow in for pupal chamber construction. This species is endemic to California and occurs in Kern, Kings, San Luis Obispo, Santa Barbara, and Ventura Counties. The species was originally known only from a small population in the northwestern section of Walker Basin, but more recently small populations have been discovered on the Carrizo Plain, and at the Cuyama Valley. (Jump, Longcore, & Rich, 2006) (USFWS, 1984c) (USFWS, 2007g)

A major threat to the species is habitat loss and degradation within its extremely limited range. Development, agriculture and disking, sheep grazing and bedding, off-road vehicle use, and the use of pesticides and herbicides have been identified as threats to its habitat. The species occurs on unprotected private lands. Its rarity makes it desirable to collectors and over collection has been identified as a threat to its continued existence. Because of its small and fragmented population distribution and limited range, it is vulnerable to random local events that can cause

extirpation of populations without a nearby source population for recolonization. (USFWS, 1980b) (USFWS, 2007g)

Laguna Mountains Skipper. The Laguna Mountains skipper (*Pyrgus ruralis lagunae*) is a subspecies of the more widespread rural skipper (*P. ruralis*) known only from a few locations in the mountains of San Diego County. This is a small butterfly in the skipper family with a wingspan of about one inch with black upper wing surfaces covered with white marks. The head is large and the body covered with hair.

The species was federally listed as endangered in 1997 (USFWS, 1997a) with critical habitat designated in 2006 (USFWS, 2006e). No recovery plan has been published for the subspecies (USFWS, 2015cm).

Laguna mountains skipper is closely tied to its primary larval host plant Cleveland's horkelia (*Horkelia clevelandii*). This is the plant that larvae (caterpillars) feed on after emerging from eggs. It occurs mainly in mountain meadow habitat where the host plant occurs and other flowering plants are available as nectaring food sources for adult skippers. The subspecies is known only from small mountain meadow areas in the Lagunas Mountains and Palomar Mountain in San Diego County. Approximately 6,662 acres have been designated as critical habitat in these areas. (USFWS, 1997a) (USFWS, 2006e) (USFWS, 2007h)

The extremely small and fragmented range of the subspecies makes it vulnerable to random events that can lead to local extirpations without the possibility of recolonization from nearby populations. Threats to the species have included development, recreational activities such as hiking, camping and trail building, and off-highway vehicle use, and wildfire. (USFWS, 2007h) (USFWS, 1997a) (USFWS, 2007h)

Lange's Metalmark Butterfly. The Lange's metalmark butterfly is a small species (wingspan of 1.0-1.5 in); their wings are mostly black with white spots and a portion of the inner forewing has a red-orange background. There is a small red-orange patch on the center of the upper hindwing that distinguishes this species from other similar subspecies. Adult males and females are similar (USFWS, 2008e). This species was federally listed as endangered in 1976 (41 FR 22041 22044, June 8, 1976). Critical habitat in Contra Costa County was proposed in 1977 (42 FR 7972 7976, February 8, 1977).

This species endemic to California. The only known population inhabits the Antioch Dunes National Wildlife Refuge. This species relies on the naked stemmed buckwheat (*Eriogonum nudum* var. *auriculum*) as the sole food source for the larvae and adults use the buckwheat for perching and feeding. Like other butterfly species, the population sizes of the Lange's metalmark butterfly are tied to the health and density of the host plant. Primary threats to the Lange's metalmark butterfly include sand mining, recreational activities, wildfires, non-native plant species, and small population sizes. (USFWS, 2008e)

Longhorn Fairy Shrimp. The longhorn fairy shrimp is a small freshwater crustacean that lacks a hard shell. This species exhibits 11 pairs of swimming legs and an elongated body shape. The longhorn fairy shrimp can be distinguished from other fairy shrimp species by the length of the male's second antennae, which is much longer than the antennae of other fairy shrimp (USFWS,

2012k). The longhorn fairy shrimp was federally listed as endangered in 1994 (59 FR 48136 48153, September 19, 1994).

This species is believed or known to occur in five counties in west-central California (USFWS, 2015cn). Longhorn fairy shrimp can be found in a variety of seasonally flooded pools. This species has been known to inhabit small sandstone pools, large grassland pools, and disturbed roadside pools (USFWS, 2012k). In 2005, critical habitat was designated in 34 counties throughout California for this species and three other vernal pool crustacean species (70 FR 46924 46999, August 11, 2005).

Threats to the longhorn fairy shrimp include habitat loss and degradation due to urban development, agricultural development and practices, grazing practices, non-native plan species, and climate change. Another threat to this species is the current isolation and small size of existing populations, which can increase the risk of localized extinction due to stochastic[113] events (USFWS, 2012k).

Lotis Blue Butterfly. The lotis blue butterfly typically possesses a wingspan of approximately one inch (USFWS, 2011k). On males, the top side of the wings are dark purple or blue with a black border and a white fringe along the edge of the wings. On females, the top side of the wings are brown or blueish-brown with a lateral orange band on each wing. On both sexes, the bottom of the wings are gray with black spots (USFWS, 1985d). This subspecies was federally listed as endangered in 1976 (41 FR 22041 22044, June 8, 1976).

Regionally, the lotis blue butterfly is only believed or known to occur Mendocino County (USFWS, 2015co). This subspecies is rare and therefore there is limited information relating to its habitat requirements. The lotis blue butterfly is believed to inhabit wet meadows and sphagnum[114] bogs. The last observation of this species occurred in a sphagnum bog within a pygmy forest in Mendocino County. Potential threats to the lotis blue butterfly include habitat loss and fragmentation due to ecological succession, land use changes, residential development, and road construction (USFWS, 2011k).

Mission Blue Butterfly. The mission blue butterfly is a small butterfly with a wingspan of approximately 1.0 to 1.5 inches. On males, the top side of the wings are blue with a black border and a white fringe along the edge of the wings. On females, the top side of the wings are dark brown with blue coloring towards the base and a black border with white fringe along the edges of the wings. On both sexes, the bottom of the wings are light gray with black spots that are outlined in white. (USFWS, 2010m). This subspecies was federally listed as endangered in 1976 (41 FR 22041 22044, June 8, 1976).

The mission blue butterfly believed or known to occur in four counties in west-central California (USFWS, 2015cp). This subspecies is typically found in coastal grassland habitats that experience natural disturbances such as rockslides, mudslides, or fire. Disturbance allows for the host plants of the mission blue butterfly, *Lupinus* species, to colonize an area. Threats to the

[113] Stochastic: "Involving chance or probability." (USEPA, 2015w)

[114] Sphagnum: "Any of an order (Sphagnales, containing a single genus Sphagnum) of atypical mosses that grow only in wet acid areas where their remains become compacted with other plant debris to form peat." (USEPA, 2015w)

mission blue butterfly include habitat loss and degradation due to commercial development, road construction, non-native plant species, ecological succession, and recreational activities. Other potential threats include small population size and isolation. (USFWS, 2010m)

Morro Shoulderband Snail. The Morro shoulderband snail is a small snail, measuring approximately 0.7 to 1.1 inches in diameter. The shell of this species is light brown and exhibits 5 to 6 whorls, deep spiral grooves, and one narrow dark band (USFWS, 2001a). This species was federally listed as endangered in 1994 (59 FR 64613 64623, December 15, 1994).

The Morrow shoulderband snail is believed or known to occur only in San Luis Obispo County (USFWS, 2015cq). This species is typically found in coastal dune habitats. Occasionally, this species has been found in suburban habitats. The preferred habitat for the Morro shoulderband snail is thought to be early successional scrub areas where low-lying branches are abundant (USFWS, 2006f). In 2001, critical habitat was designated for this species in San Luis Obispo County (66 FR 9233 9246, February 7, 2001). The major threats to this species are development and lack of habitat management (USFWS, 2006f).

Mount Hermon June Beetle. Mount Hermon June beetle is a small, dark brown scarab beetle growing to an adult size 0.79 to 0.87 inches long. The elytra (wing covers) have irregular, lighter-colored stripes. Females are flightless and males fly in search of mates. The species spends much of its life underground as a larva, feeding on roots and fungus (USFWS, 2009l). The species was federally listed as endangered in 1997 (USFWS, 1997b) and it is addressed in a recovery plan for the insects of the Santa Cruz Mountains (USFWS, 1998j).

The species is closely associated with the Zayante soil type, which is associated with pockets of eroding limestone and sandstone in the Zayante Sand Hills. Vegetation types associated with the soils include maritime coast range ponderosa pine forest, northern maritime chaparral, and northern maritime chaparral. The species is found where these occur as "open, park-like associations" (USFWS, 1997b). The species is endemic to the Santa Cruz Mountains in Santa Cruz County and its range is limited to 10 known small populations totaling less than 10 square miles in the vicinity of the communities of Ben Lomond, Felton, Mount Hermon, Zayante, and Scotts Valley. Within the region, 4,230 acres have been designated as critical habitat. (USFWS, 2001b).

Threats to the species have included habitat loss from development, sand mining, and recreational use, and introduced exotic plant species. The species range was reduced by and estimated more than 75 percent, only a percentage of which is comprised of potentially suitable habitat. The small population sizes and limited range make the species vulnerable to local random events such as wildfires and disease that can lead to the extirpation of isolated populations. (USFWS, 1998j) (USFWS, 2009l).

Myrtle's Silverspot Butterfly. The Myrtle's silverspot butterfly is a medium-sized butterfly with a wingspan of 2.1 to 2.3 inches. The top side of the wings are golden brown to reddish-brown, and exhibit various black markings. The underside of the wings are light brown, brown, or reddish-brown and exhibit black lines, black, and silver spots (USFWS, 2009m). The body and

base of the wings are covered with fine hair. This subspecies was federally listed as endangered in 1992 (57 FR 27848 27859, June 22, 1992).

This species is believed or known to occur in six counties in the west-central region of California. (USFWS, 2015cs). The Myrtle's silverspot butterfly is typically found in coastal dune, coastal scrub, and coastal prairie habitats. This subspecies utilizes the early blue violet (*Viola adunca*) as a larval host plant, and a variety of plants as nectar sources. Threats to the Myrtle's silverspot butterfly include development, recreational activities, non-native plant species, vehicle strikes, and climate change. (USFWS, 2009m)

Ohlone Tiger Beetle. The Ohlone tiger beetle is a medium-sized predatory beetle, approximately 0.37 to 0.49 inches long. This species has an elongated metallic green body with stripes and spots (USFWS, 2009n). This species was federally listed as endangered in 2001 (66 FR 50340 50350, October 3, 2001). The Ohlone tiger beetle is believed or known to occur only in Santa Cruz County (USFWS, 2015ct), particularly along coastal terraces where patches of native grassland habitat are present (USFWS, 2009n).

This species prefers areas where grasses are low and bare ground is interspersed throughout the habitat. The Ohlone tiger beetle is active from January to April. Primary threats to the Ohlone tiger beetle include habitat loss and degradation due to urban development and non-native plan species. Other threats include unrestricted collecting, pesticides and recreational activities (USFWS, 2009n).

Oregon Silverspot Butterfly. The Oregon silverspot butterfly is a medium-sized butterfly with a wingspan of 2.2 inches. The upper side of the wings are golden brown with many black spots and lines. The undersides of the wings are brown, orange-brown, and tan with black lines and silver and black spots. The body and base of the wings are covered in fine hair. This species can be distinguished from the similar Behren's silverspot and Myrtle's silverspot by its smaller size and northern distribution. The Oregon silverspot butterfly was federally listed as threatened in 1980 (45 FR 44935 44939, July 2, 1980). This species is found in California and Oregon. In California, it can be found in Del Norte County (USFWS, 2011l) (USFWS, 2015cu).

The Oregon silverspot butterfly inhabits three types of grasslands, including coastal terrace and headland "salt spray" meadows, coastal dune systems, and montane grasslands. All of these habitats are close to the ocean, have mild temperatures, regular rainfall, and regular fog in the summer. Habitats must also have caterpillar host plants (violets) and adult nectar sources for this species to survive. The greatest threat to the Oregon silverspot butterfly is habitat degradation and destruction due to development, agriculture, invasion of exotic plants, succession of grasslands, off-road vehicles, livestock grazing, and erosion. Other threats include vehicle collisions, pesticides, collection, and lack of periodic fires. (USFWS, 2011l)

Palos Verdes Blue Butterfly. The Palos Verdes blue butterfly is a medium-sized butterfly with a wingspan of approximately one inch. On males, the top side of the wings are silvery-blue and have a thin black border. On females, the top side of the wings are brownish-gray. On both sexes, the bottom side of the wings are gray with dark spots that are outlined in white (USFWS,

2014m). This subspecies was designated critical habitat and federally listed as endangered at the same time in 1980 (45 FR 44939 44942, July 2, 1980).

Regionally, this subspecies only occurs in Los Angeles County, and is endemic to the Palos Verdes Peninsula (USFWS, 2014m) (USFWS, 2015cv). The Palos Verdes blue butterfly is typically found in disturbed areas within coastal sage scrub communities. This subspecies utilizes coast locoweed (*Astragalus trichopodus lonchus*) and deerweed (*Acmispon glaber*) as larval host plants. Primary threats to the Palos Verdes blue butterfly include non-native plants, fire suppression, small population sizes, and isolation of populations. Potential threats include ecological succession and climate change (USFWS, 2014m).

Quino Checkerspot Butterfly. Quino checkerspot butterfly is in the brush-footed butterfly family (*Nymphalidae*), and possesses orange, red, black and white checkers on the wings. Adults have a 1-inch wingspan with a black and orange body. Quino checkerspot is 1 of 12 subspecies of Edith's butterfly *(E. editha)*, and is slightly larger and redder than other subspecies. Larvae are small and black with orange tubercles (protrusions) (USFWS, 2009o). The species was federally listed as endangered in 1997 (USFWS, 1997a). A final critical habitat revision was published in 2009 (USFWS, 2009o). The recovery plan for the species was published in 2003 (USFWS, 2003a).

Larvae and adults are often are closely associated with certain larval host plants, particularly dot-seed plantain (*Plantago erecta*), Patagonian plantain (*P. patagonica*), and purple owl's clover (*Castilleja exserta*), and Coulter's snapdragon (*Anterrhinum coulterianum*). Host plants are the specific plants that the larvae (caterpillars) eat. Habitat includes native grasslands, coastal sage scrub, chaparral, vernal pool edges, and wherever the host plants grow. Host plants generally grow on moist, often clay soils that retain water after rains. Nectaring (feeding) occurs in native grasslands, wildflower fields, or other open habitats. Adults often "hilltop," a behavior consisting of flying uphill to a high point or rock outcropping in the area. Eggs are laid on host plants and larvae feed and go on to feed on the host plant stems and leaves. Larvae can enter "diapause" or summer dormancy, sheltering under debris or in cracks in the ground near host plants until suitable conditions return for transformation into adult butterflies. (USFWS, 1997a) (USFWS, 2009o).

Quino checkerspot is a subspecies of the more widespread species Edith's checkerspot, a species with a range across western Canada, the U.S., and into Mexico. The Quino checkerspot subspecies is endemic to extreme southwestern California and northern Baja California. Quino checkerspot was historically reported as common across southwestern Ventura, southwestern San Bernardino, western Riverside, and San Diego Counties, and into northern Baja California, Mexico. It is now known from localized populations in western Riverside and San Diego Counties after suffering a loss of an estimated 75 percent of its historical range. (USFWS, 2009p). Critical habitat has been designated in 9 subunits totaling 62,125 acres across western Riverside and San Diego Counties (USFWS, 2009o).

The primary threat to the subspecies has been identified as loss of habitat and habitat fragmentation. Much of the former range of the subspecies is now within urban and agricultural areas, with remaining populations fragmented by development and lack connectivity (small,

isolated, and vulnerable to random local events such as wildfire that can cause local extirpation). Other threats include invasion of habitat by nonnative plants, grazing, fire, enhanced soil nitrogen, increased atmospheric carbon dioxide, and climate change. (USFWS, 2009o)

Riverside Fairy Shrimp. Riverside fairy shrimp is a small, freshwater crustacean inhabiting shallow ephemeral (temporary) pools in coastal Southern California. Adults range in size from 0.5 to 0.9 inch in length with transparent bodies and swim in an inverted position with 11 pair of swimming legs. Females carry an elongated, torpedo-like brood pouch under their bodies. The species remains dormant for long periods in the form of cysts, or "resting eggs." The cysts hatch when pools fill with winter or spring rains into a short-lived adult phase that feeds and reproduces in the pool, with the population becoming dormant again as the pools become dry again (USFWS, 2012l). Riverside fairy shrimp is distinguished from similar species in the genus *Streptocephalus* by microscopic differences in an outgrowth of the head, and adults often have orange to red tail structures (cercopods).

The riverside fairy shrimp was listed as federally endangered in 1993 (USFWS, 1993b) with final revisions to critical habitat being designated in 2012 (USFWS, 2012l). The species was included in a 1993 recovery plan for the vernal pools of Southern California (USFWS, 1998k).

Riverside fairy shrimp occurs in vernal pools and other temporary ponded areas, generally associated with clay or hardpan soils with a low permeability that allows for the extended ponding of water in depressions. This species is believed to require longer inundation periods and warmer water than other species in its range, and therefore occurs primarily in pools with depths that exceed 12 inches and retain water for 2 to 8 months of the year, drying down during the remaining period. Habitat has been recorded in grasslands, coastal sage scrub, chaparral, and other open habitats, and includes both naturally occurring vernal pools and isolated manmade depressions such as cattle ponds, scrapes, and bermed areas. (USFWS, 1993b) (USFWS, 2012l)

The species' range is limited to 45 known occupied vernal pool complexes in Ventura, western Riverside, Orange, and San Diego Counties, and northwestern Baja California, Mexico. It was extirpated from another 9 known complexes (USFWS, 2008f). Critical habitat has been designated covering 1,724 acres, including approximately 466 acres in Ventura County, 396 acres in Orange County, and 862 acres in San Diego County (USFWS, 2008f) (USFWS, 2012l).

The primary threats to the species include loss and degradation of habitat. Much of the vernal pool habitat within the species' range has been eliminated and the remaining areas face the threat of degradation through off-highway vehicle use, altered hydrology, invasive exotic plant species, and habitat fragmentation. Only 59 acres of habitat are known to be occupied, composed mostly of small, widely separated groups of pools. (USFWS, 2012l)

San Bruno Elfin Butterfly. San Bruno Elfin butterfly possesses a wingspan of about one inch. The upper surface of the wings are brown and reddish brown, with lighter colored underwings and a whitish, irregular medial line (USFWS, 2010m). The subspecies was federally listed as endangered in 1976 (USFWS, 1976)with a recovery plan published in 1984 (USFWS, 1984d). Critical habitat was proposed in 1977 but was not designated (USFWS, 1977).

San Bruno Elfin butterfly is closely associated with its larval host plant (the species used as food by caterpillars) stonecrop (*Sedum spathulifolium*). Habitat is typically in the coastal Bay Area, where the larval host plant occurs. Populations are known from several localities including San Bruno Mountain, Milagra Ridge, the San Francisco Peninsula Watershed, and Montara Mountain. The host plant generally occurs in most areas of north-facing slopes within low scrub and coastal prairie grassland habitats. (USFWS, 1984d) (USFWS, 2010m)

Threats to the species include commercial development, road construction, park development, and quarrying. The subspecies has a small range. Small, isolated populations are tied to host plant distribution and are, therefore, vulnerable to local random events that can cause extirpation of populations without the opportunity to recolonize. (USFWS, 1984d) (USFWS, 2010m)

San Diego Fairy Shrimp. The San Diego fairy shrimp (*Branchinecta sandiegonensis*) is a small, freshwater crustacean inhabiting shallow ephemeral (temporary) pools in coastal Southern California. Adults range in size from 0.12 to 0.63 inches with transparent bodies. Adults swim in an inverted position with 11 pairs of swimming legs. Females carry an elongated, torpedo-like brood pouch under their bodies. As with most fairy shrimp, the species remains dormant for long periods in the form of cysts, or "resting eggs." During winter or spring rains, pools fill and the cysts hatch into a short-lived adult phase that feeds and reproduces in the pool, with the population becoming dormant again as the pools become dry again. (USFWS, 1997c)

San Diego fairy shrimp occurs in vernal pools and can also be found in other inundated depressions where cysts are present such as road ruts, shallow excavations, or other inundated low areas that regularly remain filled with water for sufficient time to allow for reproduction. In the U.S., the species is restricted to the coastal slope of southern California, particularly in San Diego and Orange Counties. Critical habitat has been designated for the species, including 3,082 acres of land in five units with a total of 29 subunits. (USFWS, 2007i)

San Diego fairy shrimp was listed as endangered in 1997 (USFWS, 1997c). Final critical habitat for the species was designated in 2000, and revised in 2007 (USFWS, 2007i). Threats to the San Diego fairy shrimp include loss of habitat and habitat degradation associated with development, off-highway vehicle activity, agriculture, and other human disturbance (USFWS, 1997c).

Shasta Crayfish. The Shasta crayfish is a medium-sized crayfish, measuring 2 to 4 inches in body length. The body of this species is dark brown on top and bright red to red-orange on the underside (USFWS, 2009q). Slight variations in body color can exist between populations. Males have slimmer abdomens than females and exhibit larger claws (USFWS, 2015cw). This species was federally listed as endangered in 1988 (53 FR 38460 38465, September 30, 1988).

Regionally, this species is believed or known to occur in six counties in northern of California (USFWS, 2015cx). The Shasta crayfish is typically found in clear spring-fed bodies of water where large lava rocks are available for cover. This species requires a clean and firm substrate consisting of sand or gravel. Major threats to the Shasta crayfish include water diversion and impoundment projects, hydroelectric projects, and competition with non-native crayfish species (USFWS, 2009q).

Smith's Blue Butterfly. Smith's blue butterfly is a subspecies of Pacific blue-dotted butterfly (*E. enoptes*). Smith's blue butterfly possesses a wingspan of less than one inch. Undersides of wings are whitish-gray with a series of black dots and a red-orange band near the outer edge of the hind wing. Males have silvery upper wing surfaces; females have a brown wash. The Smith's subspecies is distinguished other *E. enoptes* by lighter colored underwing surfaces with prominent black markings and faint, black terminal line.

Smith's blue butterfly was listed as federally endangered in 1976, along with six other species (USFWS, 1976). Critical habitat was proposed in 1977 (USFWS, 1977) but not finalized. A recovery plan was published in 1984 (USFWS, 1984e).

Smith's blue butterfly is closely tied to its primary host and food plants, which include coast buckwheat (*Eriogonum latifolium*) and seacliff buckwheat (*E. parvifolium*). It has been observed mainly on coastal dune systems that support the windblown sand required by the host plants as well as serpentine grasslands and ancient beach deposits, in scrub and grassland habitats. The subspecies is endemic to the Central Coast of California, from south of the Monterey Peninsula, to northern Monterey County. (USFWS, 1984e) (USFWS, 2006g)

Threats to the species include the loss of an estimated 50 percent of its original habitat extent to development, infrastructure projects, and other disturbances. Invasive exotic plant species are also identified as a threat (USFWS, 1977) (USFWS, 2006g).

Valley Elderberry Longhorn Beetle. Valley Elderberry Longhorn beetle spends much of its life in a larval stage, boring in the center of elderberry (*Sambucus spp.*) tree twigs for as much as two years before emerging as adults in mid-March through June. Adult males have red elytra (wing covers) with four dark, oblong spots, and females have metallic dark green to black elytra with red edges.

The species was listed as federally threatened in 1980, with critical habitat designated at the same time (USFWS, 2015cy). The species is currently under review for possible delisting (USFWS, 2012m).

Elderberry longhorn beetle is closely tied it its host plant, elderberry. Habitat includes moist valley oak woodlands with elderberry thickets in the understory, or other habitats with an elderberry component. At the time of listing, the species was known from only 10 localities in the Central Valley of California, and Merced, Sacramento, and Yolo Counties. (USFWS, 1980c) It is currently documented from 201 occurrences at 26 locations across the San Joaquin and Sacramento Valleys, and ranging from Shasta County in the north to Kern County in the south (USFWS, 2012m).

Identified threats to the species include loss of suitable habitat including the elderberry host plant due to agricultural and urban development, levee construction, and other development within the species' range (USFWS, 2006h) (USFWS, 2012m).

Vernal Pool Fairy Shrimp. Vernal pool fairy shrimp is a small, freshwater crustacean which inhabits shallow ephemeral pools in California. Adults range in size from 0.12 to 1.5 inches long, with transparent bodies. They swim in an inverted position with 11 pairs of swimming legs. Males are distinguished by microscopic characteristics of the second antenna and females

carry a pear-shaped brood pouch under their bodies. As with most fairy shrimp, the species remains dormant for long periods in the form of cysts, or "resting eggs." The cysts hatch when pools fill with winter or spring rains into a short-lived adult phase that feeds and reproduces in the pool, with the population becoming dormant again as the pools become dry again. The species was listed as federally threatened in 1994, with critical habitat initially designated in 2003, with a final rule published in 2005, with clarifications published in 2007 (USFWS, 2007j) (USFWS, 2015cz).

Vernal pool fairy shrimp occurs in shallow depressions that fill with water in the wet season and are generally dry for the remainder of the year. They are documented in grassy and mud bottomed pools and swales, rock pools in sandstone and basaltic flows, as well as alkaline pools. The species' range includes several areas in California, with a disjunct population in southern Oregon. This is a cold water species, with hatching recorded at 50°F and die-offs observed at temperatures above 75°F (USFWS, 2007j). In California, it occurs primarily in the Central Valley, north to Tehama County, with disjunct populations in Southern California's Coast Range and Riverside County (USFWS, 2007j) (USFWS, 2015cz). Critical habitat totaling 241,929 acres was designated in 35 segments across the state (USFWS, 2006i).

Threats to the species include loss and degradation of suitable habitat, including vernal pools associated with development, agriculture, alterations to hydrologic systems, and off-highway vehicle activity (USFWS, 1994d) (USFWS, 2007j).

Vernal Pool Tadpole Shrimp. Vernal pool tadpole shrimp (*Lepidurus packardi*) is a small, freshwater crustacean with a wide flattened plate covering the head and forward half of the body, and 35 pairs of swimming legs a segmented tail. Adults can grow to 3.3 inches long and are tan to olive. This species is distinguished by a flat, paddle-like process on the tail (supra-anal plate) located between two long spines (cerocopods) (USFWS, 1994d). The species was listed as federally endangered in 1994 (USFWS, 1994d), and critical habitat was designated in 2002, with a final, revised rule in 2006 (USFWS, 2006i).

Vernal pool tadpole shrimp inhabit larger vernal pools that hold water late into the wet season. Eggs require up to three weeks to hatch and adults mature in three or more weeks. The species have been found in mud or grassy-bottomed pools and swales where suitable conditions exist to retain surface water for longer periods after rains. This species is endemic to the Central Valley of California, including parts of Shasta, Tulare, Alameda, and Contra Costa Counties. Occurrences also have been recorded in Butte, Colusa, Fresno, Glenn, Kings, Merced, Placer, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, Tehama, Yolo, and Yuba Counties. (USFWS, 2007k)

White Abalone. White abalone (*Haliotis sorenseni*) is a flattened spiral gastropod with a large, exposed foot used to cling to rocks. Abalone use their foot as a suction cup and can clamp their shell tightly against the substrate, protecting the soft parts of the animal. White abalone adults are typically 5 to 8 inches long, with sizes recorded to 10 inches (NOAA, 2008).

The species was listed as federally endangered in 2001 by the NMFS, and by the USFWS in 2005 (USFWS, 2015da). A recovery plan was finalized in 2008 (NOAA, 2008), and no critical habitat has been designated for the species.

White abalone is typically the deepest-dwelling of the California abalone species, with a narrow depth range of 100 to 200 feet, restricted by a combination of light penetration for algal growth and temperature. Habitat generally consist of flat rock surfaces in areas with boulders on the sea floor. The species historically ranges from the near-shore areas south of Point Conception, the Channel Islands, and San Diego. (NOAA, 2008)

White abalone was once abundant (densities as high as one per square meter) in the coastal waters of Southern California, but declined by an estimated 99 percent due to overfishing between the 1970s and 1996, when a ban on collecting was put in place. An active recovery program including captive breeding has been necessary as the remaining population densities in the wild are believed to be too low to support reproduction. (USFWS, 2015da).

Zayante Band-winged Grasshopper. Zayante band-winged grasshopper is a small (0.54 to 0.85-inch) gray to light brown grasshopper with dark cross bands on the forewing. The species was federally listed as endangered in 1997 (USFWS, 1997b) and critical habitat was designated in 2001 (USFWS, 2001b). It was included in a recovery plan for insect and plant taxa[115] of the Santa Cruz Mountains which was published in 1998 (USFWS, 1998j).

The Zayante band-winged grasshopper is closely associated with the Zayante soil type, which is associated with pockets of eroding limestone and sandstone in the Zayante Sand Hills. Vegetation types associated with the soils include maritime coast range ponderosa pine forest, northern maritime chaparral, and northern maritime chaparral. The species is found where these occur as "open, park-like associations" (USFWS, 1997b). The species is endemic to the Santa Cruz Mountains in Santa Cruz County, and its range is limited to an area of about 4 square miles in the vicinity of Ben Lomond, Felton, Mount Hermon, Zayante, and Scotts Valley. Critical habitat has been designated for 4,230 acres in the state (USFWS, 2001b).

Identified threats to the species and its habitat include grading, disking of soil and vegetation removal; mining and construction; recreational activities such as off-trail hiking, horse riding, and off-road vehicle use; introduced exotic plant species; and pesticide use and collecting. The small population size and limited range makes the species vulnerable to random events and local extirpation. (USFWS, 1997b) (USFWS, 2001b) (USFWS, 2009l)

Plants

Currently, there are 136 endangered, 47 threatened, and 2 candidate plant taxa in California (USFWS, 2015bz) (USFWS, 2016ax). The two candidate species are the Whitebark Pine (*Pinus albicaulis*) and the San Fernando Valley Spineflower (*Chorizanthe parryi* var. *fernandina*). Only 61 plant taxa have critical habitat designated (USFWS, 2016a). Listed plant species occur throughout California.

[115] Taxa: Plural form of the word Taxon. Taxons are the outcome of taxonomy, which is "the process or system of describing the way in which different living things are related by putting them in groups." (USEPA, 2015w)

Table 4.1.6-12: Federally Listed Plant Species of California

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Amargosa Niterwort	*Nitrophila mohavensis*	E	Yes	Alkaline, salt encrusted, clay soils in wetland areas of Ash Meadows, Nevada and Death Valley, California.
Antioch Dunes Evening-Primrose	*Oenothera deltoides* ssp. *howellii*	E	Yes	Riverine sand dunes
Applegate's Milk-vetch	*Astragalus applegatei*	E	No	Seasonally moist meadows and drainage ditches on alkaline soils
Ash-grey Paintbrush	*Castilleja cinerea*	T	Yes	Montane pebble plains, forest meadows, mixed conifer forest and pinyon-juniper woodlands
Baker's Larkspur	*Delphinium bakeri*	E	Yes	Mixed woodlands on decomposed shale at elevations of 400 to 500 feet
Bakersfield Cactus	*Opuntia treleasei*	E	No	Floodplains, ridges, bluffs and rolling hills on sandy to dandy loam soils in saltbush scrub and woodlands
Beach Layia	*Layia carnosa*	E	No	Near-shore coastal dunes
Bear Valley Sandwort	*Arenaria ursinus*	T	Yes	Montane pebble plains and associated dry slopes
Ben Lomond Spineflower	*Chorizanthe pungens* var. *hartwegiana*	E	No	Sandy, well-drained soils in open areas of sandhill communities at elevations of 295 to 2,000 feet
Ben Lomond Wallflower	*Erysimum teretifolium*	E	No	Open areas in sand parklands or northern maritime chaparral on pockets of sandstone-derived soils
Big-leaved Crownbeard	*Verbesina dissita*	T	No	Rugged coastal canyons on San Onofre breccia-derived soils in dense southern maritime chaparral or other coastal communities
Braunton's Milk-vetch	*Astragalus brauntonii*	E	Yes	Chaparral or coastal sage scrub on limestone outcrops or knolls with shallow calcium carbonate soils, or downslope from such areas
Burke's Goldfields	*Lasthenia burkei*	E	No	Seasonally inundated vernal pools, swales, or meadows

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Butte County Meadowfoam	*Limnanthes floccosa* ssp. *californica*	E	Yes	Annual grasslands on the margins of vernal pools or vernal swales on alluvial terraces with mima mound topography
California Jewelflower	*Caulanthus californicus*	E	No	Non-native annual grasslands, shrublands, juniper woodlands
California Orcutt Grass	*Orcuttia californica*	E	No	Deep vernal pools
California Seablite	*Suaeda californica*	E	No	High tidal marsh zone of estuary sand beaches or sandy tidal marshes
California Taraxacum	*Taraxacum californicum*	E	Yes	Open drier margins of seasonally moist meadows and flats along perennial streams at elevations of 5,300 to 9,000 feet
Calistoga Allocarya	*Plagiobothrys strictus*	E	No	Alkaline flats and grasslands on clay soils with pools and swales fed by Sulphur hot springs and geysers
Catalina Island Mountain-mahogany	*Cercocarpus traskiae*	E	No	On steep slopes and bottom of Wild Boar Gully, Santa Catalina Island, at elevations of 430 to 700 feet
Chinese Camp Brodiaea	*Brodiaea pallida*	T	No	Serpentine clay wetlands (overflow channels, seeps and springs)
Chorro Creek Bog Thistle	*Cirsium fontinale* var. *obispoense*	E	No	Open seeps on serpentine soils
Clara Hunt's Milk-vetch	*Astragalus clarianus*	E	No	Thin, rocky clay, volcanic, or serpentine soils in grasslands and openings of whiteleaf manzanita-blue oak woodlands
Clover Lupine	*Lupinus tidestromii*	E	No	Partially stabilized dune communities
Coachella Valley Milk-vetch	*Astragalus lentiginosus* var. *coachellae*	E	Yes	Loose wind-blown or water transported sands, sand dunes or flats in the Coachella Valley
Coastal Dunes Milk-vetch	*Astragalus tener* var. *titi*	E	No	Seasonal wetlands and swales with short herbaceous cover in coastal terrace grasslands on fine loamy sand

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Colusa Grass	*Neostapfia colusana*	T	Yes	On margins of seasonally inundated alkali basins, acidic alluvial fans and terraces of intermittent streams, and vernal pools and lakes at elevations of 18 to 350 feet
Conejo Dudleya	*Dudleya abramsii* ssp. *parva*	T	No	Grassland and coastal sage scrub with shallow thin soils on outcrops of Conejo formation volcanic rock
Contra Costa Goldfields	*Lasthenia conjugens*	E	Yes	Vernal pools, swales and depressions in open grassy woodlands and valley grasslands
Contra Costa Wallflower	*Erysimum capitatum* var. *angustatum*	E	Yes	In sand and sandy loams of riverine dune systems associated with the Antioch Dunes, including stabilized dunes, hard pan, river bluffs, and excavated flats
Coyote Ceanothus	*Ceanothus ferrisae*	E	No	Dry slopes in serpentine chaparral or valley and foothill grasslands at elevations of about 1,000 feet
Cushenbury Buckwheat	*Eriogonum ovalifolium* var. *vineum*	E	Yes	Areas with little vegetation cover or accumulation or organic material, often with powdery fine soils and substantial rock cover in pinyon, pinyon-juniper or Joshua tree woodlands, and blackbrush scrub on carbonate substrates (limestone and/or dolomite) along the northern edge of the San Bernardino Mountains on north- or west-facing slopes between 4,600 and 7,900 feet
Cushenbury Milk-vetch	*Astragalus albens*	E	Yes	In pinyon, pinyon-juniper or Joshua tree woodlands, and blackbrush scrub on carbonate substrates (limestone and/or dolomite) along the northern edge of the San Bernardino Mountains

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Cushenbury Oxytheca	*Oxytheca parishii* var. *goodmaniana*	E	Yes	Under open canopies with minimal litter and gentle slopes in pinyon-juniper and canyon live oak woodlands on carbonate substrates (limestone and/or dolomite) along the northern edge of the San Bernardino Mountains at 4,724 to 7,782 feet
Del Mar Manzanita	*Arctostaphylos glandulosa* ssp. *crassifolia*	E	No	Sandstone terraces and bluffs in southern maritime chaparral or other coastal scrub or chaparral
El Dorado Bedstraw	*Galium californicum* ssp. *sierrae*	E	No	Gabbro soils in oak woodlands often with ponderosa and gray pines
Encinitas Baccharis	*Baccharis vanessae*	T	No	Chaparral brushlands below 3,000 feet in elevation
Eureka Dune Grass	*Swallenia alexandrae*	E	No	Deep sand of dune faces in the Eureka Valley
Eureka Valley Evening-primrose	*Oenothera avita* ssp. *eurekensis*	E	No	Shallower sand dunes in the Eureka Valley
Few-flowered Navarretia	*Navarretia leucocephala* ssp. *pauciflora*	E	No	Vernal pools with volcanic substrates in chaparral, grassland, or marshes at elevations of 1,460 to 2,320 feet
Fish Slough Milk-vetch	*Astragalus lentiginosus* var. *piscinensis*	T	Yes	Seasonally moist but not flooded alkaline, desert wetland flats with cordgrass and dropseed
Fleshy Owl's-clover	*Castilleja campestris* ssp. *succulenta*	T	Yes	Margins of vernal pools, vernal swales, and other seasonal wetlands in foothills of annual grassland
Fountain Thistle	*Cirsium fontinale* var. *fontinale*	E	No	Openings in serpentine chaparral or riparian areas at elevations of 300 to 600 feet
Franciscan Manzanita	*Arctostaphylos franciscana*	E	Yes	In serpentine maritime chaparral vegetation on bare, stony, rocky, or gravelly ground or bedrock outcrops in coastal uplands; summer fog is a major influence on the survival and diversity of manzanitas

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Gambel's Watercress	*Rorippa gambellii*	E	No	Freshwater or brackish marshes, lake margins, banks of slow-slowing streams
Gaviota Tarplant	*Deinandra increscens* ssp. *vllosa*	E	Yes	Grasslands or openings in coastal scrub on marine terraces or fractured shales at elevations of 150 to 1,000 feet
Gentner's Fritillary	*Fritillaria gentneri*	E	No	Edges of open woodland, chaparral or grasslands at elevations of 60 to 450 feet
Gowen Cypress	*Cupressus goveniana* ssp. *goveniana*	T	No	Mixed conifer forest and coastal chaparral
Greene's Tuctoria	*Tuctoria greenei*	E	Yes	Shallow vernal pools or margins of deeper pools on northern basalt flow or northern hard or clay pan substrates in pine forests and grasslands
Hairy Orcutt Grass	*Orcuttia pilosa*	E	Yes	Vernal pools or stream terraces in annual grasslands at elevations of 85 to 405 feet
Hartweg's Golden Sunburst	*Pseudobahia bahiifolia*	E	No	Non-native annual grassland and the grassland-blue oak woodland transition zone, often on north to northeast-facing small hills or Mima mounds associated with vernal pools
Hickman's Potentilla	*Potentilla hickmanii*	E	No	Seasonally wet coastal prairie or non-native annual grassland on fine sandy loam soils
Hidden Lake Bluecurls	*Trichostema austromontanum* ssp. *compactum*	T	No	Margin of a montane vernal pool and swale at 8,700 feet
Hoffmann's Rock-cress	*Arabis hoffmannii*	E	No	Protected areas on steep cliffs, volcanic cliff edges, or under nurse shrubs and trees that limit competition from other annual plant species
Hoffmann's Slender-flowered Gilia	*Gilia tenuiflora* ssp. *hoffmannii*	E	No	Open areas in stabilized sand dunes or dune scrub
Hoover's Spurge	*Chamaesyce hooveri*	T	Yes	Vernal pools on northern hard or clay pan substrates on alluvial fans or floodplain terraces

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Howell's Spineflower	*Chorizanthe howellii*	E	No	Near coastal foredunes and adjacent sandy coastal prairie at elevations ranging from sea level to 120 feet
Indian Knob Mountain Balm	*Eriodictyon altissimum*	E	No	Coastal maritime chaparral and oak woodland
Ione Buckwheat	*Eriogonum apricum*	E	No	On acidic, nutrient-poor, and coarse-textured soils derived from the Ione formation with sparse, low-growing shrubs and herbs, in barren areas with little other vegetation present, including disturbed areas such as clay pits, spoil piles, and abandoned roads
Ione Manzanita	*Arctostaphylos myrtifolia*	T	No	On acidic, nutrient-poor, and coarse-textured soils derived from the Ione formation with sparse, low-growing shrubs and herbs, dominant in chaparral or in patches in oak forest
Island Barberry	*Berberis pinnata* ssp. *insularis*	E	No	Shady, mesic, north-facing slopes in pine forest, oak woodland, and chaparral below 1,150 feet on Santa Cruz Island
Island Bedstraw	*Galium buxifolium*	E	No	North-facing sea cliffs and rocky slopes in pine forest and coastal sage scrub on Santa Cruz and San Miguel Islands
Island Malacothrix	*Malacothrix squalida*	E	No	Coastal scrub on bluffs or rocky canyon flats and slopes with shallow soils below 656 feet on Anacapa, San Miguel, Santa Rosa, and Santa Cruz Islands
Island Phacelia	*Phacelia insularis* ssp. *insularis*	E	No	Stabilized sand dunes in lupine-grassland on Santa Rosa and San Miguel Islands
Island Rush-rose	*Helianthemum greenei*	T	No	Open, exposed areas in chaparral, coastal sage scrub, and island pine forest on Santa Catalina, Santa Cruz, Santa Rosa, and San Miguel Islands

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Keck's Checker-mallow	*Sidalcea keckii*	E	Yes	On relatively open areas of grassy slopes with serpentine soils at elevations of 250 to 1,940 feet
Kenwood Marsh Checker-mallow	*Sidalcea oregana* ssp. *valida*	E	No	Freshwater marshes
Kern Mallow	*Eremalche kernensis*	E	No	Arid non-native grasslands, alkali saltscrub flats, eroded hillsides at lower elevations, and in juniper woodlands at elevations above 3,000 feet
Kneeland Prairie Penny-cress	*Thlaspi californicum*	E	Yes	On shallow, rocky, serpentine soils in coastal prairie from elevations of 2,700 to 2,800 feet
La Graciosa Thistle	*Cirsium loncholepis*	E	Yes	Back dunes and coastal wetlands around dune lakes or swales
Laguna Beach Liveforever	*Dudleya stolonifera*	T	No	Steep cliffs in canyons, on shaded, north-facing sandstone and breccia rock outcrops and slopes with mosses and lichens in coastal sage scrub or chaparral
Lake County Stonecrop	*Parvisedum leiocarpum*	E	No	Volcanic, often gravelly substrates in vernal pools, depressions in meadows or gravelly flats, and depressions in exposed bedrock adjacent to oak woodlands, chaparral, or grasslands at elevations of 1,700 to 2,600 feet
Lane Mountain Milk-vetch	*Astragalus jaegerianus*	E	Yes	Mixed creosote-white bursage desert scrub on shallow, granitic soils
Large-flowered Fiddleneck	*Amsinckia grandiflora*	E	Yes	Historically in native perennial bunchgrass communities, currently in non-native annual grassland on gentle, grassy slopes
Layne's Butterweed	*Senecio layneae*	T	No	Gabbro or serpentine soils in openings in dense chaparral
Loch Lomond Coyote Thistle	*Eryngium constancei*	E	No	Vernal pools and the shallow, seasonally inundated Loch Lomond

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Lompoc Yerba Santa	*Eriodictyon capitatum*	E	Yes	Disturbed areas in coastal maritime chaparral and coastal sage scrub or inland pine woodlands on Monterey shales
Lyon's Pentachaeta	*Pentachaeta lyonii*	E	Yes	In openings or pocket grasslands with low cover, rocky clay volcanic-derived soils, and macrobiotic crusts in a chaparral/coastal sage scrub mosaic on saddles, hilltops, knolls and flat areas at the base of slopes at elevations of 280 to 2,060 feet
Many-flowered Navarretia	*Navarretia leucocephala* ssp. *plieantha*	E	No	Vernal pools and lakes with volcanic ash substrates at elevations of 110 to 2,800 feet
Marcescent Dudleya	*Dudleya cymosa* ssp. *marcescens*	T	No	Sheer faces of volcanic outcrops and canyon walls adjacent to perennial streams in chaparral or coast live oak woodlands often with California bay
Marin Dwarf-flax	*Hesperolinon congestum*	T	No	Serpentine chaparral and bunchgrass grassland
Mariposa Pussypaws	*Calyptridium pulchellum*	T	No	Decomposed granitic soils, often in small barren areas southwestern foothills of the Sierra Nevada Mountains
Marsh Sandwort	*Arenaria paludicola*	E	No	Marshes and freshwater wetlands
McDonald's Rock-cress	*Arabis macdonaldiana*	E	No	Dry, open conifer woodlands or brushy slopes with serpentine soils below 5,900 feet
Menzies' Wallflower	*Erysimum menziesii*	E	No	Near shore sandy foredune systems
Metcalf Canyon Jewelflower	*Streptanthus albidus* ssp. *albidus*	E	No	Serpentine rock outcrops
Mexican Flannelbush	*Fremontodendron mexicanum*	E	Yes	Closed-cone conifer forests and mixed chaparral at elevations below 3,000 feet with metavolcanic soils along alluvial benches and canyon slopes associated with ephemeral drainages

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Monterey Clover	*Trifolium trichocalyx*	E	No	In openings in pine woodlands with loamy fine to coarse sandy soils; often a fire follower
Monterey Gilia	*Gilia tenuiflora* ssp. *arenaria*	E	No	Open but wind-protected sandy areas in dune scrub or maritime chaparral
Monterey Spineflower	*Chorizanthe pungens* var. *pungens*	T	Yes	Sandy soils in coastal dunes and openings and bare patches in coastal scrub, maritime chaparral and oak woodlands
Morro Manzanita	*Arctostaphylos morroensis*	T	No	Baywood fine sand soils in coastal dune scrub, maritime chaparral, and coastal live oak woodlands
Munz's Onion	*Allium munzii*	E	Yes	Mesic clay soils in grasslands or grassy openings in coastal sage scrub or juniper woodlands
Napa Bluegrass	*Poa napensis*	E	No	Alkaline meadows and grasslands with clay soils fed by sulphur hot springs and geysers
Nevin's Barberry	*Berberis nevinii*	E	Yes	Flat sandy washes, terraces, and canyon floors to gravelly wash margins, steep-sloped drainage banks, and steep rocky ridges, slopes, or mountain summits in chaparral, coastal sage scrub, oak woodland, riparian scrub/woodland, and alluvial scrub
Nipomo Mesa Lupine	*Lupinus nipomensis*	E	No	Pockets of bare sand in stabilized back dune areas in the Guadalupe-Nipomo Dunes
Orcutt's Spineflower	*Chorizanthe orcuttiana*	E	No	Weathered sandstone bluffs with sandy soils in openings of southern maritime chaparral
Otay Mesa-mint	*Pogogyne nudiuscula*	E	No	Vernal pools
Otay Tarplant	*Deinandra conjugens*	T	Yes	Clay soils on slopes and mesas, associated with grassland, open coastal sage scrub, or maritime succulent scrub

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Pallid Manzanita	*Arctostaphylos pallida*	T	No	In maritime chaparral vegetation at elevations of 656 to 1,460 feet, on thin, well-drained and nutrient-deficient soils in areas where summer fog occurs with high frequency
Palmate-bracted Bird's Beak	*Cordylanthus palmatus*	E	No	Seasonally-inundated saline-alkali soils in lowland flats and basins below elevations of 500 feet in Valley sink scrub or alkali meadows
Parish's Daisy	*Erigeron parishii*	T	Yes	Dry, rocky slopes, active washes and outwash plains pinyon and pinyon-juniper woodlands and blackbush scrub on carbonate substrates (limestone and/or dolomite) in the San Bernardino Mountains at 3,842 to 6,500 feet
Pedate Checker-mallow	*Sidalcea pedata*	E	No	On clay soils in seasonally moist meadows, sparsely vegetated drier meadow sites, and pebble plains dominated by basin sagebrush at elevations of 5,250 to 8,200 feet in the Big Bear Lake area
Peirson's Milk-vetch	*Astragalus magdalenae* var. *peirsonii*	T	Yes	Active windblown sand dune areas between active faces in bowls or shallow protected slopes of dunes
Pennell's Bird's-beak	*Cordylanthus tenuis* ssp. *capillaris*	E	No	Serpentine barrens associated with Sargent's cypress and Baker's manzanita
Pine Hill Ceanothus	*Ceanothus roderickii*	E	No	Gabbro soils in open areas of chaparral
Pine Hill Flannelbush	*Fremontodendron californicum* ssp. *decumbens*	E	No	Gabbro or serpentine soils in openings in dense chaparral
Pismo Clarkia	*Clarkia speciosa* ssp. *immaculata*	E	No	Grassy openings with sandy soils in chaparral and oak woodlands
Pitkin Marsh Lily	*Lilium pardalinum* ssp. *pitkinense*	E	No	Freshwater marshes, wet meadows and margins of willow riparian woodland with seasonally saturated sandy soils
Presidio Clarkia	*Clarkia franciscana*	E	No	Serpentine grassland

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Presidio Manzanita	*Arctostaphylos hookeri* var. *ravenii*	E	No	Serpentine maritime chaparral-coastal prairie
Purple Amole	*Chlorogalum purpureum*	T	Yes	On undisturbed clay soils and soil crusts of lichens, algae, mosses, and cyanobacteria among grassland, oak savanna, and oak woodland
Red Hills Vervain	*Verbena californica*	T	No	Margins of perennial streams and in other moist habitats in serpentine areas of the Red Hills
Robust Spineflower	*Chorizanthe robusta* var. *robusta*	E	Yes	Dunes or openings in coastal scrub, grassland, maritime chaparral, or oak woodlands in near-shore coastal and near coastal areas with sandy soils
Sacramento Orcutt Grass	*Orcuttia viscida*	E	Yes	Vernal pools on high stream terraces in oak woodland and annual grassland communities at elevations ranging from 150 to 270 feet
Salt Marsh Bird's-beak	*Cordylanthus maritimus* ssp. *maritimus*	E	No	Saline marshes in the upper middle littoral or high marsh zones
San Benito Evening-primrose	*Camissonia benitensis*	T	No	Flat to gently sloping alluvial terraces or adjacent alluvial outwash slopes at elevations below 4,500 feet less than 25 percent cover by chaparral species
San Bernardino Bluegrass	*Poa atropurpurea*	E	Yes	Along the drier margins of seasonally wet meadows
San Bernardino Mountains Bladderpod	*Physaria (Lesquerella) kingii* ssp. *bernardina*	E	Yes	In single-leaf pinyon-mountain juniper and white fir forest on dolomite soils with gentle to moderate slopes
San Clemente Island Bush-mallow	*Malacothamnus clementinus*	E	No	Generally on southwesterly-facing coastal terraces and escarpments on San Clemente Island
San Clemente Island Indian Paintbrush	*Castilleja grisea*	T	No	Steep, rocky canyons and coastal bluffs, slopes, and terraces across the southern two-thirds of San Clemente Island

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
San Clemente Island Larkspur	*Delphinium variegatum* ssp. *kinkiense*	E	No	Gently sloping open grassy terraces with northwest, north, and east exposures, at elevations ranging from 260 to 840 feet, on the east coast of the northern and central portions of San Clemente Island
San Clemente Island Lotus	*Acmispon dendroideus* var. *traskiae*	T	No	Open, north-facing slopes, ridgelines, and canyon bottoms, often associated with rock outcrops and boulders in grassy areas and in open sites near the ocean, at elevations of 25 to 1,400 feet on San Clemente Island
San Clemente Island Woodland-star	*Lithophragma maximum*	E	No	Deeply incised canyons on the eastern escarpment of southern San Clemente Island
San Diego Ambrosia	*Ambrosia pumila*	E	Yes	Upper terraces of rivers and drainages in open grassland and openings in coastal sage scrub
San Diego Button-celery	*Eryngium aristulatum* var. *parishii*	E	No	Vernal pools on clay soils
San Diego Mesa-mint	*Pogogyne abramsii*	E	No	Vernal pools
San Diego Thornmint	*Acanthomintha ilicifolia*	T	Yes	Openings in coastal sage scrub, chaparral, and native coastal grassland in areas with heavy clay soils that are loose and crumbly in texture, including gabbro-derived soils
San Francisco Lessingia	*Lessingia germanorum*	E	No	Openings in coastal dune scrub on remnant sand dunes and sand terraces or similarly sparsely vegetated coastal sand deposits with blowing sand, at elevations of 80 to 300 feet
San Jacinto Valley Crownscale	*Atriplex coronata* var. *notatior*	E	No	Seasonally inundated highly alkaline-saline, silty clays in alkali sink scrub, alkali playas, vernal pools and alkali annual grasslands at elevations of 100 to 2,500 feet

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
San Joaquin Adobe Sunburst	*Pseudobahia peirsonii*	T	No	Heavy clay or adobe-colored soils in non-native grassland and the grassland-blue oak woodland transition zone in level or gently sloping areas between low hills at elevations of 400 and 2,600 feet
San Joaquin Orcutt Grass	*Orcuttia inaequalis*	T	Yes	Deep vernal pools and vernal lakes on alluvial fans, stream terraces, and tabletop lava flows
San Joaquin Wooly-threads	*Monolopia congdonii*	E	No	Non-native grasslands and open areas in saltbush scrub communities on alluvial sand, sandy loams or silts
San Mateo Thornmint	*Acanthomintha obovata* ssp. *duttonii*	E	No	Serpentine heavy clay soils of chaparral, valley, and foothill grasslands
San Mateo Woolly Sunflower	*Eriophyllum latilobum*	E	No	Steep, grassy or sparsely wooded slopes in coast live oak woodland with mesic, shaded sites on serpentine or other soils
Santa Ana River Wooly-star	*Eriastrum densifolium* ssp. *santorum*	E	No	Open, well-lit areas along sandy alluvial terraces with infrequent flooding, often with persistent shrublands
Santa Barbara Island Liveforever	*Dudleya traskiae*	E	No	Steep xeric cliffs with shallow rocky soils in maritime cactus shrub and the sea cliff phase of coastal bluff communities
Santa Clara Valley Dudleya	*Dudleya setchellii*	E	No	Rocky outcrops in serpentine grasslands at elevations of 300 to 900 feet
Santa Cruz Cypress	*Cupressus abramsiana*	T	No	Dry ridges above the fog belt on poorly developed, well-drained, sandy or gravelly soils in a mosaic of coastal chaparral and mixed evergreen forest at elevations of 1,000 to 2,550 feet
Santa Cruz Island Bush-mallow	*Malacothamnus fasciculatus* var. *nesioticus*	E	No	Rocky, south-facing slopes in chaparral and coastal scrub on Santa Cruz Island
Santa Cruz Island Dudleya	*Dudleya nesiotica*	T	No	Low marine terrace in coastal scrub and grassland on Santa Cruz Island

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Santa Cruz Island Fringepod	*Thysanocarpus conchuliferus*	E	No	Rocky outcrops on ridges and canyon slopes on Santa Cruz Island
Santa Cruz Island Malacothrix	*Malacothrix indecora*	E	No	Open rocky areas with shallow soils along coastal bluffs on the edge of vegetated habitat on Anacarpa and Santa Cruz Islands
Santa Cruz Island Rockcress	*Sibara filifolia*	E	No	Generally found in open areas along dry rocky ridgelines in coastal prickly pear scrub or desert thorn shrubland, but found in diverse habitats on San Clemente, Santa Catalina, and historically on Santa Cruz islands
Santa Cruz Tarplant	*Holocarpha macradenia*	T	Yes	Sandy clay alluvium on coastal terraces in coastal grassland and prairie
Santa Monica Mountains Dudleyea	*Dudleya cymosa* ssp. *ovatifolia*	T	No	Shaded slopes and canyon bottoms on sedimentary or conglomerate rock in chaparral or coastal scrub, with one form being found volcanic outcrops or gravels in chaparral and coast live oak or California juniper woodlands
Santa Rosa Island Manzanita	*Arctostaphylos confertiflora*	E	No	Slopes above sandstone outcrops and on sedimentary soils derived from shale and volcanic substrates, in mixed chaparral, mixed woodland, Torrey pine and island pine woodlands on Santa Rosa Island
Scotts Valley Polygonum	*Polygonum hickmanii*	E	Yes	Level to gently sloping meadows and grasslands with thin, fine-textured soils over mudstone or sandstone bedrock at 700 to800 feet of elevation
Scotts Valley Spineflower	*Chorizanthe robusta* var. *hartwegii*	E	Yes	Meadows and grasslands on thin soils or scree over sandstone or mudstone bedrock
Sebastopol Meadowfoam	*Limnanthes vinculans*	E	No	Vernal pools and seasonally wet swales and wet meadows

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Showy Indian Clover	*Trifolium amoenum*	E	No	Various habitats, but generally in open, low wet swales, open grassy hillsides, and grasslands
Slender Orcutt Grass	*Orcuttia tenuis*	T	Yes	Vernal pools with volcanic ashflow or mudflow substrates and other natural and man-made wetland systems at elevations of 90 to 1,756 feet in oak woodlands, grasslands, and mixed conifer forests
Slender-horned Spineflower	*Dodecahema leptoceras*	E	No	Alluvial benches and terraces in the foothills of the Transverse and Peninsular ranges at elevations of 656 to 2,296 feet in scalebroom alluvial scrub, openings in chaparral, coastal live oak, or western sycamore woodlands
Slender-petaled Mustard	*Thelypodium stenopetalum*	E	No	On clay soils in seasonally moist meadows, alkaline flats and lakeshores, and pebble plains dominated by basin sagebrush, at elevations of 5,250 to 8,200 feet in the Big Bear Valley
Soft Bird's-beak	*Cordylanthus mollis* ssp. *mollis*	E	Yes	In the upper middle or high marsh zones of coastal tidal and brackish marshes
Soft-leaved Paintbrush	*Castilleja mollis*	E	No	coastal bluff scrub with host plant (goldenbush) on Santa Rosa Island
Solano Grass	*Tuctoria mucronata*	E	Yes	Alkali vernal pools, alkaline playas, and intermittent lakes in annual grasslands
Sonoma Alopecurus	*Alopecurus aequalis* var. *sonomensis*	E	No	Freshwater marshes, swamps, and riparian shrub lands
Sonoma Spineflower	*Chorizanthe valida*	E	No	Sandy coastal prairie
Sonoma Sunshine	*Blennosperma bakeri*	E	No	Shallow vernal pools, grassy swales, and seasonally wet grasslands
Southern Mountain Wild-buckwheat	*Eriogonum kennedyi* var. *austromontanum*	T	Yes	Montane pebble plains

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Spreading Navarretia	*Navarretia fossalis*	T	Yes	Vernal pools on clay soils, in artificial depressions in disturbed vernal pool habitat subject to similar vernal inundations, in alkali annual grasslands, and in alkali playas
Springville Clarkia	*Clarkia springvillensis*	T	No	Openings and roadsides in blue oak woodlands on granitic soils at 1,200 to 3,000 feet
Stebbins' Morning-glory	*Calystegia stebbinsii*	E	No	Gabbro or serpentine soils in openings in dense chaparral
Suisun Thistle	*Cirsium hydrophilum* var. *hydrophilum*	E	Yes	Freshwater-influenced upper tidal marsh plain and infrequently flooded banks of tidal creeks, ditches, and marsh edges in organic peaty soils
Thread-leaved Brodiaea	*Brodiaea filifolia*	T	Yes	Grasslands, herbaceous plant communities, openings in coastal sage scrub on gently sloping hills, valleys, and floodplains on clay, alkaline silty-clay or alkaline soils, clay lenses within loamy sand, silty loam, silty deposits with cobbles, and vernal wetlands with clay hardpans
Tiburon Jewelflower	*Streptanthus niger*	E	No	Shallow rocky serpentine soils on slopes of the southern Tiburon Peninsula at elevations around 300 feet
Tiburon Mariposa Lily	*Calochortus tiburonensis*	T	No	Rocky serpentine soils and in open areas of serpentine bunch grass at elevations around 460 feet on Ring Mountain
Tiburon Paintbrush	*Castilleja affinis* ssp. *neglecta*	E	No	North and west facing slopes in serpentine bunchgrass at elevations of 250 to 1,300 feet

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Triple-ribbed Milk-vetch	*Astragalus tricarinatus*	E	No	Sonoran-Mojave desert transition zone at elevations of 1,300 to 4,000 feet on disturbed ridgetops or disturbed soils within washes or the base of canyon scree slopes
Vail Lake Ceanothus	*Ceanothus ophiochilus*	T	Yes	Gabbro or mixed gabbro-sedimentary soils in areas of dense chaparral, often on ridge tops
Vandenberg Monkeyflower	*Mimulus fremontii* var. *vandenbergensis*	E	Yes	In sandy openings between shrubs in maritime chaparral mixed with coastal scrub, oak woodland, or small patches of native grasslands on Burton Mesa
Ventura Marsh Milk-vetch	*Astragalus pycnostachyus* var. *lanosissimus*	E	Yes	Low-elevation coastal dune swales
Verity's Dudleya	*Dudleya verityi*	T	No	Coastal sage scrub, in a narrow band with Conejo volcanic rock outcrops in the region around Conejo Mountain
Vine Hill Clarkia	*Clarkia imbricata*	E	No	Acidic sandy grasslands in the Sonoma Barrens
Water Howellia	*Howellia aquatilis*	T	No	Seasonally inundated wetlands formed by glacial potholes often surrounded by deciduous forest
Webber Ivesia	*Ivesia webberi*	T	Yes	Seasonally moist, rocky, clay soils in the transition zone between the Sierra Nevada Mountains and the Great Basin Desert
Western Lily	*Lilium occidentale*	E	No	Near the ocean in coastal prairie and scrub areas, freshwater fens, the periphery and transition zones of bogs, and spruce forests, on deep organic peats that are saturated much of the year
White Sedge	*Carex albida*	E	No	Fens, freshwater marshes and swamps, seeps, and moist meadows
White-rayed Pentachaeta	*Pentachaeta bellidiflora*	E	No	Serpentine grasslands
Willowy Monardella	*Monardella viminea*	E	Yes	In and along sandy bottoms and banks of ephemeral washes in canyons with coastal sage scrub and riparian scrub

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in California	Habitat Description
Yadon's Piperia	*Piperia yadonii*	E	Yes	Well-drained but mesic sandy soils in maritime chaparral and Monterey pine forests
Yellow Larkspur	*Delphinium luteum*	E	Yes	Moderate to steep rocky slopes with some disturbance in open coastal prairie or coastal scrub at sea level to 300 feet
Yreka Phlox	*Phlox hirsuta*	E	No	Serpentine soils in Jeffrey pine-incense cedar forest at elevations of 2,800 to 4,400 feet

Sources: (CDFW, 2016a) (USFWS, 2016de)

[a] E = Endangered, T = Threatened

Amargosa Niterwort. The Amargosa niterwort (*Nitrophila mohavensis*) is a member of the goosefoot family (*Chenopodiaceae*) endemic to eastern California and Ash Meadows in Nye County, Nevada. It is a small, perennial, rhizomatous[116] species, which rarely exceeds four inches in height (USFWS, 1990). It was federally listed as endangered and afforded critical habitat in 1985 (50 FR 20777 20794, May 20, 1985). Critical habitat for this species includes approximately 1,300 acres of land in Nevada and California (USFWS, 2015db).

There are two known populations of the Amargosa niterwort in eastern California and three populations in Ash Meadows, Nevada, with a total of 56 acres of estimated occupied habitat. While population trends for the species are unknown, the largest population (in Lower Carson Slough, California) is believed to be decreasing in size (USFWS, 2007l). Habitat for the species is limited to alkaline, salt encrusted, clay soils in wetland areas of harsh desert environments. Being tolerant of high levels of salt and alkali in soils, it is often the only species occupying this habitat. It grows in large root colonies and produces small flowers in the late spring. The species is particularly sensitive to ground disturbance due to its delicate habitat requirements (USFWS, 1990). The primary threat to the species is human caused habitat alteration in several varieties: direct disturbance or draining of wetlands for mining activities, altered sedimentation from nearby roads, off-highway vehicle usage, and soil compaction from feral horses (USFWS, 1990) (USFWS, 2007l).

Antioch Dunes Evening-Primrose. Antioch Dunes evening-primrose (*Oenothera deltoides ssp. howellii*) is a short-lived perennial herb in the evening-primrose family. It forms spreading clusters with many-branched stems up to 4 feet long. Leaves are hairy and narrowly lance-shaped, between 1 to 5 inches long and 0.4 to 1.2 inches wide. Large, white flowers with four petals and bright yellow stamens open in the evenings and close in midmorning (USFWS,

[116] Rhizome: "a prostrate [root-like] underground stem or branch…" (Weber & Wittmann 2012); rhizomatous – a plant with rhizomes.

2008e). Bloom time is March to September (USFWS, 2008e). The fruit is an elongated capsule.[117]

The subspecies was listed as endangered in 1978 (43 FR 17910 17916, 26 April 1978). It is endemic to the Antioch Dunes in Contra Costa County and has been introduced into Sacramento and Alameda Counties (USFWS, 2008e) (USFWS, 2015dc). Critical habitat was designated in 1978 (43 FR 39042 39044, 31 August 1978) in Contra Costa County.

Antioch Dunes evening-primrose occurs on riverine sand dunes. Threats to the subspecies include agricultural and industrial development, airborne gypsum from industrial activities, unauthorized pedestrian traffic, trampling, wildfires, competition with non-native invasive plants, insect pest predation, and random catastrophic events due to restricted distribution, narrow habitat requirement, and small population size (USFWS, 2008e).

Applegate's Milk-vetch. Applegate's milk-vetch (*Astragalus applegatei*) "is a taprooted, herbaceous, perennial plant. The numerous tufted or trailing stems are 2.5-8 decimeters (10-33 inches) long, simple or branching, and may be smooth or have sparse stiff, short hairs. Leaves are 3.5-12 centimeters (1.5-5 inches) long, are on petioles, and have 7-1 1 linear to linear-elliptic flat leaflets, the terminal one usually the longest. Racemes[118] typically bear 5-20 pea-like flowers with lavender-tipped white petals. The 8-13 millimeters (0.4-0.6 inches) long, stalked fruit pods are oblong, compressed, have short hairs and frequently have green or purple speckled valves." (USFWS, 1998l) (Oregon Department of Agriculture, 2015)

Applegate's milkvetch was federally listed as endangered in 1993 (58 FR 40547 40551, July 28, 1993). No critical habitat has been designated for this species. It is found in Siskiyou County (USFWS, 1998l). Habitat for Applegate's milkvetch "occurs in flat-lying, seasonally moist, strongly alkaline soils dominated by greasewood (*Sarcobatus vermiculatus*) with sparse, native bunch grasses and patches of bare soil" (USFWS, 2009r).

Ash-grey Paintbrush. Ash-grey paintbrush (*Castilleja cinerea*) is a hairy perennial herb in the broomrape family. It is a hemi-parasite,[119] and host plants for ash-grey paintbrush include several species of buckwheat (*Eriogonum spp*.) and sagebrush (*Artemisia spp*.) (USFWS, 2013i). It grows with several upright to trailing hairy grayish green stems to about 8 inches tall. Blooming time is from June to August, and the fruit is a capsule. The flowering portion of the plant is at the end of the stems, and appears a greenish-yellow (occasionally reddish-orange tinged) due to showy, petal-like bracts[120] an inch or so long at the base of each flower; the flowers themselves are relatively nondescript (USFWS, 2013i).

The species was listed as threatened in 1998 (63 FR 49006 49022, 14 September 1998) with 1,769 acres of critical habitat being designated in 2007 (72 FR 73092 73178, 26 December

[117] Capsule: "a dry, dehiscent [opening at maturity] fruit composed of more than one carpel" a carpel is the basic reproductive unit of the pistil, and is interpreted as a single ancestral "inrolled spore-bearing leaf" (Oregon Department of Agriculture, 2015).
[118] Raceme: "an elongated inflorescence with a single main axis along which single, stalked flowers are arranged" (Oregon Department of Agriculture, 2015).
[119] Hemi-parasite: a plant that is parasitic on a host plant but also possesses chlorophyll and photosynthesizes to some degree.
[120] Bract: "a leaf from the axil of which a flower or floral axis arises" (Merriam Webster Dictionary, 2016e).

2007). It is endemic to the San Bernardino Mountains of San Bernardino County in southern California (USFWS, 2015dd).

Ash-grey paintbrush grows on montane pebble plains,[121] forest meadows, mixed conifer forest and pinyon-juniper woodlands (USFWS, 2013i). Threats to the species include habitat loss, fragmentation or degradation due to residential or commercial development, utility construction and maintenance, recreation (trampling by hikers, horseback or off-highway vehicle use, and road/trail development and maintenance), grazing and trampling by livestock, alteration of hydrology, competition with non-native species, mining, and alteration of habitat due to climate change (USFWS, 2013i).

Baker's Larkspur. Baker's larkspur (*Delphinium bakeri*) is a perennial herb in the buttercup family. Plants grow from clusters of thickened, tuber-like[122] fleshy roots. Stems are hollow and erect and grow to over two feet tall. Leaves are shallowly five-lobed and are mostly on the upper third of the stem. Flowers appear on short stalks on the leafless top of the stem. Each flower has five large, blue, showy sepals, with one modified into an almost inch-long, rearward projecting spur, and two pairs of small, almost inconspicuous petals, the upper pair being white and the lower blue. Bloom time is April to May. Fruit consists of three to five short, curved, many-seeded pods (USFWS, 2013j).

The species was listed as endangered in 2000 (65 FR 4156 4162, 26 January 2000) and critical habitat was designated in 2003 (68 FR 12834 12863, 18 March 2003). It is known from mostly coastal locations in Marin and Sonoma Counties (USFWS, 2015de).

Baker's larkspur occurs on decomposed shale in mixed woodlands at 400 to 500 ASL. Threats to the species include habitat loss and degradation, competition with non-native invasive species, road construction and maintenance, overcollection, habitat alteration due to climate change, random catastrophic events due to restricted distribution, narrow habitat requirement, and small population size (USFWS, 2013j).

Bakersfield Cactus. Bakersfield cactus (*Opuntia treleasei* or *Opuntia basilaris* var. *treleasei*) is a low-growing prickly-pear or beavertail cactus. Stems are flattened, roughly oval, heart-shaped or cylindrical succulent pads 3 to 4 inches wide and 5 to 7 inches long; clumps may be over one foot high and spread over 30 feet, and may consist of a number of individuals. The surface of the pad is dotted with eyelike areoles,[123] which are flush with numerous short bristles and quarter-inch long spines. Flowers are mangenta and large, and include many petals. Bloom time is April to May. The fruit is a bristly, egg-shaped fleshy berry (USFWS, 1998a) (USFWS, 2011ae).

The species was listed as endangered in 1990 (55 FR 29361 29370, 19 July 1990) and no critical habitat has been proposed (USFWS, 2015df). It is endemic to Kern County at the southern end of the San Joaquin Valley in southern California (USFWS, 1998a).

[121] Pebble plains are montane treeless open areas on clay soils covered by quartzite pebbles that represent the remnant erosional surface of a Pleistocene lake bed; in California, these are limited to the San Bernardino Mountains of southern California.
[122] Tuber: "a fleshy underground stem, as in potato…" (USFWS, 2015de).
[123] Areole: "in cacti, the point at which a cluster of spines originates…" (USFWS, 2011n).

Bakersfield cactus grows in clumps or large colonies on sandy to sandy loam soils (often with gravels, cobbles and boulders) on open "floodplains, ridges, bluffs and rolling hills" in saltbrush scrub and woodlands (USFWS, 2011ae). Threats to the species include habitat loss and degradation due to residential and commercial development, agricultural conversion, road construction and maintenance, utility construction and maintenance, oil and gas exploration and development, sand mining, off-highway vehicle use, flood control measures and maintenance, herbicide use, competition with non-native invasive species and related changes in fire frequency, air pollution, habitat alteration due to climate change, random catastrophic events due to restricted distribution, narrow habitat requirement, and small population size (USFWS, 1998a) (USFWS, 2011ae).

Beach Layia. Beach layia (*Layia carnosa*) is a succulent annual herb in the sunflower family. Plants grow to about 6 inches tall, but can spread to over 16 inches across. Stems can be simple or highly branched. The narrowly ovate fleshy stem leaves are crowded along the stem, and are sticky due to glands on the surface; leaves at the base of stem are larger with rounded teeth. Cup-shaped daisy-like flowering heads terminate the stems and are less than a half inch tall. 4 to 10 white 3-lobed ray florets[124] (less than 0.16 inches long each) surround a yellow center of 5 to 45 tiny disk florets with purple anthers. Bloom time is April to July. The fruit of each floret is a tiny sunflower-like "seed" topped by feather-like bristles (Baldwin & Bainbridge, Layia carnosa, 2014) (USFWS, 1998m). The species was listed as endangered in 1992 (57 FR 27848 27859, 22 June 1992) and no critical habitat has been proposed (USFWS, 2015dg). It is known from coastal California in Humboldt, Marin, Monterey and Santa Barbara Counties (USFWS, 2011n).

Beach layia occurs in openings in coastal near-shore sand dunes from sea level to about 100 ASL. The species is threatened by habitat loss or modification due to residential or commercial development, trampling by hikers, livestock or equestrians, off-highway vehicles, over-stabilization of dune habitat, encroachment by non-native invasive species, dangers from random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change (USFWS, 1998m) (USFWS, 2011n).

Bear Valley Sandwort. Bear Valley sandwort (*Arenaria ursina* or *Eremogene ursina*) is a low growing clumped perennial herb in the pink family. Stems grow 2 to 6 inches tall. Leaves are very narrow and threadlike, up to a half inch long. Stem leaves grow opposite of each other. Flowers occur in open clusters at the end of the stem. Flowers are white, about a quarter inch across, with 5 petals. Bloom time is May to August (USFWS, 2015dh). According to USFWS, "The seeds of *E. ursina* are flat, reticulate, measure 2 millimeters (mm) (0.079 in) long, remain

[124] Floret: "a small flower…" (USFWS, 2011n); this term is typically used for the highly reduced and specialized flowers found in members of the sunflower family, grasses, and sedges. In the sunflower family, three kinds of florets can be found – those with longer, showy strap-shaped petals (ray and ligulate florets; these are the "petals" of the daisy) and those with much smaller, not showy at all petals (disk florets – the center of the sunflower or daisy). What most people think of as the "flower" is actually an aggregate of several to many florets grouped in a head, and specific to the species, heads can be composed of all ray/ligulate florets (like a dandelion or chicory) ray/ligulate florets and disk florets (sunflowers, daisies), or all disk florets (most thistles). In the wind-pollinated grasses and sedges, the flowers are reduced to just the reproductive parts (pistils and stamens) and various kinds of small bracts or other structures that are so small and unremarkable that most people do not realize these plants have flowers.

in open erect capsules for up to 2 months, and can bounce out of the capsule in a strong wind." (USFWS, 2015dh)

The species was listed as threatened in 1998 (63 FR 49006 49022, 14 September 1998) with 1,412 acres of critical habitat being designated in 2007 (72 FR 73092 73178, 26 December 2007). It is endemic to the San Bernardino Mountains of San Bernardino County in southern California (USFWS, 2015di).

Bear Valley sandwort grows on montane pebble plains and associated dry slopes. Threats to the species include habitat loss, fragmentation or degradation due to residential or commercial development, recreation development and maintenance (roads and trails), utility construction and maintenance, recreation (trampling by hikers, horseback or off-highway vehicle use), grazing and trampling by livestock, alteration of hydrology, competition with non-native species, mining, fire suppression activities, and alteration of habitat due to climate change. (USFWS, 2015dh)

Ben Lomond Spineflower. Ben Lomond spineflower (*Chorizanthe pungens* var. *hartwegiana*) is a grayish, hairy annual herb in the buckwheat family. Leaves form a basal rosette at the base of the stem, with leaves being up to 2 inches long and wider near the tip. Wiry stems branch from the base, spreading up to 20 inches across and up to 10 inches tall. Small (less than 0.25 inches long) pink flowers are surrounded by 6 hooked spines each. Flowers appear in small ball-like clusters. Bloom time is April to May. The fruit is an elliptic, three-angled seed (USFWS, 1998j) (USFWS, 2012n).

The variety was listed as endangered in 1994 (59 FR 5499 5510, 4 February 1994) and no critical habitat has been proposed (USFWS, 2015dj). It is endemic to the Zayante Sandhills in the Santa Cruz Mountains (USFWS, 2012n).

Ben Lomond spineflower occurs on sandy, well-drained soils in open areas of sandhill communities from 295 to 2,000 feet in elevation. Threats to the variety include habitat loss and degradation due to residential and commercial development, sand mining, agricultural conversion of natural lands, trampling by hikers, equestrians, bicyclists, and livestock, off-highway vehicles, competition with non-native invasive species, ecological succession due to altered fire cycles, air pollution (nitrification), dangers from random catastrophic or climatic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change (USFWS, 1998j) (USFWS, 2012n).

Ben Lomond Wallflower. Ben Lomond wallflower (*Erysimum teretifolium*) is a biennial (rarely annual) herb in the mustard family. Stems rise from a basal rosette of narrowly linear leaves that wither as the plant begins to flower; stem leaves are also narrowly linear. Flowers are on short stalks that are arranged along most of the length of the stem, but may appear clustered at the terminal end as the plant grows through the season. Each flower has four deep yellow petals up to one inch long. Bloom time is March to July. The fruit is a long, thin capsule up to 4 inches long, covered in hairs with three arm-like rays. (USFWS, 1998j) (USFWS, 2008g)

The species was listed as endangered in 1994 (59 FR 5499 5510, 4 February 1994) and no critical habitat has been proposed (USFWS, 2015dk). It is endemic to the Zayante Sandhills in the Santa Cruz Mountains (USFWS, 1998j).

Ben Lomond wallflower occurs in pockets of sandstone-derived soils in open areas in sand parkland or northern maritime chaparral. Threats to the species include habitat loss and degradation due to residential and commercial development, sand mining, agricultural conversion of natural lands, trampling by hikers, equestrians, bicyclists, and livestock, off-highway vehicles, sandboarding, competition with non-native invasive species, ecological succession due to altered fire cycles, herbivory by small mammal species, and dangers from random catastrophic or climatic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 1998j) (USFWS, 2008g)

Big-leaved Crownbeard. Big-leaved crownbeard (*Verbesina dissita*) is a perennial subshrub[125] in the sunflower family. Plants grow from 1.5 to 3.5 feet tall, and can spread by rhizomes. Leaves have many short, stubbly hairs that make them rough to the touch, are ovate in outline, and arranged opposite on the stem. The upper stem branches freely, with bowl-shaped daisy-like flowering heads terminating the leafless branches. Heads have 10 to 12 or more bright yellow ray florets surrounding a center of 60 to 150 yellow disk florets with brown anthers. Bloom time is April to July. The fruit is a small sunflower-like winged seed with two small awl-like scales (awns) at the top. (Keil, 2014) (USFWS, 2010n)

The species was listed as threatened in 1996 (61 FR 52370 52384, 7 October 1996) and no critical habitat has been proposed (USFWS, 2015dl). It is commonly found in Laguna Beach (USFWS, 2010n).

Big-leaved crownbeard is found in rugged coastal canyons on San Onofre breccia-derived gravelly soils (soils weathered from breccia, a sedimentary parent rock formed of angular fragments cemented in a fine-grained matrix of other material) in dense southern maritime chaparral or to limited extents in other coastal vegetation communities. Threats to the species include habitat loss due to residential and commercial development, disruption of natural fire cycles, prescribed fuel modification for fire prevention (e.g., vegetation thinning, fire breaks, disking, mowing), encroachment and competition with non-native invasive species, habitat alteration due to climate change, and dangers from random catastrophic or climatic events due to restricted distribution, narrow habitat requirements, and small population size (USFWS, 2010n).

Braunton's Milk-vetch. Braunton's milk-vetch (*Astragalus brauntonii*) is a short-lived perennial herb in the pea family. It grows up to 5 feet tall with stems rising from a thick taproot and woody crown. Stems appear white due to a dense covering of wooly hairs. The compound leaves range from 1.5 to 6.5 inches long, with 25 to 33 oblong-ovate, pale to greenish abruptly-pointed leaflets. Flowers are a typical pea-type flower on short stalks, and are light purple, with 35 to 60 clustered in the last 1.5 to 5.5 inches of stems and branches. Bloom time is January to August. The fruit is an ovoid, slightly curved bean pod 2.5 to 3.5 inches long with 3 to 6 seeds (USFWS, 1999c) (USFWS, 2009bo).

The species was listed as endangered in 1997 (62 FR 4172 4183, 29 January 1997) and 3,300 acres of critical habitat was designated in 2006 (71 FR 66374 66423, 14 November 2006). It is

[125] Subshrub: a perennial plant that has annual herbaceous growth rising from a woody root and crown, typically dying back to the crown each year or becoming somewhat woody on persisting older growth.

known from the mountains surrounding the Los Angeles Basin in Los Angeles, Orange, and Ventura Counties (USFWS, 2009bo).

Braunton's milk-vetch is found on limestone outcrops and knolls with shallow calcium-carbonate soils, and in chaparral and coastal sage scrub communities at elevations ranging from 800 to 2,100 feet ASL. Threats to the species include habitat loss, fragmentation or degradation due to residential and commercial development, loss of pollinators and associated species, disruption of natural fire cycles, prescribed fuel modification for fire prevention (e.g., vegetation thinning, fire breaks, disking, mowing), fire suppression activities, land management activities (e.g., mowing, herbicide and pesticide application, livestock grazing), encroachment and competition with non-native invasive species, recreational activities (e.g., off-highway vehicles, equestrian activities), habitat alteration due to climate change, and dangers from genetic drift and random catastrophic or climatic events due to restricted distribution, narrow habitat requirements, and small population size. (USFWS, 1999c) (USFWS, 2009bo)

Burke's Goldfields. Burke's goldfields (*Lasthenia burkei*) is an annual herb in the sunflower family. Plants are typically less than 1 foot tall, but may reach 2 feet. Stems are slender and branched, with narrow leaves (up to 3 inches long) attached oppositely along the stem. Daisy-like yellow half inch wide flowering heads terminate the branches, with 8 to 13 small, notched-at-the-tips ray florets surrounding a center with many disk florets. Bloom time is April to June. The fruit of each floret is a small sunflower-like seed with one or rarely two long bristles and several small-scales on top (USFWS, 2008h) (USFWS, 2014n).

The species was listed as endangered in 1991 (56 FR 61173 61182, 2 December 1991) and no critical habitat has been proposed (USFWS, 2015dm). It is known from vernal pools in the Cotati Valley of Sonoma County and from southern Mendocino and Lake Counties (USFWS, 2014n).

Burke's goldfields inhabits vernal pools and seasonally inundated swales and wet meadows. Threats to the species include habitat loss, fragmentation, and degradation due to residential and commercial development, agricultural conversion of natural lands, grazing and trampling by livestock, competition from non-native invasive species, alteration of hydrology, summer irrigation with wastewater, off-highway vehicles, thatch buildup, road construction and maintenance (grading, mowing, and herbicide application), dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2008h) (USFWS, 2014n)

Butte County Meadowfoam. Butte County or Shippee meadowfoam (*Limnanthes floccosa* ssp. *californica*) is a densely hairy annual herb of the false mermaid family. Stems grow to 10 inches long, trailing along the ground with ascending tips; plants are less than 10 inches tall. Stem leaves are compound with long stalks and 5 to 11 narrowly ovate to egg-shaped leaflets. Cup- and bowl-shaped flowers rise on long stalks from the upper leaf axils, and are fragrant, with five white notched petals with dark yellow veins; each petal is 0.3 to 0.4 inches long and hairy at the base. Bloom time is March through April, with plants dying by early May. The fruit of each flower is 1 to 5 tiny egg-shaped, warty nutlets. (USFWS, 2006d) (USFWS, 2008i)

The subspecies was listed as endangered in 1992 (57 FR 24192 24199, 8 June 1992). Critical habitat was designated in 2003 (68 FR 46684 46867, 6 August 2003) with re-evaluations of non-economic and economic exclusions in 2005 (70 FR 11140, 8 March 2005; 70 FR 46924 46999, 11 August 2005), and administrative revisions in 2006 (71 FR 7118 7316, 10 February 2006). The subspecies grows along the northeastern side of the Sacramento Valley in Butte County of north central California (USFWS, 2006d).

Butte County meadowfoam is found in vernal swales and "the margins of vernal pools … on alluvial terraces in annual grasslands with mima mound topography." Threats to the subspecies include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, alteration of hydrology, road widening and realignment, grazing and trampling by livestock, competition from non-native invasive species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, off-highway vehicles), loss of pollinators, dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2008i)

California Jewelflower. California jewelflower (*Caulanthus californicus*) is an annual herb in the mustard family. One to several hairless branching stems grow to less than two feet tall from a basal rosette of oblong, wavy-toothed leaves. Stem leaves are egg- or heart-shaped and clasp the stem. Flowers on short, drooping stalks top the stem, and have four white petals tipped with purple or green. Bloom time is February to May. The fruit is a "sword-shaped," curved, flattened pod to 2.5 inches long and a quarter inch wide. (USFWS, 1998a) (USFWS, 2013k)

The species was listed as endangered in 1990 (55 FR 29361 29370, 19 July 1990) and no critical habitat has been proposed (USFWS, 2015dn). It was historically widespread in the San Joaquin Valley and associated foothills in Kings, Fresno, Tulare, and Kern Counties, the Carrizo Plain in San Luis Obispo County, and the Cuyama Valley in Santa Barbara and Ventura Counties east of the Sierra Nevada in south central California (USFWS, 1998a).

California jewelflower currently inhabits non-native annual grassland, shrub, and juniper woodland communities (USFWS, 1998a) (USFWS, 2013k). Threats to the species include habitat loss and degradation due to residential and commercial development, agricultural conversion, grazing and trampling by livestock, oil and gas exploration and development, off-highway vehicle use, mining, utility construction and maintenance (including solar power development), competition with non-native invasive species and related changes in fire frequency, herbicide and insecticide use, air pollution (nitrification), habitat alteration due to climate change, and random catastrophic events due to restricted distribution, narrow habitat requirement, and small population size. (USFWS, 1998a) (USFWS, 2013k)

California Orcutt Grass. California Orcutt grass (*Orcuttia californica*) is a small, semi-aquatic clumped annual C_4[126] grass. Plants germinate underwater, forming a rosette of five to eight

[126] C_4 is an alternate photosynthetic pathway that utilizes a different enzyme to fix carbon from airborne CO_2, and is an adaptation to more extreme conditions such as high temperatures, high intensity light, and low water or CO_2 availability. C4

cylindrical juvenile leaves. Intermediate leaves are produced as the pool warms, and have a cylindrical submerged portion and a flat, floating blade. Once the pool has evaporated, multiple pith-filled upright stems up to about four inches tall rise from a common fibrous root system and produce the flattened terrestrial leaves, with the lower portion folding around the stem. Plants are bright grayish-green due to a sparse covering of long, soft hairs, and produce an aromatic, sticky exudate. The top third of each stem is terminated by a head-like cluster of two dense, compact rows of 7 to 10 groups (spikelets[127]) of 5 to 15 or more florets; spikelets are more crowded toward the tip. Each floret lacks petals and sepals, and is enclosed in a pair of small bracts. The most prominent of the bracts is usually less than 0.2 inches long and deeply cleft (about half the length of the bract) into five awl-like teeth, with the middle one prominently longer than the others. Bloom time is May to July. The fruit of each floret is a grain. (USFWS, 2006d) (USFWS, 1998k) (USFWS, 2011o)

The species was listed as endangered in 1993 (58 FR 41384 41392, 3 August 1993). No critical habitat has been proposed (USFWS, 2016dj). It is known to occur in Ventura, Los Angeles, Riverside, and San Diego Counties of southern California and historically from the adjacent state of Baja California, Mexico (USFWS, 2011o).

California Orcutt grass is found in deep vernal pools. Threats to the species include habitat loss, fragmentation and degradation due to urban and agricultural development, livestock grazing and trampling, trampling by humans, road construction and maintenance, mowing or plowing, off-highway vehicle use, competition with non-native invasive plants, watershed or drainage alterations, military activities, trash dumping, fire and fire suppression activities, drought and alteration of habitat due to climate change, and dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirement, and small population size. (USFWS, 1998k) (USFWS, 2011o)

California Seablite. California seablite (*Suaeda californica*) is a subshrub in the goosefoot family. It is somewhat spreading or mound-forming, growing to at least 2 feet tall, and spreading to 6 or 7 feet across. Leaves are linear or somewhat needle-like, a pale to bluish green, and up to about 1.5 inches long. They are densely crowded along the stem. The small (0.3 inch) flowers occur in clusters of 1 to 3 (rarely 5) at the base of the leaves, with the middle terminal flower typically producing both pollen and seed and the smaller lateral flowers producing only seed. (USFWS, 2014b)

The species was listed as endangered in 1994 (59 FR 64613 64623, 15 December 1994) but critical habitat has not been proposed (USFWS, 2016i). It occurs in six counties of the north central California coast from Morro Bay to San Francisco Bay (USFWS, 2014b).

California seablite is found in the high tidal marsh zone of estuary sand beaches or sandy tidal marsh habitats. Threats to the species include habitat fragmentation, degradation and alteration

grass is a perennial grasses that uses the C4 pathways to capture carbon dioxide during photosynthesis. All species have the more basic C3 pathway, but the additional C4 pathway evolved in species in the wet and dry tropics.

[127] Spikelet: "(in grasses and sedges) the smallest unbranched flower cluster in an inflorescence, usually forming a distinct and compact unit" (Williams, 1987) in grasses, a spikelet typically consists of two small bracts (glumes) subtending one or more florets along an axis, with each floret typically having two small bracts (the palea and lemma), a pistil and/or stamens.

from earlier marsh filling or dredging associated with dike-building and industrial, agricultural or residential development, competition with non-native invasive species, changes in salinity or freshwater inputs, trampling associated with human recreation, crude oil or refined petroleum spills, dredging of navigable waterways, sea level rise and other habitat alteration associated with global climate change, and the genetic dangers and susceptibility to random catastrophic events due to small population size, restricted distribution, and narrow habitat requirements. (USFWS, 2014b)

California Taraxacum. California taraxacum (*Taraxacum californicum*) is a perennial herb in the sunflower family. It grows from a thick taproot, with leaves that grow in a light green basal rosette, are wider at the tip, about 2 to 5 inches long and 0.4 to 1.2 inches wide, with smooth to wavy-toothed edges. Flowers grow in short cylindrical dandelion-like heads on leafless stalks (USFWS, 2013l). Flowering heads contain 20 to 150 petal-like ray florets. Bloom time is May to August. Fruit is a dandelion-like seed.

The species was listed as endangered in 1998 (63 FR 49006 49022, 14 September 1998) with 1,914 acres of critical habitat being designated in 2008 (73 FR 47706 47767, 14 August 2008). It is endemic to the San Bernardino Mountains of San Bernardino County in southern California (USFWS, 2015do).

California taraxacum occurs in the open, drier margins of seasonally moist meadows and open flats along perennial streams at 5,300 to 9,000 feet (USFWS, 2013l). Threats to the species include habitat loss, fragmentation or degradation due to residential or commercial development, recreation development and maintenance (roads and trails), utility construction and maintenance, recreation (trampling by hikers, equestrians or off-highway vehicle use), grazing and trampling by livestock, alteration of hydrology, competition with non-native species, hybridization with other species, mining, fire suppression activities, alteration of habitat due to climate change, and random catastrophic events due to restricted distribution, narrow habitat requirement, and small population size (USFWS, 2013l).

Calistoga Allocarya. Calistoga allocarya (*Plagiobothrys strictus*) is an annual herb in the borage family. It grows erect from about 4 to 15 inches tall, as a single stem or branching from the base. Stem and leaves are essentially without hairs. Lower leaves are narrow, linear, and 1.5 to 4 inches long. Small five-lobed white flowers usually appear at the end of the stem in pairs. Bloom time is March to April. The fruit of each flower has four tiny egg-shaped nutlets only 0.06 of an inch long (USFWS, 2010o).

The species was listed as endangered in 1997 (62 FR 54791 54808, 22 October 1997). No critical habitat has been proposed (USFWS, 2015dp). It is known from two locations in Napa County totaling less than acre in extent, and historically from adjacent Sonoma and Lake Counties, inland from the north central coast of California (USFWS, 2010o).

Callistoga allocarya occurs on alkaline flats and grasslands with clay soils fed by pools and swales near sulphur hot springs and geysers. Threats to the species include recreational activities (hiking), residential and commercial development, road construction and maintenance, landscape maintenance (mowing), random catastrophic events due to restricted distribution, narrow habitat

requirement and small population size, alterations to hydrology that affect the hot springs and geysers, non-native invasive plant species, and alterations to habitat resulting from climate change (USFWS, 2010o).

Catalina Island Mountain-mahogany. Catalina Island mountain-mahogany (*Cercocarpus traskiae*) is an evergreen shrub or small tree in the rose family that can reach up to 15 feet tall. Its leaves are leathery, clustered along the stems, with toothed margins, and range from 1 to 2.5 inches long (USFWS, 1997d). The leaves are densely woolly on the undersides, while the upper surfaces are smooth. Catalina Island mountain-mahogany blooms from March to May, with flowers in clusters that lack petals with woolly white bases (USFWS, 1997d). The fruit is a single-seeded achene[128] with a long, feathery style that dries in a spiral (USFWS, 1997d).

This species was listed as endangered in 1997 (62 FR 42692 42702, 8 August 1997) and no critical habitat has been designated (USFWS, 2016j). This plant is known to occur naturally only in Wild Boar Gully, a steep-sided narrow arroyo on the southwestern coast of Santa Catalina Island, one of the Channel Islands of southern California. Within the gully, these mountain-mahogany plants are typically found on steep slopes and near drainage bottoms, at elevations ranging from 430 to 700 feet ASL. Major threats to this species include competition with exotic plant species and, to a lesser extent, overgrazing by non-native mammals, as well as dangers from random events such as fires, landslides, or disease given the extremely small population size. (USFWS, 2007m)

Chinese Camp Brodiaea. Chinese Camp brodiaea (*Brodiaea pallida*) is an erect perennial herb in the false onion family. It grows from an underground, bulb-like corm[129] and is reaches 4 to 12 inches tall. The basal, succulent leaves are long and narrow. Flowering occurs between May and June when umbrella-like terminal clusters of lilac to purple flowers appear. (CDFW, 2014a) (USFWS, 2010p) (USFWS, 1998n)

The species was listed as endangered in 1998 (63 FR 49022 49035, 14 September 1998). Only five populations are known in Tolumne and Calaveras Counties. No critical habitat has been designated for this species (USFWS, 2010p) (CDFW, 2014a) (USFWS, 1998n).

Chinese Camp brodiaea is found growing in a rare, wet serpentine-derived clay habitat including overflow channels, seeps, springs, and intermittent creek beds. Primary threats to the species include urban development, poor regulatory mechanisms, small range, and small population. (USFWS, 2010p) (CDFW, 2014a) (USFWS, 1998n).

Chorro Creek Bog Thistle. Chorro Creek bog thistle (*Cirsium fontinale* var. *obispoense*) is a short-lived perennial herb in the sunflower family. First year plants form a single rosette that can reach 3.3 ft. in diameter, with a tall branching stalk that can reach up to 6.6 feet in height during the second or third year. Numerous white to lavender-pink flowering nodding heads are

[128] Achene: "a small, dry, indehiscent [not opening at maturity], one-loculed, one-seeded fruit [derived] from a single carpel; in Asteraceae [the sunflower family] it is derived from two carpels" [though technically, this is not an achene, but a cypsela; the sunflower "seed" is an example, where the seed is surrounded by the fruit coat]

[129] Corm: "enlarged fleshy base of a stem, bulb-like but solid" as opposed to a bulb, in which "…as in onions…[the] spherical structure consists mostly of [fleshy] scales" (Williams, 1987)

produced. Glandular hairs on the leaves and flower heads distinguish this from similar thistle species (USFWS, 2016k) (USFWS, 1994e) (CDFW, 2013b).

The species was listed as endangered in 1994 (9 FR 64613 64623, 15 December 1994). It is endemic to San Luis Obispo County in California, with nine populations known to exist. No critical habitat has been designated for this species (CDFW, 2013b) (USFWS, 2016k) (USFWS, 1994e).

Chorro Creek bog thistle is restricted to open seeps on serpentine soils. Primary threats to the species include trampling from cattle, proposed water diversions, road maintenance, drought conditions, and competition from invasive plants. (CDFW, 2013b) (USFWS, 1994e) (USFWS, 2016k).

Clara Hunt's Milk-vetch. Clara Hunt's milk-vetch (*Astragalus clarianus*) is an annual herb in the pea family. It is typically low growing, to about 8 inches tall. Stems can be single or may branch from the base, with relatively few leaves. Leaves alternate along the stems and branches, and are up to 2.5 inches long. Leaves are compound and composed of five to nine small oblong leaflets that are notched at the tip and less than a half-inch long. Flowers are a small white pea-type flower tipped by purple, and are clustered at the end of flowering stems. Bloom time is March to April. The fruit is a short linear bean pod, which has a slight curve and is pointed at both ends. (USFWS, 2009s)

The species was listed as endangered in 1997 (62 FR 54791 54808, 22 October 1997). No critical habitat has been proposed (USFWS, 2015dq). It is known from five localities in Napa and Sonoma Counties just inland from the north central coast of California (USFWS, 2009s).

Clara Hunt's milk-vetch occurs on "thin, rocky clay soils derived from volcanic or serpentine substrates in grasslands and openings in whiteleaf manzita [*Arctostaphylos manzanita*]-blue oak [*Quercus douglasii*] woodlands" (USFWS, 2009s). Threats to the species include recreational activities (hiking), residential and commercial development, road construction and maintenance, agricultural conversion (viticulture), reservoir expansion and maintenance, rooting by feral pigs, invasive plant species, fire suppression that allows encroachment by woody species, alterations to habitat resulting from climate change, and random catastrophic events due to restricted distribution, narrow habitat requirement, and small population size (USFWS, 2009s).

Clover Lupine. Clover lupine or Tidestrom's lupine (*Lupinus tidestromii*) is a creeping, perennial herb in the pea family. Exposed roots are a bright yellow in some populations. Multiple stems arise from the roots, trailing on the ground but rising from 4 to 12 inches at the tips. Stems and leaves have short, silky hairs. Leaves are on long stalks, and are compound with three to five narrow leaflets arranged in a fan-shape. Blue to lavender or purple pea-type flowers form in whorled clusters terminating the last 2.5 to 4 inches of stem. Bloom time is May to June. Fruit is a shaggy, hairy bean pod less than an inch long (USFWS, 2009t) (USFWS, 1998m) (Sholars, 2014).

The species was listed as endangered in 1992 (57 FR 27848 27859, 22 June 1992) and no critical habitat has been proposed (USFWS, 2015dr). It is found in dune habitats in Marin, Monterey, and Sonoma Counties of coastal California (USFWS, 2009t).

Clover lupine is found in partially-stabilized dune communities. The species is threatened by habitat loss or modification due to residential or commercial development, trampling by hikers, livestock or equestrians, herbivory by small mammals, over-stabilization of dune habitat, encroachment by non-native invasive species, dangers from random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change (USFWS, 1998m) (USFWS, 2009t).

Coachella Valley Milk-vetch. Coachella Valley milk-vetch (*Astragalus lentiginosus* var. *coachellae*) is an upright winter annual or short-lived perennial plant in the pea family. This variety generally grows 8 to 12 inches tall, with fern-like divided leaves and the entire plant is covered in white-silky hairs (USFWS, 1998o). Blooming occurs from February to May, with pink-purple flowers that are loosely to densely clustered along the floral stem that develop into inflated pods (USFWS, 1998o) (Wojciechowski & Spellenberg, 2016a).

This variety was listed as endangered in 1998 (63 FR 53596 53615, 6 October 1998). Critical habitat was designated in 2013 (78 FR 10449 10497, 13 February 2013) in Riverside County (USFWS, 2013b).

Coachella Valley milk-vetch is found on loose wind-blown or water transported sands, sand dunes or flats in the Coachella Valley (USFWS, 1998o) (USFWS, 2009u). Major threats to this variety include habitat alteration or destruction from urbanization, off-highway vehicle use, and competition with non-native plants (USFWS, 2009u).

Coastal Dunes Milk-vetch. Coastal dunes milk-vetch (*Astragalus tener* var. *titi*) is an annual herb in the pea family. Stems typically reach 0.8 to 4.7 inches in natural environments, and are slightly pubescent. Leaves (0.8 to 2.7 inches long) grow from several places on the stalk with 7 to 11 leaflets with slightly bilobed tips and narrow leaf bases. Plants have 2 to 12 clusters of lavender to purple flowers (0.3 inches) (USFWS, 2004d). Flowers bloom between March and May (Calflora, 2016a). Plants may have one to numerous branches with up to 60 seed pods (USFWS, 2004d).

The variety was listed as endangered in 1998 (63 FR 43100 43116, 12 August 1998). Critical habitat has not been designated. Coastal dunes milk-vetch has historically been found in Monterey, San Diego, and Los Angeles Counties (Calflora, 2016a). The population in Los Angeles County has not been documented since 1903 and the San Diego County population has not been documented since 1983. In Monterey County, one population of the variety persists on Pebble Beach Company and Monterey Peninsula Country Club property (USFWS, 2004d).

Coastal dunes milk-vetch historically occurred in seasonal wetlands next to coastal terrace grasslands. The only known extant population of the species is located in loamy fine sand on a flat, coastal terrace, 100 feet from the ocean. Habitat is seasonally flooded during winter and spring. Individuals prefer the bottom or sides of wetland swales with herbaceous vegetation no more than 4 to 6 inches tall. The variety tolerates low-levels of disturbance from light pedestrian traffic and gophers. Threats to the variety include urbanization, coastal military activity, recreation altering and destroying habitat, non-native plant species competition, grass mowing for fire suppression, hydrology modifications, consumption by native and non-native wildlife,

fertilizers and pesticides from nearby golf courses, and naturally-occurring variation in populations (USFWS, 2004d).

Colusa Grass. Colusa grass (*Neostapfia colusana*) is a small, semi-aquatic clumped annual C_4 grass. Plants germinate underwater, with one or two cylindrical juvenile leaves. As the pool dries, multiple pith-filled trailing to upright stems ranging from 4 to 12 inches long rise with a characteristic zigzag growth pattern from a common fibrous root system. Plants are pale green when young, but produce an aromatic exudate that turns brown over the growing season giving the mature plant a brownish appearance. Flattened terrestrial leaves about 2 to 4 inches long form along the stem, with the lower portion folding around the stem. Each stem is terminated by a very dense, compact cylindrical cluster (0.8 to 3 inches long and up to a 0.5 inches wide) of spirally arranged groups (spikelets) of five florets, with the tip of the stem projecting beyond. Each floret lacks petals and sepals, and is enclosed in a pair of small bracts, the most prominent of which is less than 0.2 inch long, fan-shaped, and translucent with 7 to 11 green veins. Bloom time is May to August. The fruit of each floret is a grain. (USFWS, 2006d) (USFWS, 2008j)

The species was listed as threatened in 1997 (62 FR 14338 14352, 26 March 1997). Critical habitat was designated in 2003 (68 FR 46684 46867, 6 August 2003) with re-evaluations of non-economic and economic exclusions in 2005 (70 FR 11140, 8 March 2005; 70 FR 46924 46999, 11 August 2005) and administrative revisions in 2006 (71 FR 7118 7316, 10 February 2006). It occurs in the Sacramento and San Joaquin valleys in Yolo, Solano, Merced, and Stanislaus Counties and historically from Colusa County of north central California (USFWS, 2006d).

Colusa grass is usually found in single species stands on the margins of seasonally inundated alkali basins, acidic alluvial fans, intermittent stream terraces, and in vernal pools and lakes, from 18 to 350 feet ASL. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, alteration of hydrology, road widening and realignment, overgrazing and trampling by livestock, exclusion of grazing by livestock, competition from non-native invasive species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, off-highway vehicles), dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements, small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2008j)

Conejo Dudleya. Conejo dudleya (*Dudleya abramsii* ssp. *parva, or D. parva*) is a succulent perennial herb in the stonecrop family. The roots are constricted at regular intervals along their length, with "rhizome-like branches." It forms a basal rosette of fleshy, narrowly oblanceolate leaves with pointed tips (0.6 to 1.6 inches long and 0.1 to 0.2 inch wide) that wither by early summer. Fleshy flowering stems rise to 7 inches tall, are often reddish with small fleshy, leaf-like bracts, and topped with pale yellow-green five-lobed flowers often flecked with red. Bloom time is May to June. The fruit of each flower consists of five many-seeded pods. (USFWS, 1999c) (USFWS, 2015ds)

The subspecies was listed as threatened in 1997 (62 FR 4172 4183, 29 January 1997) and no critical habitat has been proposed (USFWS, 2015dt). It is known from the western Simi Hills to the Conejo Grade in Ventura County of southern California (USFWS, 2015ds).

Conejo dudleya is found on shallow, thin soils on outcrops of Conejo formation volcanic rock in grassland and "cactus-dominated coastal sage scrub" communities. Threats to the subspecies include habitat loss, fragmentation or degradation due to residential and commercial development, prescribed fuel modification for fire prevention (e.g., vegetation thinning, fire breaks, disking, mowing), fire suppression activities, encroachment and competition with non-native invasive species, recreational activities (e.g., off-highway vehicles, hiking, mountain biking, rock climbing, equestrians), collection by commercial and private enthusiasts, habitat alteration due to climate change, and dangers from genetic drift and random catastrophic or climatic events due to restricted distribution, narrow habitat requirements, and small population size. (USFWS, 1999c) (USFWS, 2015ds)

Contra Costa Goldfields. Contra Costa goldfields (*Lasthenia conjugens*) is an annual herb in the sunflower family. Plants are typically less than a foot tall. Stems are slender and branched, with narrow linear leaves (up to 3 inches long) attached oppositely along the stem. Upper leaves often have one or two pairs of narrow lobes. Yellow, half inch wide daisy-like flowering heads terminate the branches, with 6 to 13 small, notched-at-the-tips ray florets and many disk florets. The leaf-like bracts that form the cup of each head are fused from one-quarter to half their length to neighboring bracts. Bloom time is March to June. The fruit of each floret is a small club-shaped sunflower-like seed. (USFWS, 2006d) (USFWS, 2013n)

The species was listed as endangered in 1997 (62 FR 33029 33038, 18 June 1997). Critical habitat was designated in 2003 (68 FR 46684 46867, 6 August 2003) with re-evaluations of non-economic and economic exclusions in 2005 (70 FR 11140, 8 March 2005; 70 FR 46924 46999, 11 August 2005) and administrative revisions in 2006 (71 FR 7118 7316, 10 February 2006). It is known from 10 counties of coastal north central California (USFWS, 2006d).

Contra Costa goldfields occur in vernal pools, swales, and depressions, in open grassy woodlands and valley grasslands. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, alteration of hydrology, road widening and realignment, competition from non-native invasive species, recreational uses (hiking, mountain biking, equestrians, off-highway vehicles), overgrazing and trampling by livestock, elimination of grazing by livestock, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, loss of pollinators, dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements, small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2013n)

Contra Costa Wallflower. Contra Costa wallflower (*Erysimum capitatum* var. *angustatum*) is a biennial or short-lived perennial subshrub in the mustard family. The stem is unbranched and grows erect from 6 to 18 inches tall. The narrowly lance-shaped leaves are toothed along the edges, and are clustered at the base in a rosette. Under magnification, leaves have short T-shaped hairs. Flowers are on short stalks in loose clusters at the tip of stem, with four yellow-

orange petals. Bloom time is March to June. The fruit of each flower is a narrow, linear pod. (USFWS, 2008e)

The variety was listed as endangered in 1978 (43 FR 17910 17916, 26 April 1978). It is endemic to the Antioch Dunes from Contra Costa County in north central California (USFWS, 2008e) (USFWS, 2015du). Critical habitat was designated in 1978 (43 FR 39042 39044, 31 Aug 1978) in Contra Costa County.

Contra Costa wallflower grows in a variety of conditions in sand and sandy loams in riverine dunes, including stabilized dunes, broken hard pan areas, river bluffs, and excavated flats. Threats to the variety include agricultural and industrial development, airborne gypsum from industrial activities, unauthorized pedestrian traffic, trampling, and wildfires, competition with non-native invasive plants, insect pest predation, and random catastrophic events due to restricted distribution, narrow habitat requirements, and small population size. (USFWS, 2008e)

Coyote Ceanothus. Coyote ceanothus (*Ceanothus ferrisae*) is an evergreen shrub in the buckthorn family. The erect shrub grows 3 to 6 feet high with long divergent branches. Leaves are dark green, round, and have hairs on the undersides, but are hairless on the upper surfaces. Leaf margins often have short teeth. Small white flowers appear from January to March and are present in clusters up to an inch long. Seed capsules can be up to 0.35 inches long and have three apical horns (USFWS, 1995b) (USFWS, 2009v) (USFWS, 2016l).

The coyote ceanothus was listed as endangered in 1995 (60 FR 6671 6685, 3 February 1995). The shrub is endemic to Santa Clara County in California. To date, no critical habitat has been designated for the species (USFWS, 1995b) (USFWS, 2009v) (USFWS, 2016l).

Coyote ceanothus prefers to grow on dry slopes in serpentine chaparral, and valley and foothill grasslands at approximately 1,000 feet ASL. Currently, the species is only known to exist in three locations: Anderson Dam, Kirby Canyon, and Llagas Avenue north of Morgan Hill, all located in Santa Clara County within 4 miles of one another. Threats to the species includes altered fire regime, dumping, landfill activities, development, lack of natural recruitment, and grazing. (USFWS, 1995b) (USFWS, 2009v) (USFWS, 2016l).

Cushenbury Buckwheat. Cushenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*) is a low-growing perennial in the buckwheat family that grows in a dense, mat-like form. Leaves have white-woolly hairs and are round to ovate in shape; the plants grow as mats from 6 to 10 inches or greater in diameter. Flowering stalks grow to about 4 inches long, topped by globe-like heads of densely clustered, small flowers that are whitish-cream in color, darkening to reddish or purple with age (USFWS, 2009w).

This variety was listed as endangered in 1994 (59 FR 43652 43664, 24 August 1994) and critical habitat was established in 2002 (67 FR 78570 78610, 24 December 2002) in San Bernardino County, north and east of Big Bear Lake (USFWS, 2016m). This plant is known only to occur in the San Bernardino Mountains of southern California (USFWS, 2009w).

Limestone, dolomite, or a mix of these soils types is an important habitat component, and these "carbonate" soils occur as a belt along the northern edge of the San Bernardino Mountains. Cushenbury buckwheat typically grows in areas with little vegetation cover or accumulation or

organic material, often in powdery fine soils and substantial rock cover. Associated vegetation includes pinyon woodland, pinyon-juniper woodland, Joshua tree woodland, and blackbush scrub vegetation, most often on north- or west-facing slopes between 4,600 and 7,900 feet elevation. Major threats to this variety include habitat modification as a result of mining, off-road vehicle use, energy development projects, fire suppression activities, and the effects of global climate change as well as dangers from random events such as drought and fire due to the small population size. (USFWS, 2009w)

Cushenbury Milk-vetch. Cushenbury milk-vetch (*Astragalus albens*) is a small, silvery-white perennial plant in the pea family that grows in a spreading fashion rather than upright, with slender stems about 12 inches long. Purple flowers appear toward the ends of branches, and bloom from March to May, maturing into slender pods. Leaves are divided into five to nine small leaflets that tend to have cobwebby hairs and are folded along the middle. (USFWS, 1994a)

This species was listed as endangered in 1994 (59 FR 43652 43664, 24 August 1994) and critical habitat was established in 2002 (67 FR 78570 78610, 24 December 2002) in San Bernardino County, in southern California, northeast of Big Bear Lake (USFWS, 2016n). This plant is known only to occur in the San Bernardino Mountains of southern California (USFWS, 2009x).

Cushenbury milk-vetch is found along rocky washes and gentle to moderate slopes with open canopies and a high percentage of rock cover in pinyon-juniper or Joshua tree woodlands and blackbrush scrub. Limestone, dolomite, or a mix of these soils types is an important habitat component for this species. These "carbonate" soils occur as a belt along the northern edge of the San Bernardino Mountains. Major threats to this species occur as a result of habitat alteration from mining, off-road vehicle use, fire suppression activities, and effects associated with climate change. (USFWS, 2009x)

Cushenbury Oxytheca. Cushbenbury oxytheca (*Oxytheca parishii* var. *goodmaniana* or *Acanthocyphus parishii* var. *goodmaniana*) is a small, wiry annual plant in the buckwheat family that grows to a height of 2 to 12 inches. Leaves are about 0.4 to 1.2 inches long, growing from a basal rosette. Flowers occur in clusters of 3 to 20 total flowers, and consist of small white to rose or greenish-yellow petals. (USFWS, 2009y)

This variety was listed as endangered in 1994 (59 FR 43652 43664, 24 August 1994) and critical habitat was established in 2002 (67 FR 78570 78610, 24 December 2002) in San Bernardino County, north and east of Big Bear Lake (USFWS, 2016o). This plant is endemic to the San Bernardino Mountains. Cushenbury oxytheca is restricted primarily to carbonate derived soils in the San Bernardino Mountains (USFWS, 2009y).

This variety typically occurs in open canopy areas with minimal organic ground litter and gentle slopes, ranging in elevation from 4,724 to 7,782 feet ASL. Cushenbury oxytheca is generally associated with pinyon-juniper and canyon live oak woodlands. Major threats to this species include mining, off-road vehicle use, energy development projects, and fire suppression, as well as dangers from random events including climate change. (USFWS, 2009y)

Del Mar Manzanita. Del Mar manzanita (*Arctostaphylos glandulosa* ssp. *crassifolia*) is a shrub in the heath family. It is a relatively open, red-barked shrub that grows erect with multiple stems from a root burl[130] to 3 to 4 feet tall. The thick, leathery roughly ovate leaves have a short stalk and are a dark gray-green; they are hairless on top but with scattered long, wooly hairs and bristles on the underside. The urn-shaped white or pink flowers hang upside down on short stalks at the end of larger branches on short, condensed branchlets that have scattered wooly hairs. Bloom time is December to June, depending on rainfall. The fruit of each flower is a berry or drupe a little larger than a quarter inch in diameter, with an average of six seeds. (USFWS, 2010q)

The subspecies was listed as endangered in 1996 (61 FR 52370 52384, 7 October 1996) and no critical habitat has been proposed (USFWS, 2015dv). Within California, it is limited in distribution to coastal San Diego County (USFWS, 2010q).

Del Mar manzanita occurs on sandstone terraces and bluffs in southern maritime chaparral or other coastal scrub or chaparral communities. Threats to the subspecies include habitat loss or modification due to residential and commercial development, prescribed fuel modification for fire prevention (e.g., vegetation thinning, fire breaks, disking, mowing), disruption of natural fire cycles (including ecological succession due to fire suppression), encroachment and competition with non-native invasive species, human access and disturbance (e.g., trail creation, waste dumping, vandalism, itinerant encampments), military training activities, habitat alteration due to climate change, and dangers from genetic drift and random catastrophic or climatic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 2010q)

El Dorado Bedstraw. El Dorado bedstraw (*Galium californicum* ssp. *sierrae*) is an herbaceous perennial plant in the coffee family. It is covered in soft hairs that grows to about 3 to 5.5 inches tall. The stems are slender, weak, and 4-angled, with 4 narrow leaves arranged opposite of each other along the stem. Flowers are small, pale yellow, and clustered at the tips of stems, blooming in May and June. (Soza, Valeri, 2016a) (USFWS, 2002h).

This subspecies was listed as endangered in 1996 (61 FR 54346 54358, 18 October 1996), and no critical habitat has been established (USFWS, 2016p). It is restricted to Pine Hill and surrounding ridges in western El Dorado County, in the north-central portion of the state (USFWS, 1996c) (USFWS, 2002h).

A primary habitat component is gabbro soil, which are soils derived from a type of dark large-crystalled rock formed when liquid magma cools slowly underground and results in a red soil as it is weathered away at the earth's surface. El Dorado bedstraw grows among oak woodland vegetation that can also include ponderosa pine and gray pine. Major threats to this subspecies include habitat alteration through residential development, road construction, grazing and trampling by horses, as well as increased risk of random environmental events presented by the isolated populations and low total number of individuals. (USFWS, 1996c)

[130] Burl: in trees and shrubs, a knotted, woody growth in which the grain is deformed and irregular, most often noted on trucks or branches; root burls on some manzanita (*Arctostaphylos spp.*) are thought to be an adaptation to frequent low intensity fire in chaparral or coastal sage scrub communities.

Encinitas Baccharis. Encinitas baccharis (*Baccharis vanessae*) is a shrub in the sunflower family. It has a broom-like habit with multiple thin stems rising erect to 4.3 feet tall. Leaves are thread-like, and up to almost two inches long. Flowers are white and tiny, with 15 to 22 small florets crowded into small cylindrical heads. Individual plants will bear either male (staminate) or female (pistillate) florets. Bloom time is August to November. The fruit of each pistillate floret is a tiny sunflower-like seed topped by bristles. (USFWS, 2011p)

The species was listed as endangered in 1996 (61 FR 52370 52384, 7 October 1996) and no critical habitat has been proposed (USFWS, 2015dw). It is endemic to San Diego County in southern California (USFWS, 2011p).

Encinitas baccharis occurs in chaparral brushlands below 3,000 feet. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, prescribed fuel modification for fire prevention (e.g., vegetation thinning, fire breaks, disking, mowing), disruption of natural fire cycles (including ecological succession due to fire suppression), encroachment and competition with non-native invasive species, recreational development and activities, habitat alteration due to climate change, and dangers from genetic drift and random catastrophic or climatic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 2011p)

Eureka Dune Grass. Eureka dune grass or Eureka Valley dunegrass (*Swallenia alexandrae*) is a coarse hummock-forming perennial grass. It has a dense root system that catches and holds drifting sand, forming stable hummocks. Stems may root at the nodes, allowing new stems to rise as older stems are buried under shifting sands. Stems rise from 0.5 to 4 feet tall, and have stiff, lanceolate, sharply pointed leaf blades that range from 1 to 5 inches long. Flowering occurs from April to June in a compact, dense branching inflorescence. (USFWS, 1978) (USFWS, 1982b) (USFWS, 2016dk)

Eureka dune grass was listed as endangered in 1978 (43 FR 17910 179, 26 April 1978). It only occurs in dune systems in the southern Eureka Valley in Death Valley National Park, Inyo County, in the northern reaches of the Mojave Desert. No critical habitat has been designated (USFWS, 1978) (USFWS, 1982b) (USFWS, 2016dk).

This species occurs in deep sand from the base of sand dunes to near the dune crest. The primary threat to this species is damage from off-road vehicle use (USFWS, 1978) (USFWS, 1982b) (USFWS, 2016dk).

Eureka Valley Evening-primrose. Eureka Valley evening-primrose (*Oenothera avita* ssp. *eurekensis* or *O. californica* ssp. *eurekensis*) is a perennial herb in the evening primrose family. This subspecies is well-adapted to life in shifting sands, and can develop new rosettes from buried stem nodes. Plants persist as a small rosette, but with sufficient rainfall, fleshy stems elongate rapidly up to 3 feet tall. Four showy, white, heart-shaped petals are open fully in the early evening to early morning hours. (USFWS, 1978) (USFWS, 1982b) (USFWS, 2016r)

The species was listed as endangered in 1978 (43 FR 17910 179, 26 April 1978). It only occurs in dune systems in the southern Eureka Valley in Death Valley National Park, Inyo County, in

the northern reaches of the Mojave Desert. No critical habitat has been designated (USFWS, 1978) (USFWS, 1982b) (USFWS, 2016r).

Eureka Valley evening-primrose is restricted to the shallower sands at the dune border and does not occur on the slopes of the dunes. The primary threat to this species is damage from off-road vehicle use (USFWS, 1978) (USFWS, 1982b) (USFWS, 2016r).

Few-flowered Navarretia. Few-flowered navarretia (*Navarretia leucocephala* ssp. *pauciflora* or *N. pauciflora*) is an annual herb in the phlox family. Plants are many branched and spreading, growing only to less than two inches tall and twice as wide. Stems are white with purple streaks and few hairs. Leaves are linear, usually between one-half to one inch long, and sometimes have a few narrow, linear lobes; they are arranged alternately along the stems. Dense flowering heads with 2 to 20 blue or white (fading to blue) flowers terminate stems. Heads are generally less than a half inch (0.16 to 0.39 inches) across, and below each head are several spiny bracts that are 1.5 to 3 times longer than the radius of the head. Much smaller bracts are below each flower in the head. The petals of the flower are fused into a funnel-shaped tube about 0.2 to 0.3 inches long, with five linear lobes with a single vein. Bloom time is May to June. The fruit of each flower is an egg-shaped, papery capsule with one or two tiny seeds. (USFWS, 2006d) (USFWS, 2008k)

The subspecies was listed as endangered in 1997 (62 FR 33029 33038, 18 June 1997). No critical habitat has been proposed (USFWS, 2016s). It grows in southern Lake and Napa Counties of north central California (USFWS, 2006d).

Few-flowered navarretia are found in vernal pools on volcanic substrates in chaparral, grassland or marsh communities at elevations of 1,460 to 2,320 feet. Threats to the subspecies include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, alteration of hydrology, road widening and realignment, overgrazing and trampling by livestock, exclusion of grazing by livestock, competition from non-native invasive species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, off-highway vehicles), loss of pollinators, dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2008k)

Fish Slough Milk-vetch. Fish Slough milk-vetch (*Astragalus lentiginosus* var. *piscinensis*) is a low-ground herbaceous perennial plant, with stems that grow up to 3 feet long and covered in stiff hairs, in the pea family. This variety has fern-like leaflets and flowers that are arranged in loose clusters, with lavender flowers blooming during June and July. The mature fruit is an inflated papery pod, covered in dense stiff rough hairs. (USFWS, 1998o) (Wojciechowski & Spellenberg, 2016b)

This variety was listed as threatened in 1998 (63 FR 53596 53615, 6 October 1998) and critical habitat was established in 2005 (70 FR 33774 33795, 9 June 2005) in Mono and Inyo Counties (USFWS, 2005d) (USFWS, 2016t). It is known only from a 6-mile stretch of alkaline flats (desert wetland) (USFWS, 1998o) (USFWS, 2009z).

This variety occurs in areas with cordgrass-dropseed vegetation with seasonally moist alkaline soils but does not grow in areas that are seasonally flooded (USFWS, 1998o). Major threats to this variety include herbivory of seedlings, changes in soil hydrology or chemistry, as well as risk of events such as seismic activity and changing temperatures given the low population size. (USFWS, 2009z)

Fleshy Owl's-clover. Fleshy or succulent owl's-clover (*Castilleja campestris* ssp. *succulenta*) is a hemi-parasitic perennial herb in the broomrape family. Stems can be simple or rarely branched and up to a foot tall. Stems and leaves are hairless. The fleshy and somewhat succulent leaves alternate along the stems and are easily broken or dislodged. Flowers appear in the axils of large, green leaf-like bracts in a dense, short cluster that can be half length of the stem. Each flower has four hairy sepals fused into a tube surrounding the bright yellow to white two-lipped petals. Bloom time during April and May. The fruit of each flower is a capsule. (USFWS, 2006d) (USFWS, 2011q)

The subspecies was listed as threatened in 1997 (62 FR 14338 14352, 26 March 1997). Critical habitat was designated in 2003 (68 FR 46684 46867, 6 August 2003) with re-evaluations of non-economic and economic exclusions in 2005 (70 FR 11140, 8 March 2005; 70 FR 46924 46999, 11 August 2005) and administrative revisions in 2006 (71 FR 7118 7316, 10 February 2006). It grows along the eastern San Joaquin Valley primarily in Merced County, but also occurs in Fresno, Madera, Stanislaus, and San Joaquin Counties of central California (USFWS, 2006d).

Fleshy owl's-clover is found on the margins of vernal pools, in vernal swales, and some other types of seasonal wetlands in foothills annual grassland communities. Threats to the subspecies include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, discing, alteration of hydrology, road widening and realignment, overgrazing and trampling by livestock, exclusion of grazing by livestock, competition from non-native invasive species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, off-highway vehicles), loss of pollinators, dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2011q)

Fountain Thistle. Fountain thistle (*Cirsium fontinale* var. *fontinale*) is a perennial herb in the sunflower family. The plant has multiple erect stems that are a reddish color and range from 1 to 3 feet in height. Basal leaves are lobed, 4 to 8 inches long, with spiny tips. White to pinkish florets are clustered in spiny, cup-shaped heads with distinct, egg-shaped spiny bracts forming the cup. The thistle flowers from June through October. (USFWS, 1995b) (USFWS, 2009aa) (USFWS, 2016u)

The fountain thistle was listed as endangered in 1995 (60 FR 6671 6685, 03 February 1995). It is known to occur at four localities and is endemic to San Mateo County. As of 2015, critical habitat has not been designated (USFWS, 1995b) (USFWS, 2009aa) (USFWS, 2016u).

Fountain thistle grows in openings of serpentine chaparral in seeps or riparian areas with clay soils that are consistently moist. The variety prefers elevations of 300 to 600 feet ASL and has been associated with the non-natives English plantain (*Plantago lanceclata*), pampas grass (*Cortaderia selloana*), and wild oat (*Avena fatua*). Threats to the variety include roadside maintenance, recreational development, garbage dumping, and competition with non-native plants. (USFWS, 1995b) (USFWS, 2009aa) (USFWS, 2016u).

Franciscan Manzanita. Franciscan manzanita (*Arctostaphylos franciscana*) is a somewhat low, spreading, evergreen shrub in the heath family. Plants may reach 2 to 3 feet tall when mature, with oblong leaves and reddish-brown stems and twigs. Blooming occurs from January through April, with clusters of small, white to pale pinkish urn-shaped flowers (Parker, Vasey, & Keeley, 2016a) (USFWS, 2012u). This species was listed as endangered in 2012 (77 FR 54434 54450, 5 September 2012), with critical habitat established in 2013 (78 FR 77289 77325, 20 December 2013) in San Francisco County.

Franciscan manzanita is only known to occur on the San Francisco peninsula in coastal upland habitat where frequent summer fog has a strong influence on local climate. This species is associated with serpentine maritime chaparral vegetation. Sites where this plant is known to have occurred tend to be bare, stony rocky ground or gravelly or bedrock outcrops (USFWS, 2012u). Major threats to this species include habitat loss and destruction of suitable habitat, fungal pathogens, climate change, altered fire regime, vandalism, loss of genetic diversity, effects of small population size, and loss of pollinators (USFWS, 2012u) (USFWS, 2013s).

Gambel's Watercress. Gambel's watercress (*Rorippa gambellii* or *Nasturtium gambellii*) is a rhizomatous perennial herb in the mustard family. The species roots from the lower stem nodes and can reach 6 feet in height. Blooming occurs from April to July in a dense cluster of 10 to 30 four-petaled white flowers that terminate flowering stems. Petals range from 0.23 to 0.31 inches in length. Each flower produces a thin, pod-like fruit. (USFWS, 1993c) (USFWS, 2011r) (USFWS, 2016v)

The species was listed as endangered in 1993 (58 FR 41378 41384, 03 August 1993) and no critical habitat has been designated. It is only documented at three locations in San Luis Obispo and Santa Barbara Counties (USFWS, 1993c) (USFWS, 2011r) (USFWS, 2016v).

Gambel's watercress requires a permanent water source, and grows in freshwater or brackish marsh habitat, the margin of lakes or along slow-flowing perennial streams. Threats to the species include alteration of hydrology, maintenance, development, and competition with non-native plants, especially eucalyptus trees. (USFWS, 1993c) (USFWS, 2011r) (USFWS, 2016v)

Gaviota Tarplant. Gaviota tarplant (*Deinandra increscens* ssp. *villosa*) is an annual herb in the sunflower family. The subspecies has tall stems that branch near the base and reach 12 to 35 inches. Leaves are gray-green in color and have soft hairs. Ray and disk florets are deep yellow in color, with heads consisting of 8 to 15 ray flowers and 16 to 32 disk flowers. (USFWS, 2011s).

Gaviota tarplant was listed as endangered in in 2000 (65 FR 14888 14898, 20 March 2000). A total of 16,110 acres of critical habitat was designated for the subspecies in Santa Barbara

County in 2002 (67 FR 67968 68001, 7 November 2002). Gaviota tarplant is highly localized and occurs in seven populations in western Santa Barbara County (USFWS, 2011s).

Habitat for Gaviota tarplant includes grasslands on marine terraces and fractured shales from 150 to 1,000 feet in elevation. Coastal scrub is often intermixed with grassland habitat. Threats to this subspecies include habitat degradation and loss from agriculture and urbanization, non-native species competition, wind energy development, sea level rise, and herbivory. (USFWS, 2011s)

Gentner's Fritillary. Gentner's fritillary (*Fritillaria gentneri*) is a perennial herb in the lily family. The stem can reach 1.5 feet tall and has red to purple flowers with yellow streaks. Flowers typically are 1 to 2 inches long and bloom from April to June. Gentner's fritillary reproduce asexually, by breaking off bulblets[131] that fall to the ground and develop into new plants (USFWS, 2011t).

Gentner's fritillary was federally listed as endangered in 1999 (64 FR 69195 69203, December 10, 1999). No critical habitat has been designated for this species. This species is found in the southwest part of Oregon, in Josephine and Jackson Counties and neighboring Siskiyou County (USFWS, 2011t).

Gentner's fritillary is typically found at elevations of 60 to 450 feet in open woodland edge habitat. The species may also be present in open chaparral and grassland habitat near hardwood forests. Species commonly associated with Gentner's fritillary include Oregon white oak (*Quercus garryana*), Pacific madrone (*Arbutus menziesii*), white-leaved manzanita (*Arctostaphylos viscida*), poison oak (*Rhus diversiloba*), and ashy rock cress (*Arabis subpinnatifida*) among many other species (USFWS, 2011t).

Gowen Cypress. Gowen cypress (*Cupressus goveniana* ssp. *goveniana*) is a coniferous tree in the cypress family. The species typically ranges from 17 to 23 feet tall with a sparingly branched crown that extends 7 to 13 feet. The tree's bark is smooth and grey to brown in color. Foliage on the tree is a rich-green color with scale-like leaves 0.04 to 0.08 inches long (USFWS, 2004d).

Gowen cypress was listed as threatened in 1998 (63 FR 43100 43116, 12 August 1998). Critical habitat has not been designated for the subspecies. It is found in Monterey County, at two naturally occurring locations: Huckleberry Hill on the Monterey Peninsula, and about 6 miles south on the north side of Gibson Creek (USFWS, 2004d).

Habitat for the subspecies includes mixed conifer forests and coastal chaparral. Chaparral habitat typically consists of dense, dwarf woodlands with stunted bishop pine (*Pinus muricata*), Monterey pine (*Pinus radiata*), woolly leaf manzanita (*Arctostaphylos tomentosa*), and California huckleberry (*Vaccinium ovatum*). Gowen cypress is fire-dependent and regenerates rapidly following a fire with thousands of seedlings emerging at times. Threats to the subspecies include urban development causing habitat degradation and removal, fire suppression, air

[131] Bulblets:"Asexually reproductive structures derived from flowers or branch primordia, or divisions of a bulb" (Williams, 1987).

pollution, climate change, genetic contamination, and non-native pests and disease (USFWS, 2004d).

Greene's Tuctoria. Greene's tuctoria (*Tuctoria greenei*) is a bunchgrass in the grass family. The species grows in pilose[132] tufts with erect or decumbent[133] stems that are 2 to 5.9 inches tall. Leaves are small and do not exceed 0.2 inches in width. The inflorescence is on average 3.1 inches long with 7 to 40 spikelets that form a spiral (USFWS, 2006j).

Greene's tuctoria was federally listed as endangered in 1997 (62 FR 14338 14352, March 26, 1997). A total of 145,118 acres of critical habitat was designated for this species in 2006 (71 FR 7118 7316, February 10, 2006). This species is mostly found or believed to occur in 16 counties of northern California, but has also been documented previously in Klamath and Lake counties, Oregon (USFWS, 2016w).

Habitat for Greene's tuctoria includes low and high terraces within specific vernal pool systems. Vernal pools that provide habitat include northern basalt flow, northern claypan, and northern hardpan. The species has been documented to grow in shallower and deeper pools. Vernal pools containing the species have been located in pine and grasslands (USFWS, 2006j).

***Hairy Orcutt Grass*.** Hairy Orcutt grass or hairy orcuttia (*Orcuttia pilosa*) is a small, semi-aquatic clumped annual C_4 grass. Plants germinate underwater, forming a rosette of 5 to 8 cylindrical juvenile leaves. Intermediate leaves are produced as the pool warms, and have a cylindrical submerged portion and a flat, floating blade. Once the pool has evaporated, multiple pith-filled upright stems ranging from 2 to 8 inches long rise from a common fibrous root system and produce the terrestrial leaves; stems are often branching from near the base. The flattened terrestrial leaves are about 2 to 4 inches long with the lower portion folding around the stem. Plants are grayish-green due to a covering of long, soft hairs, and produce an aromatic exudate. The top 2 to 4 inches of each stem is terminated by a cluster of two dense, compact rows of 8 to 18 groups (spikelets) of 10 to 40 florets; spikelets are more densely crowded near the tip. Each floret lacks petals and sepals, and is enclosed in a pair of small green bracts, the most prominent of which has five more or less equal-length awl-like teeth. Bloom time is May to September. The fruit of each floret is a grain. (USFWS, 2006d) (USFWS, 2009ab)

The species was listed as endangered in 1997 (62 FR 14338 14352, 26 March 1997). Critical habitat was designated in 2003 (68 FR 46684 46867, 6 August 2003) with re-evaluations of non-economic and economic exclusions in 2005 (70 FR 11140, 8 March 2005; 70 FR 46924 46999, 11 August 2005) and administrative revisions in 2006 (71 FR 7118 7316, 10 February 2006). It occurs in Butte, Glenn, Madera, Merced, Stanislaus, and Tehama Counties (USFWS, 2006d).

Hairy Orcutt grass is found in vernal pools on stream terraces or alluvial fans in annual grasslands from elevations of 85 to 405 feet. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, discing, alteration of hydrology, road widening and realignment, overgrazing and trampling by livestock, exclusion of livestock grazing, competition from non-native invasive

[132] Pilose: "Having long soft hairs (more sparsely so than villous)" (Williams, 1987).
[133] Decumbent: "Prostrate except for the ascending tips of the branches" (Williams, 1987).

species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, off-highway vehicles, dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2009ab)

Hartweg's Golden Sunburst. Hartweg's golden sunburst (*Pseudobahia bahiifolia*) is a small, branched annual plant in the sunflower family that grows from about 2 to 6 inches tall. This plant, similar to other sunburst plants of this genus, is covered in woolly hairs. Leaves of this species are relatively narrow and three-lobed or bluntly toothed at the tip, and are about 0.4 to 0.8 inch long (USFWS, 1997e). Flowers are arranged in daisy-like heads about one inch wide, and bloom from approximately March through May (USFWS, 2007n) (Johnson, Dale E., 2016a).

This species was listed as endangered in 1997 (62 FR 5542 5551, 6 February 1997), and no critical habitat has been established (USFWS, 2016a). It is restricted to the southern Sacramento Valley and San Joaquin Valley of California (USFWS, 1997e).

Preferred habitat for Hartweg's golden sunburst is located in non-native grassland and the grassland-blue oak woodland transition zone (USFWS, 1997e). This includes north to northeast-facing small hills or Mima mounds, which are a few feet in height and are associated with vernal pool habitat (USFWS, 2007n). Major threats to this species include residential development and land use conversion from ranching to urban development and agriculture, competition from non-native plant species, as well as general risk of environmental factors due to small and isolated populations (USFWS, 2007n).

Hickman's Potentilla. Hickman's potentilla (*Potentilla hickmanii*) is a perennial herb in the rose family. Stems recline and are between 2 to 16 inches long. Stems bear pinnately compound leaves with 6 to 12 wedge-shaped, deeply-toothed leaflets (0.1 to 0.3 inches long, 0.04 to 0.12 inches wide). Yellow flowers are present on stems and are comprised of five heart-shaped petals (0.2 to 0.4 inches long) with 20 stamens and 10 styles (USFWS, 2004d). Flowers bloom from April through August (Calflora, 2016c).

The species was listed as endangered in 1998 (63 FR 43100 43116, 12 August 1998). Critical habitat has not been designated. Hickman's potentilla can be found in Monterey, and San Mateo Counties (Calflora, 2016c) (USFWS, 2004d). Historically, the species was found at Moss Beach in San Mateo County, on the Monterey Peninsula and Pacific Grove in Monterey County, and in the Two Rock Quadrangle in Sonoma County. Presently, the species is only known at two locations, including near Martini Creek and Montara State Beach in San Mateo County and near Indian Village picnic area on the Monterey Peninsula (USFWS, 2004d).

The Monterey Peninsula population occurs on loamy, fine sandy soils in a non-native coastal prairie that is seasonally wet. The Montara population is found in a native, gently sloping grassland with some grazing disturbance. Threats to the species include urbanization altering and destroying habitat, non-native plant species competition, mowing, consumption by native and non-native wildlife and insects, and naturally-occurring variation in populations. (USFWS, 2004d).

Hidden Lake Bluecurls. Hidden Lake bluecurls (*Trichostema austromonta*num ssp. *compactum*) is an annual herb in the mint family. Plants are short and compact, with a very short internode separating the leaves along the stem, and have long, soft hairs all over. They are also strongly vinegar scented. Leaves are born opposite on the stem, and are narrowly oval. Flowers appear in clusters in the leaf axils. The flower is short (just over a quarter inch) and blue, with a short tube that opens into five petal lobes of differing sizes and shapes and four blue anthers that extend well beyond the petals. Bloom time is late June to August. The fruit consists of four nutlets. (USFWS, 2013o)

The subspecies was listed as threatened in 1998 (63 FR 49006 49022, 14 September 1998) with no critical habitat being proposed (USFWS, 2015dx). It is endemic to a single montane vernal pool in the San Jacinto Mountains of Riverside County (USFWS, 2013o).

Hidden Lake bluecurls grows along the margin of a vernal pool and a runoff swale at an elevation of 8,700 feet ASL. Threats to the subspecies include trampling by hikers or equestrian recreation (now minimized by administrative actions), alteration of habitat due to climate change, and random catastrophic events due to restricted distribution, narrow habitat requirement and small population size; the latter two threats may be ameliorated by a resilient seed bank and the life history of the species. (USFWS, 2013o)

Hoffmann's Rock-Cress. Hoffmann's rock-cress (*Arabis hoffmannii*) is a slender herbaceous perennial plant that blooms once before dying (USFWS, 1997f). This plant can grow several stems that reach up to two feet in length, with primarily basal leaves. Blooming occurs from February to March with white to pale lavender, four-petaled flowers about 0.4 inch long (USFWS, 1997f) (Windham & Al-Shehbaz, 2014). Fruits are long, slender, slightly curved pods at the end of relatively long stalks and contain many seeds (Windham & Al-Shehbaz, 2014).

Hoffmann's rock-cress was listed as endangered in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016x). It is endemic to Santa Rosa, Santa Cruz, and Anacapa Islands (USFWS, 2011u).

This plant tends to occur in protected areas such as steep cliffs and volcanic cliff edges or under the shade of shrubs or trees that provide protection from annual plant species (USFWS, 1997f) (USFWS, 2011u). It is threatened by soil damage and residual habitat alteration as a result of herbivory by native and non-native ungulates, competition from non-native grass species, dangers of random events such as storms, drought, landslides, and disease due to small population size, and climate change (USFWS, 2011u).

Hoffmann's Slender-Flowered Gilia. Hoffmann's slender-flowered gilia (*Gilia tenuiflora* ssp. *hoffmannii*) is a small herbaceous annual plant in the phlox family that grows to about 2.5 to 5 inches tall (USFWS, 1997f). Most of the plant's leaves are hairy, forming a rosette at the base of the plant, from which grows a flowering stem. Blooming occurs from April to June, with flowers of five purplish-pink petals less than 1 inch wide (USFWS, 1997f) (Porter, 2016).

This plant was listed as endangered in in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016y). This gilia subspecies is endemic to Santa Rosa Island, one of the Channel Islands off the southern California coast (USFWS, 2009ac).

Hoffmann's slender-flowered gilia inhabits open patches of stabilized sand dunes, in areas of dune scrub vegetation with high amounts of bare ground (USFWS, 1997f) (USFWS, 2000e) (USFWS, 2009ac). Threats to this subspecies include habitat alteration and soil erosion from previous ungulate grazing, competition with non-native grass species, climate change and associated sea level rise, and small population size (USFWS, 2009ac).

Hoover's Spurge. Hoover's spurge (*Chamaesyce hooveri* or *Euphorbia hooveri*) is an annual forb in the spurge family. Stems lay flat on the ground, forming gray-green mats. Plants are hairless and contain a milky sap. Leaves are simple and kidney-shaped, and are arranged opposite of each other along the stem. Tiny flowers are contained in cyathia, which are small cup-like structures averaging 0.08 inches in diameter with small fringed white appendages that resemble petals (USFWS, 2006j).

Hoover's spurge was federally listed as threatened in 1997 (62 FR 14338 14352, March 26, 1997). A total of 114,713 acres of critical habitat was designated for this species in 2006 (71 FR 7118 7316, February 10, 2006). This species is found or believed to occur in 13 counties in northern California (USFWS, 2016z).

Hoover's spurge occurs in vernal pools with clay to sandy loam soils with northern hardpan and northern claypan substrates on alluvial fans or historical floodplain terraces. Individuals may be located on the periphery of pools or in the deepest parts of the pools once dried. Hoover's spurge is most commonly found with Greene's tuctoria (*Tuctoria greenei*) and hairy Orcutt grass (*Orcuttia pilosa*) (USFWS, 2006j).

Howell's Spineflower. Howell's spineflower (*Chorizanthe howellii*) is a hairy annual herb in the buckwheat family. Leaves form a basal rosette at the base of the stem, and are spatula-shaped and up to 1.2 inches long. Stems branch from the base, rising from 1 to 4 inches tall and spreading from 4 to 20 inches across. Small white or rose flowers (typically less than 0.18 inch) are each surrounded six brown, straight spines. Bloom time is May to July. The fruit is an elliptic, three-angled seed. (USFWS, 1998m)

The species was listed as endangered in 1992 (57 FR 27848 27859, 22 June 1992). No critical habitat has been proposed (USFWS, 2015dy). It occurs in a discontinuous distribution in dunes associated with the Ten Mile River in coastal Mendocino County (USFWS, 1998m).

Howell's spineflower grows in near-shore coastal foredunes and adjacent sandy coastal prairie at elevations from sea level to 120 feet. The species is threatened by habitat loss or modification due to residential or commercial development, trampling by hikers, livestock or equestrians, off-highway vehicles, encroachment by non-native invasive species, dangers from random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 1998m) (USFWS, 2011v)

Indian Knob Mountain Balm. Indian Knob mountain balm (*Eriodictyon altissimum*) is an evergreen shrub of the borage or waterleaf family. New growth is produced primarily from rhizomatous suckers. Plants are diffusely branched and range in height from 6.6 to 13 feet. The leaves are long (2.4 to 3.5 inches), narrow (0.08 to 0.2 inches), and notably sticky. Lavender

flowers are arranged coiled clusters. Each flower produces a many-seeded capsule. (USFWS, 1994e) (USFWS, 2016aa)

The species was listed as endangered in 1994 (9 FR 64613 64623, 15 December 1994) and is endemic to San Luis Obispo County in California. Currently only six populations are known to exist. No critical habitat has been designated for this species (USFWS, 1994e) (USFWS, 2016aa).

Indian Knob mountain balm is limited to coastal maritime chaparral and oak woodland communities, and occurs with Morro manzanita (*Arctostaphylos morrroensis*). Primary threats to the species include cattle grazing, proposed development, road maintenance, drought conditions, and competition from invasive plants. (USFWS, 1994e) (USFWS, 2016aa)

Ione Buckwheat (including Irish Hill Buckwheat). Ione buckwheat (*Eriogonum apricum*, including varieties *apricum* [Ione buckwheat] and *prostratum* [Irish Hill buckwheat]) is a low-growing, upright perennial herb in the buckwheat family that grows from 3 to 8 inches tall. Clusters of small white to reddish flowers occur at the ends of stem branches, blooming between July and October (USFWS, 1999d). Leaves of this species are round to oval shaped, growing mostly from the base of the plant, and are about 0.1 to 0.2 inches wide with white woolly hairs on the lower surface (USFWS, 1999d) (USFWS, 2010r).

This species was listed as endangered in 1999 (64 FR 28403 28413, 26 May 1999), and no critical habitat has been established (USFWS, 2016ab). Ione buckwheat is only known to occur along a 10-mile stretch of Ione soils in western Amador County. Ione soils refer to a unique geological formation (the Ione Formation) that developed during a period 35 to 57 million years ago during subtropical or tropical climate conditions (USFWS, 1999d). These soils tend to be acidic, nutrient-poor, and coarse in texture with sparse, low-growing shrubs and herbs (USFWS, 1999d). Ione buckwheat occurs in areas of barren soil surfaces where little if any other vegetation is present, including disturbed areas such as clay pits, spoil piles, and abandoned roads. Major threats to this species include habitat loss as a result of mining and residential and commercial development, as well as the risks posed by chance events such as disease, drought, landslide, or reproductive failure, given the small population size (USFWS, 2010r).

Ione Manzanita. Ione manzanita (*Arctostaphylos myrtifolia*) is an evergreen shrub that grows to less than 4 feet tall, appearing as a low and spreading shrub, in the heath family. The bark of this shrub is red, smooth, and waxy in appearance, while the leaves are olive green in color, elliptical in shape and about 0.2 to 0.6 inches long. Flowers of this shrub are urn-shaped, pale pink to white, and bloom from January to February. (USFWS, 1999d)

This species was listed as threatened in 1999 (64 FR 28403 28413, 26 May 1999), and no critical habitat has been established (USFWS, 2016ac). Ione manzanita is restricted to the Ione Formation in Amador and Calaveras Counties (USFWS, 2010r). These soils tend to be acidic, nutrient-poor, and coarse in texture with sparse, low-growing shrubs and herbs (USFWS, 1999d). Ione chaparral is a vegetation type unique to the soils in this region, with Ione manzanita being the most common plant of this vegetation type. Ione manzanita is also known to occur in patches

of oak forest vegetation. Major threats to this species include fungal diseases as well as habitat loss as a result of mining and residential and commercial development. (USFWS, 2010r)

Island Barberry. Island barberry (*Berberis pinnata* ssp. *insularis*) is a perennial shrub in the barberry family that grows from 5 to 25 feet tall (USFWS, 1997f). This shrub exhibits spreading stems and large glossy green compound leaves that are divided into five to nine leaflets (USFWS, 1997f). Blooming occurs from February to April, with clusters of yellow flowers at the branch tips that develop into waxy blue berries (USFWS, 1997f) (Williams, 2016).

Island barberry was listed as endangered in in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016ad). This subspecies is currently known to occur only on Santa Cruz Island (USFWS, 2013p).

Island barberry is found growing on shady, mesic, north-facing, rocky slopes on Santa Cruz Island, in association with pine forest, oak woodland, and chaparral habitats, at elevations below 1,150 feet (USFWS, 2000e). Threats to this subspecies include residual habitat alteration resulting from non-native ungulates, dangers from random events such as fire, pests, erosion, and disease, as well as climate change, due to the very small population size (USFWS, 2013p).

Island Bedstraw. Island bedstraw (*Galium buxifolium*) is a small, stout woody shrub that grows to about 4 feet tall with many leafy branches (USFWS, 1997f). The lower leaf surfaces and fruits have stout or upward-curved hairs that are unique characteristics of this species (USFWS, 1997f). Flowers appear in dense, leafy clusters on the woody stems with white petals, and blooms between March and July (Soza, Valeri, 2016b).

This plant was listed as endangered in in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016ae). Island bedstraw is restricted to Santa Cruz and San Miguel islands, off the coast of southern California (USFWS, 2009ad).

Habitat for island bedstraw consists of north-facing sea cliffs and rocky slopes in island pine forest and coastal sage scrub (USFWS, 2000e) (USFWS, 2009ad). Threats to this species include competition with non-native plants, residual habitat alteration resulting from non-native ungulates, events related to climate change such as altered storm intensities and sea level rise, and low genetic viability (USFWS, 2009ad).

Island Malacothrix. Island malacothrix (*Malacothrix squalida*) is an annual herb in the sunflower family that forms mat-like mounds 1.6 to 12 inches tall (USFWS, 2010s). Basal leaves are 1.5 to 5.5 inches long and are sometimes lobed to sharply toothed, while stem leaves are wider toward their bases or almost triangular shaped with sharp lobes (USFWS, 2010s). Flowers are light yellow, clustered in hemispheric heads that are about 0.5 inch long, blooming from March to June (Davis, W.S., 2016a) (USFWS, 2010s).

This plant was listed as endangered in in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016af). It is known to occur on Anacapa, San Miguel, Santa Rosa and Santa Cruz Islands in the northern Channel Islands off the southern California coast (USFWS, 2010s).

Island malacothrix generally occurs on coastal bluffs and rocky canyon flats or slopes with shallow soils at elevations of less than 656 feet, among coastal scrub vegetation (USFWS, 1997f) (USFWS, 2010s). Threats to this variety include soil erosion, residual habitat alteration from non-native ungulate grazing, seabird nesting, competition with exotic plant species, and danger from random events due to small population size and distribution (USFWS, 2010s).

Island Phacelia. Island phacelia (*Phacelia insularis* var. *insularis*) is an herbaceous annual plant in the waterleaf or borage family, with branched stems that tend to grow down or reclining (rather than upright) (USFWS, 1997f). The stems are covered in short hairs and glands, reaching about 6 inches in height, arising from a basal rosette of leaves. The leaf shape is unique in this species, having an arrow-like shape (USFWS, 1997f) (USFWS, 2008l). Flowers are lavender to violet, bell-shaped, arranged in loose clusters, and generally bloom in March and April (USFWS, 2008l) (Walden, Patterson, Garrison, & Hansen, 2016).

This plant was listed as endangered in in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016ag). This plant is known to occur on Santa Rosa and San Miguel Islands in the northern Channel Islands off the southern California coast (USFWS, 2008l).

Island phacelia is generally found in sandy soils of stabilized dunes in areas of lupine-grassland community that are dominated by non-native grass species (USFWS, 2000e) (USFWS, 2008l). Threats to this species include residual habitat alteration from ungulate grazing, competition with non-native grass species, and dangers to random events including climate change due to small population size and limited genetic viability (USFWS, 2008l).

Island Rush-Rose. Island rush-rose (*Helianthemum greenei*) is a small shrub in the rock rose family that grows to about 18 inches tall (USFWS, 2010t). This shrub has reddish hairy stalks and alternate leaves that are covered in star-shaped hairs. Flowers are yellow, about 1 inch long and bloom from April to May (USFWS, 2010t) (Sorrie & Rosatti, 2014).

Island rush-rose was initially listed as threatened in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016ah). This species has been reported from four of the Channel Islands off the southern California coast, including Santa Catalina, Santa Cruz, Santa Rosa, and San Miguel islands (USFWS, 1997f) (USFWS, 2010t).

Island rush-rose is found in open, exposed areas in chaparral, coastal sage scrub, and island pine forest. Threats to this species include habitat modification or destruction due to soil damage, altered fire frequencies and intensities, and rooting by feral pigs. (USFWS, 1997f) (USFWS, 2010t)

Keck's Checker-mallow. Keck's checker-mallow (*Sidalcea keckii*) is an upright, slender herb in the mallow family that reaches 6 to 13 inches in height. The entire plant is covered in soft, star-shaped bristly hairs. Leaves of Keck's checker-mallow are roughly circular in outline, with several lobes or notches that are arranged somewhat like fingers and have irregular toothed edges (USFWS, 2000f). Flowers appear in April through May, with five petals that are pink or pink with a maroon center, and are about 0.4 to 0.8 inches wide (USFWS, 2000f) (USFWS, 2003b).

This species was listed as endangered in 2000 (65 FR 7757 7764, 16 February 2000), with critical habitat established in 2003 (68 FR 12863 12880, 18 March 2003) in Fresno and Tulare Counties (USFWS, 2000f) (USFWS, 2003b) (USFWS, 2016ai). Keck's checker-mallow is endemic to California and grows in close association with serpentine soils, which are nutrient-poor and high in heavy metals and tend to limit vegetation growth (USFWS, 2003b) (USFWS, 2012o). This species has been found at elevations ranging from 250 to 1,940 feet, usually in relatively open areas on grassy slopes. Major threats to this species include habitat modification or destruction through inappropriate grazing methods, agriculture, development, competition with non-native grasses, as well as vulnerability to disease, extreme weather events, disease, or fire due to small, isolated populations of this species (USFWS, 2012o).

Kenwood Marsh Checker-mallow. Kenwood Marsh checker-mallow (*Sidalcea oregana* ssp. *valida*) is a perennial herb in the mallow family. It grows from 3 to 6 feet tall with a branching, many-stemmed habit. Leaves are rounded to kidney-shaped in outline, with five to seven shallow lobes. Leaves alternate along the stem, and become smaller and more deeply lobed upwards. Flowers terminate the ends of branches in dense clusters. Flowers are cup-shaped and can grow more than one inch. There are five deep pink-mauve petals that are notched at the tip, with 10 white stamens fused into a central column. Bloom time is June to September. The fruit is a 5 to 10 parted disc-like structure. (USFWS, 2009ae)

The subspecies was listed as endangered in 1997 (62 FR 54791 54808, 22 October 1997). No critical habitat has been proposed (USFWS, 2015dz). It is known from two inland locations in Sonoma County on the north central coast of California (USFWS, 2009ae).

Kenwood Marsh checker-mallow occurs in freshwater marshes. Threats to the subspecies include residential and commercial development, grazing and trampling by livestock, competition from native and non-native invasive species, alteration of natural hydrology, waterway maintenance, habitat alteration due to climate change, random catastrophic events due to restricted distribution, narrow habitat requirements, and small population size. (USFWS, 2009ae)

Kern Mallow. Kern mallow (*Eremalche kernensis* or *E. parryi* ssp. *kernensis*) is an annual herb in the mallow family. Stems grow can exceed 20 inches in height. Leaves alternate along stems, and are on stalks with blades 1 to 2 inches wide with 3 to 5 deep lobes. Flowers arise from the upper leaf axils and are cup-shaped, with 5 white, pink, or lavender petals. Flowers on individual plants may be female (lacking stamens) or may have both male and female sexual organs (stamens and pistils). Female flowers typically have slightly smaller petals. Bloom time is March to May. The disc-like fruits have 9 to 19 segments. (USFWS, 1998a) (USFWS, 2013q)

The species was listed as endangered in 1990 (55 FR 29361 29370, 19 July 1990) and no critical habitat has been proposed (USFWS, 2015ea). It is known from the southern San Joaquin Valley in Kern and Tulare Counties, the Carrizo Plain of San Luis Obispo County, and the Cuyama Valley in Santa Barbara and Ventura Counties in south central California (USFWS, 2013q).

Kern mallow occurs on arid non-native grasslands, alkali saltscrub flats, eroded hillsides at lower elevations, and in juniper woodlands at elevations above 3,000 feet ASL. Threats to the species include habitat loss and degradation due to residential and commercial development, agricultural conversion, water development, road and utility construction and maintenance (including solar power development), oil and gas exploration, development and conveyance, competition with invasive non-native species and associated changes in fire regimes, off-highway vehicle use, grazing and trampling by livestock, herbicide and insecticide use, mineral extraction, air pollution (nitrification), habitat alteration due to climate change, and random catastrophic events due to restricted distribution, narrow habitat requirement and small population size. (USFWS, 1998a) (USFWS, 2013q)

Kneeland Prairie Penny-cress. Kneeland Prairie penny-cress (*Thlaspi californicum*) is a perennial herb in the mustard family. Plants grow from 3 to 6 inches tall, with most leaves arising from the base of the plant and few leaves along the stem. White flowers appear between May and June in clusters near the ends of stems and mature into small pod-like fruits with sharp ends. (USFWS, 2000g)

This species was listed as endangered in 2000 (65 FR 6332 6338, 9 February 2000) with critical habitat established in 2002 (67 FR 62897 62910, 9 October 2002) in Humboldt County (USFWS, 2002i) (USFWS, 2016aj). Kneeland Prairie penny-cress is only known from a few locations within Kneeland Prairie, about 15 miles from the Pacific Ocean (USFWS, 2011w). This species occurs on shallow, rocky, serpentine soils from elevations of about 2,700 to 2,800 feet (USFWS, 2011w). This plant is associated with coastal prairie vegetation (USFWS, 2000g). Major threats to this species are potential habitat modification or destruction, possible predation, and the threat from catastrophic events due to low population size and limited distribution (USFWS, 2011w).

La Graciosa Thistle. La Graciosa thistle (*Cirsium loncholepis*) is a perennial herb in the sunflower family. Plants range from 4 to 39 inches tall and are spreading and mound-like or upright and erect. Lower leaves on the plant are deeply toothed and are 4 to 12 inches long with wavy margins and spines, while those at the middle or upper parts have winged petioles. Flowers form tight groups at the tips of stems with white corollas and purple anthers. (USFWS, 2011x)

La Graciosa thistle was listed as endangered in 2000 (65 FR 14888 14898, 20 March 2000). A total of 24,103 acres of critical habitat was designated for the species in San Luis Obispo and Santa Barbara Counties in 2009 (74 FR 56978 87046, 3 November 2009). Historically, it occurred along a 32-mile stretch of the California coast from Arroyo Grande Creek in San Luis Obispo County to the Santa Ynez River in Santa Barbara County, but is currently known from five populations within the southwestern corner of Santa Barbara County. (USFWS, 2011x)

Habitat for the species includes back dunes and coastal wetlands in moist soils around dune lakes or swales. It is often found in association with rush species (*Juncus spp.*), willow (*Salix spp.*), poison oak (*Toxicodendron diversilobum*), and salt grass (*Distichlis spicata*). Threats to this species include habitat destruction and degradation from urbanization, agriculture, and flooding, groundwater pumping, oil and gas development, non-native species competition, and grazing (*65 FR 14888 14898, March 20, 2000*).

Laguna Beach Liveforever. Laguna Beach liveforever (*Dudleya stolonifera*) is a small perennial succulent plant in the stonecrop family. Bright green, flat, thick, oblong leaves form a basal rosette, from which flowering stems arise, growing from about 3 to 10 inches tall. A characteristic trait of Laguna Beach liveforever are the lateral branching stolons,[134] in addition to the floral stems (USFWS, 1998p) (USFWS, 2010u). Tubular yellow flowers appear at the end of flowering stalks from about May to July (McCabe, Dudleya stolonifera, 2016a) (USFWS, 2010u). Little is known about how the Laguna Beach liveforever reproduces (USFWS, 2010u).

This species was listed as threatened in 1998 (63 FR 54938 54956, 13 October 1998) and no critical habitat has been designated (USFWS, 2016ak). It is found only in the vicinity of Laguna Beach in Orange County (USFWS, 2010u).

Laguna Beach liveforever is found growing on steep cliffs in canyons, on shaded, north-facing sandstone and breccia rock outcrops and slopes with surrounding coastal sage scrub or chaparral vegetation communities. Laguna Beach liveforever is almost always found growing in conjunction with mosses and lichens in very thin soil and is commonly the only vascular plant in this habitat. Major threats to this species include habitat loss from urban development, competition with non-native plant species, grazing, trampling, and risk of random catastrophic events due to small genetic population size and environmental events. (USFWS, 2010u)

Lake County Stonecrop. Lake County stonecrop (*Parvisedum leiocarpum* or *Sedella leiocarpa*) is an annual herb in the stonecrop family. Plants generally reach 1 to 2 inches tall. Stems are fleshy and reddish, and may be simple or branching. The oblong leaves are similarly succulent, and are less than a quarter inch long. They are green with red streaks, but wither and fall by blooming time, though smaller, leaf-like bracts persist. Flowers terminate the curving stems and are crowded in two rows on the same side of the stem. The yellows flowers are bell-shaped, with five (rarely only four) eight-inch long petals with large, red, club-shaped nectaries (glands that secrete nectar). Bloom time is April to May. The fruit of each flower is 4 or 5 tiny (less than 0.1 inch) capsule-like one-seeded pods. (USFWS, 2006d) (USFWS, 2009af)

The species was listed as endangered in 1997 (62 FR 33029 33038, 18 June 1997). No critical habitat has been proposed (USFWS, 2016al). It occurs in southeastern Lake County of north central California (USFWS, 2006d).

Lake County stonecrop is found on volcanic, often gravelly substrates in vernal pools, depressions in meadows or gravelly flats, and depressions in exposed bedrock adjacent to oak woodlands, chaparral, or grasslands at elevations of 1,700 to 2,600 feet. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, alteration of hydrology, road widening and realignment, overgrazing and trampling by livestock, exclusion of grazing by livestock, competition from non-native invasive species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, off-highway vehicles), loss of pollinators, dangers from genetic drift and

[134] Stolon: "a slender modified stem running along the ground above the soil surface, as in a strawberry" (Williams, 1987); often rooting and producing new vegetative and reproductive growth at nodes.

random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2009af)

Lane Mountain Milk-vetch. Lane Mountain milk-vetch (*Astragalus jaegerianus*) is a wispy, few-leaved perennial plant with a somewhat woody base in the pea family. Stems of this plant grow in a zig-zag manner, about 12 to 20 inches long, with leaves divided into fern-like leaflets and are silvery-fuzzy in appearance (USFWS, 1998o). It is almost always found growing up through larger shrubs or bunchgrass (USFWS, 1998o). Blooming occurs from April to June, with pale purple to cream flowers, somewhat clustered near the ends of floral stems and developing into plump, 1-inch long pods (USFWS, 1998o) (Wojciechowski & Spellenberg, 2016c).

This species was listed as endangered in 1998 (63 FR 53596 53615, 6 October 1998). Critical habitat was originally designated in 2005 (70 FR 18220 18241, 8 April 2005) and revised in 2011 (76 FR 29108 29129, 19 May 2011) (USFWS, 2016am). Currently critical habitat has been designated within San Bernardino County, adjacent to and south of the National Training Center at Fort Irwin (USFWS, 2011y).

Lane Mountain milk-vetch grows among mixed desert scrub (creosote-white bursage desert scrub) vegetation, typically on shallow, granitic soils (USFWS, 1998o) (USFWS, 2008m). Major threats to this species include habitat alteration or destruction from military training activities, as well as off-highway vehicle use, surface mining and competition with non-native plants (USFWS, 2008m).

Large-Flowered Fiddleneck. Large-flowered fiddleneck (*Amsinckia grandiflora*) is an annual herb in the borage family. It germinates in the late fall or winter, growing through the winter and into spring. Foliage of this plant is bright green in color and covered in coarse, bristly hairs, with narrow oval-shaped leaves at the base and along the stems. Bright red-orange trumpet-shaped flowers are clustered at the ends of stem branches in a fiddleneck-shaped inflorescence, blooming from about March through May. (USFWS, 2009ag) (Kelley & Ganders, 2016)

This species was listed as endangered with critical habitat established in 1985 (50 FR 19374 19378, 8 May 1985). Critical habitat is designated in San Joaquin County, in central California (USFWS, 1985e) (USFWS, 2016an). Historically, large-flowered fiddleneck occurred in native perennial bunchgrass vegetation communities; however, currently this species is known to occur in one location that is non-native annual grassland (USFWS, 2009ag). Generally the areas in which this species has been found are on gentle, grassy slopes (Kelley & Ganders, 2016) (USFWS, 2009ag). Major threats to this species include competition with non-native and invasive plant species, and grazing, as well as the increased risk or threat from climate change, drought, disease, or genetic viability given the small total population size of this species (USFWS, 2009ag).

Layne's Butterweed. Layne's butterweed (*Senecio layneae* or *Packera layneae*) is a perennial herb in the sunflower family. Leaves sprout mostly from the base of the plant with few along the upper stems and are lance-shaped, from 3 to 10 inches long (USFWS, 2002h). Layne's

butterweed typically blooms April to June, with several flower heads that are roughly 2 to 3 inches wide. The middle is orange-yellow in color with yellow ray flowers along the outer edge (Trock, 2016) (USFWS, 2002h).

This species was listed as threatened in 1996 (61 FR 54346 54358, 18 October 1996), and no critical habitat has been established (USFWS, 2016ao). It is known primarily from scattered sites across western El Dorado County, but is also found in Tuolumne and Yuba Counties in northern California (USFWS, 2002h).

Layne's butterweed is found in openings in chaparral primarily on soils derived from gabbro or serpentine. Major threats to this species are habitat alteration and modification resulting from urban development, alteration of fire regime, road construction, herbivory and trampling by horses, and recreational mining. (USFWS, 2002h)

Loch Lomond Coyote Thistle. Loch Lomond coyote thistle or Loch Lomand button-celery (*Eryngium constancei*) is a perennial herb in the carrot or parsley family. Foliage grows annually from overwintering rootstocks. Leaves are basal to the flowering stems, and both are covered in a dense "down" of very small hairs. Leaves range from 4 to 8 inches long, on 2 to 5 inch stalks with short spines that are usually longer than the leaf blades. The earliest leaf blades of the season have crosswise partitions, while later leaf blades are broader and lobed. Stems typically reach up to one foot tall, are slender, and loosely bunched. Flowering stems and branches are terminated tiny, rounded heads (0.12 to 0.20 of an inch) with 5 to 7 small white-petaled (sometimes tinged with purple) flowers. Bloom time is June to August. The fruit of each flower is two minute flat, ovate seeds. (USFWS, 2006d) (USFWS, 2009ah)

The species was emergency listed as endangered in 1985 (50 FR 31187 31190, 1 August 1985) and later confirmed as endangered in 1986 (51 FR 45904 45907, 23 December 1986). No critical habitat has been proposed (USFWS, 2016ap). It is native to southern Lake and Sonoma Counties (USFWS, 2006d).

Loch Lomond coyote thistle is found in vernal pools and the meadow-like bed of Loch Lomond, a small shallow vernal lake. The species is threatened by dredging and filling, agricultural conversion, recreational hiking, off-highway vehicle use, alterations of natural hydrology (including increased surface runoff, spring diversion, and commercial development and timber harvest in the larger watershed), garbage dumping, erosion, grazing and trampling by livestock, loss of pollinators, road maintenance, dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2009ah)

Lompoc Yerba Santa. Lompoc yerba santa (*Eriodictyon capitatum*) is an evergreen shrub in the waterleaf or borage family (USFWS, 2011z). Stems may reach up to 10 feet tall and leaves are narrow and sticky (65 FR 14888 14898, March 20, 2000). Lavender flowers occur on a head-like inflorescence and bloom from May to August (Calflora, 2016d).

Lompoc yerba santa was listed as endangered in 2000 (65 FR 14888 14898, March 20, 2000). A total of 16,110 acres of critical habitat was designated for the species in Santa Barbara County in

2002 (67 FR 67968 68001, November 7, 2002). Currently, the species is known from five populations within the southwestern corner of Santa Barbara County (USFWS, 2011z).

Habitat for the species includes coastal maritime chaparral and coastal sage scrub or inland Monterey shales. In the coastal areas, it is often found near disturbed roadsides and is found in association with buckbrush (*Ceonothus cuneatus*), black sage (*Salvia mellifera*), coyotebrush (*Baccharis* spp.), and California scrub oak (*Quercus berberidifolia*). At inland sites, habitat typically contains bishop pine (*Pinus muricata*). Threats to this species include destruction or modification of habitat from development, competition from non-native species, and changes in fire regimes. (USFWS, 2011z)

Lyon's Pentachaeta. Lyon's pentachaeta (*Pentachaeta lyonii*) is an annual herb in the sunflower family. Plants grow from 2 to 19 inches tall, branching from the base. Leaves are narrowly linear with small hairs along the edges; nodes[135] are often hairy. Stems and branches are terminated by flowering heads, with 30 or more heads per plant. The cup-shaped daisy-like heads have small, lanceolate, hairy bracts in 2 or 3 rows, and contain many small yellow florets. There are 17 to 42 showy ray florets (the "petals" of the daisy) that curl slightly backwards, surrounding 21 to 91 disk florets in the center. Bloom time is April to June. The fruit of each flower is a tiny, sunflower-like seed topped by bristles. (USFWS, 1999c) (USFWS, 2008n)

The species was listed as endangered in 1997 (62 FR 4172 4183, 29 January 1997) and 3,396 acres of critical habitat was designated in 2006 (71 FR 66374 66423, 14 November 2006). It is known from the Santa Monica Mountains and western Simi Hills, and historically from the Palos Verdes Peninsula and Santa Catalina Island in Los Angeles and Ventura Counties of southern California (USFWS, 2008n).

Lyon's pentachaeta is found on saddles, tops of hills and knolls and flat areas at the base of slopes in pocket grasslands or openings (including margins of roads and trails). The area typically contains low vegetative cover and exposed soils with macrobiotic crusts in a mosaic of chaparral and coastal sage scrub with rocky clay soils of volcanic origin at elevations of 280 to 2,060 feet ASL. Threats to the species include habitat loss, fragmentation or degradation due to residential and commercial development, loss of pollinators and associated species, disruption of natural fire cycles, prescribed fuel modification for fire prevention (e.g., vegetation thinning, fire breaks, disking, mowing), fire suppression activities, land management activities (e.g., mowing, herbicide and pesticide application, livestock grazing), encroachment and competition with non-native invasive species, recreational activities (e.g., off-highway vehicles, equestrian activities), habitat alteration due to climate change, and dangers from genetic drift and random catastrophic or climatic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 1999c) (USFWS, 2008n)

Many-flowered Navarretia. Many-flowered navarretia (*Navarretia leucocephala* ssp. *pleiantha* or *N. pleiantha*) is an annual herb in the phlox family. Plants are branched and typically grow 2 to 8 inches wide and only 1.2 inches tall. Leaves are linear, usually between 1 to 1.5 inches long, and sometimes have a few narrow, linear lobes. Dense flowering heads with 10 to 60 blue or

[135] Node: "a point on a stem where leaves, buds or branches usually arise" (Williams, 1987).

white flowers terminate stems. Heads are generally 0.6 to 0.8 inches across, and below each head are three or more pairs of leaf-like spiny bracts that are forked three or more times at the base, and are 1 to 2 times longer than the radius of the head. Much smaller bracts are below each flower in the head. The petals of the flower are fused into a funnel-shaped tube about 0.2 to 0.24 inches long, with five linear lobes. Bloom time is May to June. The fruit is a papery, egg-shaped capsule with one to three tiny seeds. (USFWS, 2006d) (USFWS, 2009ai)

The subspecies was listed as endangered in 1997 (62 FR 33029 33038, 18 June 1997). Several populations that exhibit intermediate characters between three subspecies of *N. leucocephala* (ssp. *pleiantha*, *pauciflora*, and *bakeri*) are considered as subspecies *pleiantha*; these were mentioned in the listing as possible hybrid intercrosses. No critical habitat has been proposed (USFWS, 2016aq). It typically grows in Lake and Sonoma Counties (USFWS, 2006d).

Many-flowered navarretia is found on volcanic ash substrates in vernal pools and vernal lakes and seasonally inundated swales from elevations of 110 feet to 2,800 feet ASL. Threats to the subspecies include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, alteration of hydrology, road widening and realignment, grazing and trampling by livestock, competition from non-native invasive species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, equestrian uses, off-highway vehicles), loss of pollinators, rooting by feral pigs, dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2009ai)

Marcescent Dudleya. Marcescent dudleya (*Dudleya cymosa* ssp. *marcescens*) is a succulent perennial herb in the stonecrop family. It forms a basal rosette of fleshy, oblanceolate leaves with pointed tips (0.6 to 1.6 inches long and 0.2 to 0.5 inches wide) that wither in summer. Fleshy, branching flowering stems rise from 2 to 4 inches tall with small, fleshy, leaf-like bracts, and are topped with five-lobed flowers that vary from yellow to yellow flecked with bright red. Bloom time is May to June. The fruit consists of five many-seeded pods. (USFWS, 1999c) (USFWS, 2009aj)

The subspecies was listed as threatened in 1997 (62 FR 4172 4183, 29 January 1997) and no critical habitat has been proposed (USFWS, 2015eb). It is known from the Santa Monica Mountains of Los Angeles and Ventura Counties in southern California (USFWS, 2009aj).

Marcescent dudleya is found on sheer faces of volcanic outcrops and canyon walls adjacent to perennial streams in chaparral or coast live oak (*Quercus agrifolia*) woodlands often with California bay (*Umbellaria californica*) but in a rock-face microhabitat limited otherwise to ferns, mosses, and lichens. Threats to the subspecies include habitat loss, fragmentation or degradation due to residential and commercial development, destruction from fire or fire suppression activities, recreational activities (e.g., rock climbing, substrate removal or graffiti), collection by commercial and private enthusiasts, habitat alteration due to climate change, and dangers from genetic drift and random catastrophic or climatic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 1999c)

***Marin Dwarf-flax*.** Marin dwarf-flax (*Hesperolinon congestum*) is an annual herb in the flax family. It has slender stems that range in height from 4 to 16 inches and linear leaves. Flowers have five hairy sepals, five rose to whitish petals, and pink to purple anthers. They are born in clusters. The blooming period is from May through July. (USFWS, 1995b) (NPS, 2016a) (USFWS, 2016ar)

The subspecies was listed as threatened in 1995 (60 FR 6671 6685, 3 February 1995) and no critical habitat has been proposed to date (USFWS, 2015eb). It is found at fewer than 20 sites in Marin, San Francisco and San Mateo Counties. (USFWS, 1995b) (USFWS, 2016ar)

Marin dwarf-flax is found in serpentine chaparral and serpentine bunch grass communities. Threats to this species include foot traffic, residential development, recreational development, and competition with invasive species. (USFWS, 1995b) (USFWS, 2016ar)

***Mariposa Pussypaws*.** Mariposa pussypaws (*Calyptridium pulchellum*) is a small annual herb in the purslane or miner's lettuce family. The plant is characterized by many fibrous roots and prostrate stems. Stems are smooth and slender and can reach 4 to 8 inches in length. Each stem has a small basal rosette of smooth spatula-shaped leaves. Blooming occurs between May and August, when four rose-colored petals and yellow anthers appear in loose clusters at the end of stems (USFWS, 1998n) (USFWS, 2016as) (USFWS, 2010v).

The species was listed as threatened in 1998 (63 FR 49022 49035, 14 September 1998) and no critical habitat has been proposed to date. It is known to occur at fewer than 10 sites in Mariposa, Madera and Fresno Counties in central California (USFWS, 1998n) (USFWS, 2010v) (USFWS, 2016as).

Mariposa pussypaws is found in the southwestern foothills of the Sierra Nevada Mountains in decomposed granitic soils, often in small barren areas in foothill chaparral, gray pine, or oak woodlands. Threats to this species include small population size, urbanization, and competition from taller faster growing vegetation (USFWS, 1998n) (USFWS, 2010v) (USFWS, 2016as).

***Marsh Sandwort*.** Marsh sandwort (*Arenaria paludicola*) is a slender perennial herb of the pink family. The species roots from the nodes of procumbent stems, and the grooved, glabrous stems are often supported by surrounding vegetation. Bloom is from May to August when small white flowers appear on long stalks. Flowers are in the axils of the narrow, oppositely arranged leaves. (USFWS, 1993c) (USFWS, 2016at) (USFWS, 2016au).

Marsh sandwort was listed as endangered in 1993 (58 FR 41378 41384, 03 August 1993). The plant was historically documented from California and Washington, but the only known extant populations are in San Luis Obispo County at Oso Flaco Lake and an introduced population on the southern edge of Morro Bay. To date, no critical habitat has been designated (USFWS, 1993c) (USFWS, 2016at) (USFWS, 2016au).

This is a coastal species that occupies marshes and freshwater wetlands. Threats to the species include competition with exotic species, and changes in hydrology attributed to drought, drilling, and development (USFWS, 1993c) (USFWS, 2016at) (USFWS, 2016au).

McDonald's Rock-cress. McDonald's rock-cress (*Arabis macdonaldiana*) "is a showy perennial herb in the Brassicaceae (mustard family). The species has a branched caudex (short, vertical, often woody stem at or just beneath the ground surface) and several simple stems ranging from 2 to 10 inches in height. The lower leaves are in rosettes (a cluster of leaves in a circle), spatulate (rounded above and narrowed to the base), and range between 0.4 and 0.8 inch long and 0.2 to 0.3 inch wide. The leaves are toothed, and essentially smooth. Plants often do not flower and fruit every year. The petals are rose or purple in color and measure 0.35 to 0.43 inch long. Flowering typically occurs between April and May." (USFWS, 2013v)

McDonald's rock-cress was federally listed as endangered in 1978 (43 FR 44810 44811, September 28, 1978). No critical habitat has been designated for this species. It is found in the Siskiyou Mountains of northwest California, and has been previously documented in Mendocino, Trinity, and Siskiyou Counties (USFWS, 1984f).

Habitat for McDonald's rock-cress includes dry, open woodlands or brushy slopes with serpentine soils under 5,900 feet in elevation (USFWS, 2010aj). Woodlands associated with the species typically contain ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi*), sugar pine (*Pinus lambertiana*), incense cedar (*Calocedrus decurrens*), and occasionally knobcone pine (*Pinus attenuata*) (USFWS, 1984f).

Menzies' Wallflower. Menzies' wallflower (*Erysimum menziesii*) is a biennial or short-lived perennial herb in the mustard family. It grows from a basal rosette of succulent, spoon-shaped leaves with one to several branched stems from 1 to 6 inches tall. Flowers grow on short stalks in clusters at the top of the stems. Each flower has four large, bright yellow petals. Bloom time is March to April. Fruit is thin cylindrical pod from 1 to 5 inches long (USFWS, 1998m) (USFWS, 2008o).

The species was listed as endangered in 1992 (57 FR 27848 27859, 22 June 1992). No critical habitat has been proposed (USFWS, 2015ec). Since listing, four subspecies have been recognized, with three (subspecies *eurekense*, *menziesii*, and *yadonii*) falling within the listing concept of the species (and thus also considered endangered). The fourth subspecies, known as *E. concinnum* at the time of listing, is explicitly excluded as a separate entity (USFWS, 2008o). The three listed subspecies are found in near-shore dune systems in Humboldt, Mendocino, and Monterey Counties (USFWS, 2008o).

Menzies' wallflower grows in near-shore sandy foredunes. The species is threatened by habitat loss or modification due to residential or commercial development, trampling by hikers, livestock or equestrians, off-highway vehicles, encroachment by non-native invasive species, sand mining, coastal erosion, disposal of dredging spoils, dangers from random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change (USFWS, 1998m) (USFWS, 2008o). A rust fungus (*Albugo candida*) may also threaten seed and seedling survival (USFWS, 1998m).

Metcalf Canyon Jewelflower. Metcalf Canyon jewelflower (*Streptanthus albidus* ssp. *albidus*) is an annual herb in the mustard family. The plant grows up to 3 feet in height and has a pale green stem with a bluish, waxy covering. Flowers appear between April and June, on leafless terminal

stems. Sepal color varies between white, yellow, and whitish-green. Petals are found in fours and are approximately 0.4 inches long with purple veins. (USFWS, 1995b) (USFWS, 2016av) (USFWS, 2009ak)

The Metcalf Canyon jewelflower was listed as endangered in 1995 (60 FR 6671 6685, 3 February 1995). The herb is endemic to Santa Clara County, with 9 extant populations totalling 20,000 to 25,000 individual plants being limited to a stretch of approximately 20 miles between San Jose and Anderson Lake. To date, no critical habitat has been designated for the species. (USFWS, 1995b) (USFWS, 2016av) (USFWS, 2009ak)

The subspecies occurs on serpentine rocky outcrops with little soil development. Threats to the subspecies include development, trash dumping, off-road vehicles. Further, the fragmented nature of its habitat increases dangers from pest and disease outbreaks, fire, flood, landslides, and drought. (USFWS, 1995b) (USFWS, 2016av) (USFWS, 2009ak)

***Mexican Flannelbush*.** Mexican flannelbush (*Fremontodendron mexicanum*) is an upright, branched shrub or tree in the cacao family that grows from 5 to 19 feet tall. This plant exhibits palm-shaped leaves that are about 0.5 to 2.7 inches wide and are somewhat thick and leathery in texture (USFWS, 1998t) (Preston, Whetstone, & Atkinson, 2016a). Blooming occurs from about March through June, with showy flowers yellow to dark orange in color (Preston, Whetstone, & Atkinson, 2016a) (USFWS, 2009al).

This species was listed as endangered in 1998 (63 FR 54956 54971, 13 October 1998). Critical habitat has been designated in the Otay Mountain Wilderness Area in southern San Diego County (72 FR 54984 55010, 27 September 2007) (USFWS, 2007o) (USFWS, 2016aw).

Mexican flannelbush grows in closed-cone conifer forests and mixed chaparral at elevations below 3,000 feet (USFWS, 2009al). This species occurs most frequently in areas with metavolcanic soils along alluvial benches and canyon slopes associated with ephemeral drainages (USFWS, 1998t) (USFWS, 2009al). Major threats to this species include habitat modification from altered fire regime, competition with non-native plant species, and impacts from border patrol activities, as well as risks associated with small population size (USFWS, 2009al).

***Monterey Clover*.** Monterey clover (*Trifolium trichocalyx*) is an annual herb in the pea family. Stems and branches are prostrate and 1.2 to 1.6 inches long on average. They spread along the ground, often giving the impression of being multiple individual plants. Leaves are compound with three obovate-cuneate leaflets 0.2 to 0.5 inches long that are notched on the ends. Many flowers are present on heads with purple corollas (USFWS, 2004d).

The species was listed as endangered in 1998 (63 FR 43100 43116, 12 August 1998). Critical habitat has not been designated for the species. Historically, Monterey clover could be found in Monterey, Colusa, Mendocino, and Lake Counties (Calflora, 2016b) (USFWS, 2004d). Presently, the species is only found on Huckleberry Hill on the Monterey Peninsula, Monterey County covering an area of 40 acres (USFWS, 2004d).

Monterey clover requires an open canopy and usually shows up following fires. It often declines once the forest canopy closes. The species occurs in Monterey pine forests with loamy fine to

coarse sandy soils. Threats to the species include urban and recreational development, fire suppression, and reduction of habitat and ephemeral nature of the species (USFWS, 2004d).

Monterey Gilia. Monterey gilia (*Gilia tenuiflora* ssp. *arenaria*) is an annual herb in the phlox family. It grows to 7 inches tall with several stems rising to spreading from a basal rosette of leaves; glandular hairs[136] at the base sometimes give this area a cobwebby appearance. Leaves are toothed to deeply lobed, and are typically found at the base. Flowers terminate open, branching stems. Flowers have a narrow, funnel-shaped, half-inch long tube that spreads into five petal lobes; inside the funnel, the throat of the flower is purple, with pink or lavender and white lobes at the base. Bloom time is April to June. The fruit of each flower is a quarter-inch long capsule (USFWS, 1998m) (USFWS, 2008p).

The subspecies was listed as endangered in 1992 (57 FR 27848 27859, 22 June 1992). No critical habitat has been proposed (USFWS, 2015ed). It is found in dune systems in Santa Cruz and Monterey Counties of coastal California (USFWS, 2008p).

Monterey gilia grows in open but wind-protected sandy areas in dune scrub or maritime chaparral. The subspecies is threatened by habitat loss or modification due to residential or commercial development, trampling by hikers, livestock or equestrians, off-highway vehicles, sand mining, and encroachment by non-native invasive species. (USFWS, 1998m) (USFWS, 2008p)

Monterey Spineflower. Monterey spineflower (*Chorizanthe pungens* var. *pungens*) is a grayish, hairy annual herb in the buckwheat family. Leaves form a basal rosette at the base of the stem, and are up to 2 inches long and wider near the tip. Wiry stems branch from the base, with plants spreading up to 20 inches across but only 6 to 10 inches tall. Small (less than 0.25 inches long) white to lavender or rose flowers are surrounded by 6 hooked spines. Flowers appear in ball-like clusters, and often bloom between April and June. The fruit is an elliptic, three-angled seed. (USFWS, 1998m) (USFWS, 2009am)

The variety was listed as threatened in 1994 (59 FR 5499 5510, 4 February 1994) and 18,830 acres of critical habitat was designated in 2002 (67 FR 37498 37546, 29 May 2002). It is known from Monterey and Santa Cruz Counties of coastal California (USFWS, 2015ee).

Monterey spineflower grows in sandy soils in coastal dunes and openings and bare patches in coastal scrub, maritime chaparral and oak woodlands. The variety is threatened by habitat loss or modification due to residential or commercial development, agricultural conversion, trampling by hikers, livestock or equestrians, encroachment by non-native invasive species, dune stabilization, road construction, and alteration of habitat due to climate change. (USFWS, 1998m) (USFWS, 2009am)

Morro Manzanita. Morro manzanita (*Arctostaphylos morroensis*) is an evergreen shrub in the heath family. It ranges in height from 5 to 13 feet, with grey to brown colored shaggy bark along the trunk. Leaves are grey-green or olive-green and oblong to ovate in shape. Flowers are white

[136] Glandular hairs: a plant trichome or hair that is "ball-tipped" (Williams, 1987) with a secretory gland that excretes salts or often sticky exudates.

to pinkish and urn-shaped, only 0.2 inches in length. Each flower produces an orange brown berry reaching up to a half inch in diameter. (USFWS, 1994e) (USFWS, 2016df).

The species was listed as endangered in 1994 (9 FR 64613 64623, 15 December 1994) and is endemic to San Luis Obispo County. No critical habitat has been designated for this species (USFWS, 1994e) (USFWS, 2016df).

Morro manzanita is limited to ancient dune-derived sandy soils classified as Baywood fine sands. The species is found in coastal dune scrub, maritime chaparral, and coast live oak woodland communities in sites, but on steeper slopes may occur in almost pure stands. Primary threats to the species include proposed development and soil erosion. (USFWS, 1994e) (USFWS, 2016df)

Munz's Onion. Munz's onion (*Allium munzii*) is a perennial herb in the onion family. Flowering stems rise from 0.5 to 1.2 feet tall from a bulb with a "papery, reddish brown outer coat" and a light brown inner coat. A single more or less cylindrical leaf is produced each year, and can be up to 1.5 times longer than the flowering stem. Flowers are clustered in an umbel, with 10 to 40 flowers on short stalks that radiate from a single point of attachment at the top of the stem. Flowers have 6 elliptic to ovate petals that are white or white with a red midvein and about 0.2 to 0.3 inches long; these become red with age. Bloom time is March to May. The fruit of each flower is a capsule (USFWS, 2000h) (USFWS, 2013r).

The species was listed as endangered in 1998 (63 FR 54975 54994, 13 October 1998). It is known only from western Riverside County in southern California (USFWS, 2000h) (USFWS, 2013r). A total of 176 acres of critical habitat was designated for the species in 2005 (70 FR 33015 33033, 7 June 2005) which was revised to 98.4 acres in 2013 (78 FR 22625 22658, 16 April 2013).

Munz's onion occurs on mesic clay soils in grasslands or grassy openings in coastal sage scrub or juniper woodlands. Threats to the species include habitat loss due to residential and commercial development, recreational activities (off-highway vehicles, mountain biking, camping, hiking), clay mining, habitat alteration due to global climate change, discing and other fire suppression activities, and competition from non-native species. (USFWS, 2000h) (USFWS, 2013r).

Napa Bluegrass. Napa bluegrass (*Poa napensis*) is a bunched perennial grass that grows to over 3 feet tall. Leaves are very narrow (0.04 inches) and linear, with the blades to 8 inches long. Flowering occurs in a narrow branching structure at the top 4 to 6 inches of stem; overall color of the flowering parts may be green to purple, with small individual florets that are small and unnoticeable. Bloom time is May to August. The fruit of each floret is a grain. (USFWS, 2010o)

The species was listed as endangered in 1997 (62 FR 54791 54808, 22 October 1997). No critical habitat has been proposed (USFWS, 2015ef). It is known from two locations totaling less than acre in extent just inland from the north central coast of Napa County, and may have potential habitat in neighboring Sonoma County (USFWS, 2010o).

Napa bluegrass is restricted to alkaline meadows and grasslands with clay soils fed by sulphur hot springs and geysers. Threats to the species include recreational activities (hiking), residential

and commercial development, road construction and maintenance, landscape maintenance (mowing), random catastrophic events due to restricted distribution, narrow habitat requirement and small population size, alterations to hydrology that affect the hot springs and geysers, invasive plant species, and alterations to habitat resulting from climate change. (USFWS, 2010o)

Nevin's Barberry. Nevin's barberry (*Berberis nevinii*) is an evergreen shrub in the barberry family with gray-green leaves that are divided into flat, feather-like leaflets with toothed margins and a terminal spine. This shrub blooms from March through April, with loosely clustered yellow flowers that develop into juicy, yellowish-red berries. (USFWS, 1998t) (USFWS, 2009an)

This species was listed as endangered in 1998 (63 FR 54956 54971, 13 October 1998). Critical habitat has been designated in Riverside County (73 FR 8412 8440, 13 February 2008) (USFWS, 2008v) (USFWS, 2016ay). Fourteen native occurrences of this species are known to occur scattered discontinuously from Los Angeles County, the San Bernardino/Riverside County border, and southwestern Riverside County (USFWS, 2009an).

Nevin's barberry occurs in a variety of habitats, including nearly flat sandy washes, terraces, and canyon floors to gravelly wash margins, steep-sloped drainage banks, and steep rocky ridges, slopes, or mountain summits. This species is known to occur in chaparral, coastal sage scrub, oak woodland, riparian scrub/woodland, and alluvial scrub vegetation types. Major threats to this species include urbanization, road widening, recreational activities, fire management practices and altered fire regimes, as well as risks to environmental events due to small population size and low reproduction rates. (USFWS, 2009an)

Nipomo Mesa Lupine. Nipomo Mesa lupine (*Lupinus nipomensis*) is an annual herb in the pea family. The plant reaches 4 to 8 inches tall and has hairy decumbent stems. Leaves are palmately compound with 5 to 7 succulent, hairy leaflets, each approximately 0.5 inches long. Flowers are pink ranging in length from 0.23 to 0.3 inches long, and appear in elongate clusters at the end of stem. (USFWS, 2000i) (USFWS, 2016az)

The species was listed as endangered in 2000 (65 FR 14888 14898, 20 March 2000). It is only known from a single population in the Guadalupe-Nipomo Dunes of San Luis Obispo County. No critical habitat has been proposed for the species (USFWS, 2000i) (USFWS, 2016az).

Nipomo Mesa Lupine is restricted to pockets of bare sand in stabilized back dune areas. Nipomo Threats to the species include physical disturbances and competition from invasive species, especially veldt grass. (USFWS, 2000i) (USFWS, 2016az)

Orcutt's Spineflower. Orcutt's spineflower (*Chorizanthe orcuttiana*) is an annual herb in the buckwheat family. Plants have a spreading habit to 3 inches tall and 10 inches across. Stems branch from the base. Leaves are mostly basal and broader near the tip, often dying back by flowering time. Involucral bracts[137] form a funnel-shaped tube ending in three hooked spines

[137] Involucral bracts: bracts that form an involucre, "a circle or cluster of bracts at the base of a flower cluster [or flower], sometimes fused into a cup…" (Williams, 1987); in the heads of the sunflower family, these are termed phyllaries.

surrounding a small yellow flower. Bloom time is March to May. The fruit is a tiny three-angled seed. (USFWS, 2007p)

The species was listed as endangered in 1996 (61 FR 52370 52384, 7 October 1996) and no critical habitat has been proposed (USFWS, 2015eg). It is endemic to San Diego County in southern California (USFWS, 2007p).

Orcutt's spineflower is found on sandy soils of weathered sandstone bluffs in openings in southern maritime chaparral. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural development, prescribed fuel modification for fire prevention (e.g., vegetation thinning, fire breaks, disking, mowing), disruption of natural fire cycles (including ecological succession due to fire suppression), encroachment and competition with non-native invasive species, recreational development and activities, and dangers from genetic drift and random catastrophic or climatic events due to restricted distribution, narrow habitat requirements, and small population size. (USFWS, 2007p)

Otay Mesa-mint. Otay mesa-mint (*Pogogyne nudiuscula*) is an annual herb in the mint family. Plants are strongly aromatic with turpentine minty odor. Stems grow erect to a foot tall, with typically little branching. The spatula or spoon-shaped leaves are arranged opposite one another along the stem, and are a bright green with few hairs. They are about 1 inch long. The foliage develops a reddish tinge only after flowering is complete. The flowers occur in whorled clusters (6 per node) at the end of the stems, and are bright purple with a white throat. Sepals and the bract below the flowers are without hairs. Bloom time is May to July. (USFWS, 1998k) (USFWS, 1993b) (USFWS, 2010w)

The species was listed as endangered in 1993 (58 FR 41384 41392, 3 August 1993). It is known from Otay Mesa in San Diego County in southern California and historically from immediately adjacent Baja California, Mexico (USFWS, 1998k) (USFWS, 2010w). No critical habitat has been proposed (USFWS, 2016ba).

Otay mesa-mint is exclusively found in in vernal pool habitats. Threats to the species include habitat loss due to commercial and residential development, agricultural conversion, road and highway construction, off-highway vehicle use, human access (trash dumping, trampling), livestock trampling and grazing, alteration of hydrology, competition from non-native species, the genetic dangers of small population size, danger from random catastrophic events due to small population size and limited distribution, fire and fire suppression acivities, and habitat modifications associated with drought and global climate change. (USFWS, 1998k) (USFWS, 1993b) (USFWS, 2010w)

Otay Tarplant. Otay tarplant (*Deinandra conjugens* or *Hemizonia conjugens*) is an annual plant that grows less than 16 inches tall in the sunflower family. Plants of this species exhibit an open, airy branching pattern with small, linear leaves close to the stem and covered in soft, shaggy hairs (USFWS, 2002j). Flowers are arranged in heads of ray and disk flowers, usually grouped along the outer portions of main stem and branches. Inflorescences are yellow, usually blooming from April to June (Baldwin, Deinandra conjugens, 2016a).

This species was listed as threatened in 1998 (63 FR 54938 54956, 13 October 1998). Critical habitat has been designated (67 FR 76030 76053, 10 December 2001) in southwestern San Diego County (USFWS, 2002j) (USFWS, 2016bb).

Otay tarplant is typically found growing in clay soils on slopes and mesas, associated with grassland, open coastal sage scrub, or maritime succulent scrub vegetation types (USFWS, 1998p) (USFWS, 2002j) (USFWS, 2009ao). Major threats to this species include habitat alteration or destruction from urban development, off-highway vehicle use, and competition with invasive non-native plant species (USFWS, 2009ao).

Pallid Manzanita. Pallid manzanita (*Arctostaphylos pallida*) is an upright shrub in the heath family. It grows from about 6.5 to 13 feet or taller. Stems of this shrub are rough with gray or reddish bark and bristly twigs. Leaves are bristly and are about 1 to 1.8 inches long and 1 inch wide, oval to triangular-shaped, and often overlapping each other. The blooming period for this shrub occurs from December to March, with densely arranged clusters of white, urn-shaped flowers. (USFWS, 1998r)

This species was listed as threatened in 1998 (63 FR 19842 19850, 22 April 1998), and no critical habitat has been established (USFWS, 2016bc). Pallid manzanita is found in maritime chaparral vegetation at elevations ranging from 656 to 1,460 feet, where summer fog occurs with high frequency. This species is shade intolerant and therefore does not grow when shaded by larger trees and shrubs. Soils tend to be thin, well-drained and nutrient-deficient. This species is currently known to occur in locations among the Oakland/Berkeley Hills, in western Contra Costa and Alameda Counties. Major threats to this species include fungal pathogens, shading from native and non-native invasive plant species, and altered fire regime and wildlife fuel regime. (USFWS, 2010x)

Palmate-bracted Bird's Beak. Palmate-bracted bird's beak (*Cordylanthus palmatus or Chloropyron palmatus*) is a hemi-parasitic annual herb in the broomrape family. Stems can be highly branched and up to a foot tall. Stems and leaves are covered in glandular hairs; the salt crystals they exude give mature plants a grayish-green color. The flowers are nearly hidden by leaf-like bracts, with a green outer bract and a lavender inner bract that is deeply divided with finger-like lobes. Flowers are hairy and somewhat club-shaped with petals fused into an upper bird's beak-like structure and a lower, inflated lip. Flowers are whitish to lavender, with purple stripes on the lower lip. Bloom time is May to October. The fruit is a capsule. (USFWS, 1998a) (USFWS, 2009ap)

The species was listed as endangered in 1986 (51 FR 23765 23769, 1 July 1986) and no critical habitat has been proposed. It is known or believed to occur in 10 counties throughout central to northern San Joaquin Valley. (USFWS, 2015eh).

Palmate-bracted bird's beak is limited to seasonally-inundated saline-alkali soils in lowland flats and basins below elevations of 500 feet in Valley sink scrub or alkali meadows communities (USFWS, 1998a). Threats to the species include habitat loss and degradation due to residential and commercial development, road construction and maintenance, agricultural conversion, alterations to hydrology, competition with invasive non-native species, off-highway vehicle use,

livestock grazing and trampling, herbicide and insecticide use, air pollution (airborne dust and ozone), alteration of habitat due to climate change, and random catastrophic events due to restricted distribution, narrow habitat requirement and small population size (USFWS, 1998a) (USFWS, 2009ap).

Parish's Daisy. Parish's Daisy (*Erigeron parishii*) is a small perennial herb in the sunflower family, ranging about 4 to 14 inches tall. The leaves of this plant are linear, typically1 to 2 inches long, and covered in soft, silvery hairs (USFWS, 1994a). Inflorescences occur singly at the ends of leafy stalks, with yellow disc flowers and bluish to pink or white ray flowers on the outside, generally blooming between May and June (USFWS, 2009aq).

This species was listed as threatened in 1994 (59 FR 43652 43664, 24 August 1994) and critical habitat was established in 2002 (67 FR 78570 78610, 24 December 2002) in San Bernardino County, in southern California, north and east of Big Bear Lake (USFWS, 2016bd). This plant is known only to occur in the San Bernardino Mountains of southern California (USFWS, 2009aq).

Parish's daisy is restricted primarily to carbonate derived soils in the San Bernardino Mountains of San Bernardino County. It is typically found growing on dry, rocky slopes, active washes and outwash plains in association with pinyon woodlands, pinyon-juniper woodlands, and blackbush scrub vegetation at elevations ranging from 3,842 and 6,500 feet. Major threats to this species included habitat alteration or destruction resulting from off-road vehicle use, mining, energy development projects, and fire suppression activities, as well as dangers from random events including climate change. (USFWS, 2009aq)

Pedate Checkermallow. Pedate checker-mallow (*Sidalcea pedata*) is a perennial herb in the mallow family. The plant grows from a fleshy taproot, with multiple stems. The leaves grow primarily from the base of the plant and generally have five to seven lobes arranged like a hand. Each lobe is further divided into three divisions, with only a few leaves growing along the stem (USFWS, 1984g) (USFWS, 2011aa). Pedate checker-mallow has reddish stems that are relatively wide and covered in hairs. Flowers of this species have 5 petals that are about 0.5 inch long, are pink to magenta in color, arranged in loose clusters at the ends of stem branches, and bloom between May and August (USFWS, 2011aa).

This species was listed as endangered in 1984 (49 FR 34497 34500, 31 August 1984), and no critical habitat has been established (USFWS, 2016be). Pedate checker-mallow is known to occur only around the Big Bear Lake area in San Bernardino County, in southern California. This species is found primarily on springtime moist meadows, sparsely vegetated drier meadow sites, and pebble plains that are dominated by basin sagebrush (*Artemisia rothrockii*), at elevations ranging from 5,250 to 8,200 feet. Soils in this area are typically high in clay content, allowing moisture retention and considered key to supporting this habitat type. Primary threats to this species are habitat modification or destruction through residential development, off-highway vehicle use, alteration of hydrology, competition with non-native plant species, grazing, fire suppression, and recreational activities as well as vulnerability to disease, climate change, and drought given the small, isolated populations of this species. (USFWS, 2011aa)

Peirson's Milk-vetch. Peirson's milk-vetch (*Astragalus magdalenae* var. *peirsonii*) is a stout, short-lived perennial plant in the pea family that grows from about 8 to 27 inches tall and has fern-like divided leaves (USFWS, 1998o). The stems are covered in fine silky hairs, with dull purple flower clustered on floral stems and blooming from about December to April (USFWS, 1998o) (Wojciechowski & Spellenberg, 2016d). Mature fruits are somewhat inflated, oval pods with rough hairs (Wojciechowski & Spellenberg, 2016d).

This variety was listed as threatened in 1998 (63 FR 53596 53615, 6 October 1998). Critical habitat was originally designated in 2004 (69 FR 47330 47351, 4 August 2004) and revised in 2008 (73 FR 8748 8785, 14 February 2008) (USFWS, 2016bf). Critical habitat is currently established in Imperial County, near the border of Arizona and Baja California, Mexico (USFWS, 2008r).

Peirson's milk-vetch grows in active windblown sand dune areas between active faces in bowls or shallow protected slopes of dunes. Surrounding vegetation is restricted to sparse sand-loving desert scrub species. Major threats to this variety result primarily from off-highway vehicle use in sand dune areas, herbivory, and risks to random environmental events such as flooding or fire due to low population size. (USFWS, 2008r)

Pennell's Bird's-beak. Pennell's bird's-beak (*Cordylanthus tenuis* ssp. *capillaris*) is a herbaceous annual in the snapdragon family. The subspecies ranges in height from 12 to 24 inches and has yellow-green hairless leaves. The plant is parasitic and forms root attachments to shrubs and cypress trees. Flowering occurs in June and July when floral bracts with marginal hairs on bracts and calyx appear. Seed capsules contain 10 to 16 seeds each and are approximately 0.6 inches long. Three-lobed outer bracts distinguish this species from similar bird's beak species. (USFWS, 1995b) (USFWS, 2009ar) (USFWS, 2016bg)

Pennell's bird's-beak was listed as endangered in 1995 (60 FR 6671 6685, 3 July 1995). The plant is endemic to Sonoma County in California. To date, no critical habitat has been designated for this subspecies. (USFWS, 1995b) (USFWS, 2009ar) (USFWS, 2016bg)

Pennell's bird's-beak is associated with Sargent cypress (*Hesperocyparis sargentii*) and Baker's manzanita (*Arctostaphylos bakeri* ssp. *bakeri*) on serpentine barrens. Primary threats to the subspecies include timber harvest, development, illegal dumping, slope erosion, off-road vehicle damage, and roadside maintenance. (USFWS, 1995b) (USFWS, 2009ar) (USFWS, 2016bg)

Pine Hill Ceanothus. Pine Hill ceanothus (*Ceanothus roderickii*) is a low-growing, mounded evergreen shrub in the buckthorn family that is generally less than 2 feet tall. Branches often send down roots where they rest on the ground and the plant itself can spread to nearly 10 feet in diameter (USFWS, 1996c). Flowers of Pine Hill ceanothus are unique among other species in this genus for their blue-tinged white flowers that produce an inconspicuously horned round capsule (USFWS, 1996c) (USFWS, 2002h).

This species was listed as endangered in 1996 (61 FR 54346 54358, 18 October 1996), and no critical habitat has been established (USFWS, 2016by). Pine Hill ceanothus is restricted to Pine Hill and surrounding ridges in western El Dorado County, in the north-central portion of the state (USFWS, 1996c) (USFWS, 2002h).

Gabbro soils are a primary constituent in habitat for this species, and plants are typically growing in open areas within chaparral vegetation (USFWS, 1996c). Major threats to this species include habitat alteration through residential and commercial development, road construction, off-highway vehicle use, and altered fire regime (USFWS, 1996c) (USFWS, 2002h).

Pine Hill Flannelbush. Pine Hill flannelbush (*Fremontodendron californicum* ssp. *decumbens* or *F. decumbens*) is a branched, low-growing spreading shrub in the cacao family that grows up to 4 feet tall. This plant exhibits palm-shaped leaves that are about 0.5 to 2 inches wide, soft, and somewhat leathery in texture. Dense, star-shaped hairs cover the leaves and young twigs and branches. Blooming occurs between March and June, with showy copper-orange colored flowers. (Preston, Whetstone, & Atkinson, 2016b) (USFWS, 2002h)

This subspecies was listed as endangered in 1996 (61 FR 54346 54358, 18 October 1996), and no critical habitat has been established (USFWS, 2016bh). It occurs in the vicinity of Pine Hill in western El Dorado County, Nevada County, and in the north-central portion of the state (USFWS, 1996c) (USFWS, 2002h).

Pine Hill flannelbush is strongly associated with gabbro or serpentine soils and chaparral, occurring where there are openings in the dense vegetation (USFWS, 1996c). Major threats to this species are habitat alteration and modification resulting from urban development and alteration of fire regime (USFWS, 2002h).

Pismo Clarkia. Pismo clarkia (*Clarkia speciosa* ssp. *immaculata*) is an erect herb in the four o'clock family. It has branched stems that can stand up to 20 inches. Flowering occurs between May and July, when its larger flowers distinguish this from similar subspecies. Petals are a white cream center with lavender-pink near the tips. (USFWS, 1994e) (USFWS, 2016bi)

The species was first listed as endangered in 1994 (9 FR 64613 64623, 15 December 1994). The plant is known to occur in only five populations near Pismo Beach in San Luis Obispo County. To date, no critical habitat has been designated. (USFWS, 1994e) (USFWS, 2016bi)

Pismo Clarkia is restricted to sandy soils in grassy openings within chaparral and oak woodland. Primary threats to the species include cattle grazing, proposed development, road maintenance, drought conditions, and competition from invasive plants. (USFWS, 1994e) (USFWS, 2016bi)

Pitkin Marsh Lily. Pitkin Marsh lily (*Lilium pardalinum* ssp. *pitkinense*) is a perennial herb in the lily family that spreads by rhizomes. Stems are slender and upright, reaching 3 to 6 feet tall. Leaves are yellow-green, up to 6 inches long and less than an inch wide. Leaves are usually arranged individually along the stem but in some individuals 3 to 6 leaves will be grouped at the middle of the stem. Flowers appear on small stalks at the top of the stem and are large and showy, with red petals that grade to yellow with maroon dots in the center. Bloom time is June to July. The fruit of each flower is an elliptical, many seeded capsule. (USFWS, 2009as)

The subspecies was listed as endangered in 1997 (62 FR 54791 54808, 22 October 1997). No critical habitat has been proposed (USFWS, 2015ei). It is known only from two remnant marshes in Sonoma County on the north central coast of California (USFWS, 2009as) but may also have potential habitat in neighboring Marin County (USFWS, 2015ei).

Pitkin Marsh lily grows in at least seasonally saturated sandy soils of freshwater marshes, wet meadows and margins of willow riparian woodland. Threats to the subspecies include residential and urban development (both direct habitat loss and indirect effects on hydrology, runoff, pollution, etc.), agricultural conversion, landscape modifications that alter hydrology, road and utility construction and maintenance, competition with non-native invasive species, groundwater depletion, potential wild collection by individual or commercial enthusiasts, hybridization with other species or subspecies, habitat alteration due to global climate change, and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 2009as)

Presidio Clarkia. Presidio clarkia (*Clarkia franciscana*) is an annual herb in the evening primrose family. The species has small, narrow leaves, and can reach 16 inches in height. Flowering occurs between May and July. Petals are lavender-pink in color with a basal red spot and irregular teeth on the tip, which distinguishes this from similar species. (NPS, 2016b) (USFWS, 1995b) (USFWS, 2016bj)

Presidio clarkia was listed as endangered in 1995 (60 FR 6671 6685, 3 February 1995). It is known to occur in Alameda and San Francisco Counties in California. No critical habitat has been designated for this species (NPS, 2016b) (USFWS, 1995b) (USFWS, 2016bj).

Presidio clarkia is associated with serpentine soils in grassland communities. Primary threats to the species include potential development, roadside maintenance, foot traffic, mowing, competition from invasive plants, and shade from native and introduced shrubs and trees (NPS, 2016b) (USFWS, 1995b) (USFWS, 2016bj).

Presidio Manzanita. Presidio manzanita (*Arctostaphylos hookeri* var. *ravenii*) is a prostrate to ascending evergreen shrub in the heath family. It has reddish bark and lacks a basal root burl. Round to broadly elliptic leaves grow from branchlets covered in fine white hairs. Blooming occurs from June to March, when small, white, urn-shaped flowers appear. (NPS, 2016c) (USFWS, 1979) (USFWS, 2016bk)

The species was listed as endangered in 1979 (44 FR 61910 61911, 26 October 1979). It is restricted to the Presidio area of the northern San Francisco Peninsula, where only a single individual is known to remain in the wild a serpentine outcrop in the San Francisco Presidio. This individual has been used to vegetatively propagate additional genetically identical plants. No critical habitat has been proposed (NPS, 2016c) (USFWS, 1979) (USFWS, 2016bk).

Presidio manzanita grows in serpentine maritime chaparral-coastal prairie. Much of the San Francisco Peninsula has historically undergone extensive land use change and is highly urbanized. Continued threats to the species include lack of genetic diversity and extirpation by random environmental events such as storms, drought, and fires (NPS, 2016c) (USFWS, 1979) (USFWS, 2016bk).

Purple Amole. Purple amole (*Chlorogalum purpureum*) is a perennial bulb-forming plant in the agave family that grows from 10 to 16 inches tall. It has bright green, linear leaves that arise from the ground and are about 0.1 to 0.2 inches wide, with wavy edges (USFWS, 2000j)

(USFWS, 2008s). Bluish-purple, six-petaled flowers with bright yellow stamens occur along a widely-branching stem, typically blooming during May and June (USFWS, 2002k).

This species was listed as threatened in 2000 (65 FR 14878 14888, 20 March 2000) with critical habitat established in 2002 (67 FR 65414 65445, 42 October 2002) in Monterey and San Luis Obispo Counties (USFWS, 2002k) (USFWS, 2016bl). This species is limited in its distribution to the south coast mountain ranges of Monterey and San Luis Obispo Counties, where a Mediterranean, semiarid climate is typical (USFWS, 2002k). Purple amole tends to occur in areas of undisturbed clay soils and soil crusts of lichens, algae, mosses, and cyanobacteria (USFWS, 2002k). These soil crusts tend to protect soils from erosion, assist in water infiltration, improve soil nutrient content, and discourage annual weed growth. This species generally grows among grassland, oak savanna, and oak woodland vegetation communities. Major threats to this species include altered fire regime, competition with invasive plant species, and increased threat to survival based on the limited geographic distribution of the species (USFWS, 2008s).

Red Hills Vervain. Red Hills vervain (*Verbena californica*) is a laxly erect biennial or perennial herb in to the verbena family. Stems can reach up to 23 inches in height, and have oppositely arranged, bright green, elliptic to oblanceolate leaves. Flowering occurs from May through September with white-blue to purple colored blossoms that are at the top of each flowering stem, and produce four nutlets. Though the species is capable of reproducing by seed, most reproduction occurs asexually through the formation of bulblets underground (USFWS, 1998n) (USFWS, 2010y).

The species was listed as endangered in 1998 (63 FR 49022 49035, 14 September 1998). It is known from the Red Hills of Tuolumne County. No critical habitat has been designated (USFWS, 1998n) (USFWS, 2010y) (USFWS, 2016bm).

Red Hills vervain is restricted to the margins of perennial streams and in other moist habitats in serpentine areas. Threats to the species include hiking, gold mining, mountain biking, over-grazing, and changes in hydrology (USFWS, 1998n) (USFWS, 2010y).

Robust Spineflower. Robust spineflower (*Chorizanthe robusta* var. *robusta*) is an annual herb in the buckwheat family. Stems branch from the base, with a spreading habit. Plants typically grow to about 8 inches tall and a foot wide. Leaves are mostly basal and broader near the tip. Involucral bracts are white on the edges, with six hooked spines per white to rose colored flower. Flowers are aggregated into ball-like clusters almost an inch across with two leaf-like bracts just below; the combination of bracts, spines and flowers presents a white aspect. Bloom time is April to June, or if rainfall permits, February through September. The fruit is a small three-angled seed. (USFWS, 2004c) (USFWS, 2010z)

The variety was listed as endangered in 1994 (59 FR 5499 5510, 4 February 1994) and 469 acres of critical habitat in Santa Cruz County was designated in 2002 (67 FR 36822 36845, 28 May 2002). It is known from Santa Cruz County of coastal north central California (USFWS, 2010z), but historically may have ranged from Alameda County south to Monterey County (USFWS, 2015ej). Populations of the variety previously identified in Marin County were determined to be a different though related species (USFWS, 2010z).

Robust spineflower is found on sandy soils in near-shore coastal and near coastal areas, in dunes or openings in coastal scrub, grassland, maritime chaparral, or oak woodlands. Threats to the variety include residential and commercial development, road or landscape maintenance, recreational activities (hiking, mountain biking, equestrian uses), encroachment and competition invasive non-native species, agricultural conversion of natural lands, herbivory by insects and small mammals, ecological succession due to fire suppression or dune stabilization, alterations to habitat resulting from climate change, and random events due to restricted distribution, narrow habitat requirement and small population size. (USFWS, 2004c) (USFWS, 2010z)

***Sacramento Orcutt Grass*.** Sacramento Orcutt grass (*Orcuttia viscida*), also known as sticky Orcutt grass or Sacramento orcuttia, is a small, semi-aquatic clumped annual C_4 grass. Plants germinate underwater, forming a rosette of 5 to 8 cylindrical juvenile leaves. Intermediate leaves are produced as the pool warms, and have a cylindrical submerged portion and a flat, floating blade. Once the pool has evaporated, multiple pith-filled upright to spreading stems ranging from 1 to 4 inches tall rise from a common fibrous root system and produce the terrestrial leaves. The flattened terrestrial leaves are about 2 to 4 inches long with the lower portion folding around the stem. Plants are bluish-green due to a covering of long, soft hairs, and produce an aromatic, sticky exudate even when young. The top third or half of each stem is terminated by a head-like cluster of two dense, compact rows of 5 to 15 groups (spikelets) of 6 to 20 florets oriented to one side of the stem. Each floret lacks petals and sepals, and is enclosed in a pair of small green bracts, the most prominent of which has five awl-like teeth with middle tooth conspicuously longer than the others and is about a quarter inch long; the teeth curve outward at maturity, providing a bristly appearance. Bloom time is April to July. The fruit of each floret is a grain. (USFWS, 2006d) (USFWS, 2008t)

The species was listed as endangered in 1997 (62 FR 14338 14352, 26 March 1997). Critical habitat was designated in 2003 (68 FR 46684 46867, 6 August 2003) with re-evaluations of non-economic and economic exclusions in 2005 (70 FR 11140, 8 March 2005; 70 FR 46924 46999, 11 August 2005) and administrative revisions in 2006 (71 FR 7118 7316, 10 February 2006). It is endemic to eastern Sacramento County in north central California (USFWS, 2006d).

Sacramento Orcutt grass is found in vernal pools on high stream terraces in oak woodland and annual grassland communities at elevations ranging from 150 to 270 feet. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, alteration of hydrology, road widening and realignment, grazing and trampling by livestock, competition from non-native invasive species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, equestrian uses, off-highway vehicles), loss of pollinators, dangers from random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2008t)

***Salt Marsh Bird's-beak*.** Salt marsh bird's-beak (*Cordylanthus maritimus* ssp. *maritimus*, or *Chloropyron maritimum* ssp. *maritimum*) is a hemi-parasitic annual herb in the broomrape family. Known host plants for the species include other individuals of its own subspecies,

saltgrass (*Distichlis spicata*), alkali bulrush (*Bolboschoenus maritimus*), tule (*Bolboschoenus robustus*), alkali heath (*Frankenia salina*), shoregrass (*Monanthochloe littoralis*), and cattail (*Typha latifolia*), though it is likely that other species can serve as host plants as well. (USFWS, 1985a) (USFWS, 2009at)

All tissues of the plant are typically tinged by purple pigments, though some can lack the purplish coloration and appear light green. Stems can be relatively short and simple or highly branched and up to 16 inches tall. Stems and leaves are variably covered in glandular hairs with visible salt crystals. The stems are terminated by a clusters of flowers. Flowers are somewhat club-shaped with petals fused into an upper bird's beak-like structure and a lower, inflated lip. Flower colors vary, but can be white with dark-brownish purple lips, or can be quite showy with pale pink pouches and darker purple lips. Bloom time is May to October, and in the southern part of its range the flowering season can be extended from April to December if conditions are appropriate. The fruit of each flower is a capsule with 10 to 40 seeds. (USFWS, 2014b) (USFWS, 1985a) (USFWS, 2009at)

The subspecies was listed as endangered in 1978 (43 FR 44810 44811, 28 September 1978). No critical habitat has been proposed (USFWS, 2016bn). It is known from coastal salt marshes from San Diego to San Luis Obispo Counties in southern California (USFWS, 2009at).

The salt marsh bird's beak is found in saline marshes in the upper middle littoral or high marsh zones, often in areas of low vegetation cover and subject to fresh water or low salinity in the spring that may be inundated by tides regularly but not daily. Threats to the subspecies include habitat loss or alteration due to filling or dredging of coastal marshes (which are now largely directly protected under current law and regulation), alteration of hydrology (including erosion and storm drain flow, habitat modifications [e.g., sea-level rise, changes in intensity or timing of precipitation] due to global climate change, modifications of tidal flow, freshwater diversion or inflow), off highway vehicles, limited seed predation by larvae of the salt marsh snout moth (*Lipographis fenestrella*), localized impacts of trampling by humans or horses, loss of native pollinators, competition from invasive non-native species, and the genetic dangers and susceptibility to random catastrophic events due to small population size, restricted distribution, and narrow habitat requirements. (USFWS, 2014b) (USFWS, 2009at)

San Benito Evening-Primrose. San Benito evening-primrose (*Camissonia benitensis*) is a small, hairy annual herb in the evening-primrose family. This evening-primrose has widely branched stems that are upright or somewhat spreading, about 1 to 8 inches tall. The stems tend to peel as the plant matures. Flowers bloom from April to June, with four petals that are yellow fading to red, arranged near the ends of the stem branches. (Wagner & Hoch, 2016)

This species was listed as threatened in 1985 (50 FR 5755 5759, 12 February 1985), and no critical habitat has been established (USFWS, 2016bo). San Benito evening-primrose is restricted to southeastern San Benito County and far western Fresno County, in the Central Coast Range of central California. This species appears to prefer flat to gently sloping habitats on alluvial terraces or adjacent alluvial outwash slopes at elevations less than 4,500 feet. Associated vegetation generally consists of less than 25 percent cover by chaparral species. Major threats to this species include habitat alteration from off-highway vehicle use, erosion, competition with

invasive species, and vegetation community succession, as well as the increased threat or risk from extreme weather events and climate change such as drought or drought due to the small population size of this species. (USFWS, 2009au)

San Bernardino Bluegrass. San Bernardino bluegrass (*Poa atropurpurea*) is a bunched perennial grass that grows up to 1.5 feet tall. It has creeping rhizomes that allow it to spread vegetatively. Leaves are narrow (0.04 inch), folded, and linear, with the blades to 8 inches long. Flowering occurs in a narrow branching structure at the top of the stem with small individual florets being small and unnoticeable, with a green or purplish tinge. Male (staminate) florets and female (pistillate) florets occur on different plants. Bloom time is May to July (USFWS, 2008u). The fruit of each pistillate floret is a grain.

The species was listed as endangered in 1998 (63 FR 49006 49022, 14 September 1998) with 2,489 acres of critical habitat being designated in 2008 (73 FR 47706 47767, 14 August 2008). It is known the San Bernardino Mountains of San Bernardino County and the Palomar and Laguna mountains of San Diego County (USFWS, 2015ek).

San Bernardino bluegrass grows near the drier margins of seasonally wet meadows. Threats to the species include habitat loss, fragmentation or degradation due to residential or commercial development, recreation development and maintenance (roads and trails), utility construction and maintenance, recreation (trampling by hikers, horseback or off-highway vehicle use), grazing and trampling by livestock, alteration of hydrology, competition with non-native species, mining, fire suppression, and alteration of habitat due to climate change. (USFWS, 2008u)

San Bernardino Mountains Bladderpod. San Bernardino Mountains bladderpod (*Physaria kingii* ssp. *bernardina* or *Lesquerella kingii* ssp. *bernardina*) is a small, short-lived perennial herb in the mustard family. It grows to about 4 to 8 inches tall and is generally silvery colored, with oval-shaped leaves arising from the base of the plant (USFWS, 1994a). Yellow flowers up to 0.5-inch long bloom at the ends of the stems between May and June, developing into small, round, hairy fruiting pods (Al-Shehbaz, I. A., 2016a) (USFWS, 2009av).

This subspecies was listed as endangered in 1994 (59 FR 43652 43664, 24 August 1994) and critical habitat was established in 2002 (67 FR 78570 78610, 24 December 2002) in San Bernardino County, in southern California in the vicinity of Big Bear Lake (USFWS, 2016bp). This plant is known only to occur in the San Bernardino Mountains of southern California (USFWS, 2009av).

San Bernardino Mountains bladderpod typically is found in single-leaf pinyon-mountain juniper and white fir forest vegetation, on dolomite soils with gentle to moderate slopes. Major threats to this subspecies include habitat destruction associated with land development, gold mining, off-road vehicle use, and fire suppression activities, as well as dangers from random events such as drought and fire due to the small population size. (USFWS, 2009av)

San Clemente Island Bush-mallow. San Clemente Island bush-mallow (*Malacothamnus clementinus*) is a rounded shrub that reaches up to 6 feet in height, with numerous shaggy branches. Leaves of this plant are conspicuously bicolored, with veined, densely white-hairy undersides and smooth to sparsely short-haired upper sides (USFWS, 2007q). Blooming occurs

from March to August, with flowers near the ends of branches in dense clusters, forming interrupted spikes[138] about 4 to 8 inches long (USFWS, 2007q). Flowers range in color from pink or white to fading lavender petals about 1 inch long with woolly flower bases (Slotta, Tracey, 2014) (USFWS, 1984g). Seed production has rarely been observed, and this plant is believed to propagate via rhizomes (USFWS, 2007q).

This species was listed as endangered in 1977 (42 FR 40682 40685, 11 August 1977) and no critical habitat has been designated (USFWS, 2016bq). This plant is known to occur only on San Clemente Island, off the southern California coast (USFWS, 2012p).

This plant occurs in a variety of conditions on San Clemente Island, but is generally found on southwesterly-facing coastal terraces and escarpments on San Clemente Island (USFWS, 2012p). Major threats to this species include habitat alteration and loss from military land use, erosion, fire and fire management, impacts from non-native plants, trampling, as well as dangers from random events such as climate change and disease due to low genetic diversity (USFWS, 2012p).

San Clemente Island Indian Paintbrush. San Clemente Island Indian paintbrush (*Castilleja grisea*) is a hemi-parasitic perennial herb or subshrub in the broomrape family. This plant grows up to 2 feet in height and are ash-gray in color with densely hairy, linear-shaped leaves (USFWS, 2012q). This Indian paintbrush blooms from February to April with pale yellow-green terminal spike inflorescences (Wetherwax, Chuang, & Heckard, 2014) (USFWS, 2012q). Mature fruits are a semi-woody capsule with many small seeds (USFWS, 2012q).

This species was first listed as endangered in 1977 (42 FR 40682 40685, 11 August 1977) and was reclassified as threatened in 2013 (78 FR 45406 45439, 26 July 2013) and no critical habitat has been designated (USFWS, 2016br). San Clemente Island Indian paintbrush is endemic to San Clemente Island, one of the Channel Islands off the southern California coast.

San Clemente Island Indian paintbrush is found in steep, rocky canyons as well as on coastal bluffs, slopes, and terraces across the southern two-thirds of San Clemente Island (USFWS, 2012q) (USFWS, 2012r). This species is known to parasitize many different plants, and is often associated with coastal sage scrub and maritime desert scrub plant communities (USFWS, 2012q). Threats to this species include destruction or modification of habitat caused by land use, erosion, non-native plant species, fire, and fire management (USFWS, 2012r).

San Clemente Island Larkspur. San Clemente Island larkspur (*Delphinium variegatum* ssp. *kinkiense*) is an herbaceous perennial in the buttercup family that grows to 20 inches tall. This larkspur blooms from March to April, displaying light blue to white flowers along branched flower stalks that typically bear 12 or fewer flowers. Leaves generally occur along the lower one-third of the stem. Mature fruits are a dry, pod-like structure, within which are many winged seeds that may be wind dispersed when the pod splits open. (USFWS, 2008q)

[138] Spike: "an elongated inflorescence bearing sessile flowers" [flowers appear attached directly to the stem axis without a stalk] (Williams, 1987).

San Clemente Island larkspur was listed as endangered in 1977 (42 FR 40682 40685, 11 August 1977) and no critical habitat has been designated (USFWS, 2016bs). This larkspur subspecies occurs on San Clemente Island, one of the Channel Islands of southern California.

This subspecies is on the east side of the northern and central portions of San Clemente Island on gently sloping open grassy terraces with northwest, north, and east exposures, at elevations ranging from 260 to 840 feet. It is known to inhabit a range of soil types and is associated with both native and non-native grasses. Threats to this subspecies include habitat destruction or modification as a result of increased fire frequency from military activities, erosion, competition with non-native plant species, and constrained access to habitat for active management. (USFWS, 2008q)

San Clemente Island Lotus. San Clemente Island lotus (*Acmispon dendroideus* var. *traskiae*) is a semi-woody short-lived flowering subshrub in the pea family (USFWS, 2012s). The plant grows to less than 4 feet tall with slender erect green branches, with compound leaves divided into 3 to 5 leaflets (USFWS, 2012s). This lotus blooms from February to August with small yellow flowers arranged in clusters on stalks (Brouillet, 2014) (USFWS, 2012s).

This variety was first listed as endangered in 1977 (42 FR 40682 40685, 11 August 1977) and was reclassified as threatened in 2013 (78 FR 45406 45439, 26 July 2013). No critical habitat has been designated (USFWS, 2016bt). San Clemente Island lotus is endemic to San Clemente Island, one of the Channel Islands off the southern California coast.

San Clemente Island lotus occurs on open, north-facing slopes, ridgelines, or canyon bottoms and are often associated with rock outcrops and boulders in grassy areas and in open sites near the ocean, in areas ranging in elevation from 25 to 1,400 feet (USFWS, 2012s). This variety is threatened by destruction or modification of habitat caused by land use, erosion, non-native plant species, and military activities including fire and fire management (USFWS, 2012r).

San Clemente Island Woodland-star. San Clemente Island woodland-star (*Lithophragma maximum*) is a perennial, rhizomatous herb in the saxifrage family. The plant has basal leaves and two to three stout flowering stems that reach 16 to 24 inches high (USFWS, 1997d). This woodland-star blossoms from April to June, with each flower-bearing stem producing 20 or more white to pinkish bell-shaped flowers that are each about 0.5 inch long. Leaves are palmately compound on slender leaf stalks. (USFWS, 2007r)

This species was listed as endangered in 1997 (62 FR 42692 42702, 8 August 1997) and no critical habitat has been designated (USFWS, 2016bu). This plant species was thought to be extinct until it was rediscovered in 1997 (USFWS, 1997d). It is known only from San Clemente Island, one of the Channel Islands of southern California.

San Clemente Island woodland-star is known to occur from within five deeply incised canyons on the eastern escarpment of southern San Clemente Island. Plants are generally found growing in shady locations on canyon ledges and gentle north-facing slopes in moist canyon bottoms, at elevations ranging from 400 to 1,200 feet. It is threatened by overgrazing by non-native mammals, competition with exotic plant species, high fire frequencies associated with military

bombing activities, constrained access to habitat for active management, and habitat loss due to erosion. (USFWS, 2007r)

San Diego Ambrosia. San Diego ambrosia (*Ambrosia pumila*) is a small herbaceous perennial plant, growing about 2 to 12 inches tall, in the sunflower family. This plant spreads clonally by producing slender, underground rhizome-like roots which grow above-ground stems. The entire plant is covered in short, soft, gray-white hairs, including the leaves which are two- to four-times divided into many small segments. (USFWS, 2002l) (USFWS, 2010aa). Male and female flowers are yellowish-white, separated in clusters on flower stalks, have no petals, and are wind pollinated.

This species was listed as endangered in 2002 (67 FR 44372 44382, 2 July 2002). Critical habitat has been designated (75 FR 74546 74604, 30 November 2010) in Riverside and San Diego Counties, and is found from there south to northwestern Baja California, Mexico (USFWS, 2010aa).

San Diego ambrosia is generally found growing on upper terraces of rivers and drainages, in areas supporting open grassland and openings in coastal sage scrub. Major threats to this species include habitat loss from development, soil compaction, competition with non-native plant species, and fire management activities. (USFWS, 2010aa)

San Diego Button-celery. San Diego button-celery (*Eryngium aristulatum* var. *parishii*) is a tap-rooted biennial or perennial herb in the carrot family. Plants are mostly low-growing and spreading to erect, and can be up to 16 inches or more tall. Stems and leaves are a grayish green. Leaves are lance-shaped in outline with toothed edges and spiny lobes, "giving the plant a prickly appearance." Flowers are in greenish heads supported by short stalks at the branch ends. Bloom time is April to June (USFWS, 1998k) (USFWS, 1993b) (USFWS, 2010ab).

The species was listed as endangered in 1993 (58 FR 41384 41392, 3 August 1993). It is known from Riverside and San Diego Counties and historically from Los Angeles County in southern California and the adjacent state of Baja California, Mexico (USFWS, 1998k) (USFWS, 1993b) (USFWS, 2010ab). No critical habitat has been proposed (USFWS, 2016bv).

San Diego button-celery occurs in vernal pools on clay soils. Threats to the species include habitat loss, degradation and fragmentation due to residential and commercial development, agricultural conversion, livestock grazing, off-highway vehicle use, trampling by people and livestock, mowing and plowing/discing for weed abatement and fire suppression, alteration of hydrology, localized military activities, road and highway construction, fire and fire exclusion, competition from non-native species, genetic dangers due to small population size, susceptibility to random climate or disaster events due to small population size, loss of pollinators, and habitat modifications associated with global climate change. (USFWS, 1998k) (USFWS, 1993b) (USFWS, 2010ab)

San Diego Mesa-mint. San Diego mesa-mint (*Pogogyne abramsii*) is an annual herb in the mint family. Stems branch freely and can reach up to one foot tall. The strap-shaped leaves are arranged oppositely along the stem, and are a bright green with few hairs. The foliage develops a reddish tinge as the plant matures and flowers. The flowers are purple with white to yellow

throats and darker purple spots or stripes on the lower lip and lateral petal lobes; two flowers appear opposite of each other along the stem (i.e., two per node). Sepals are hairy, and each flower has thin hairy bracts below it. Bloom time is May to July (USFWS, 1998k) (USFWS, 2010ac)

The species was listed as endangered in 1978 (43 FR 44810 44811, 28 September 1978). It is endemic to San Diego County in southern California (USFWS, 1998k) (USFWS, 2010ac). No critical habitat has been proposed (USFWS, 2016bw).

San Diego mesa-mint is exclusively found in in vernal pool habitats. Threats to the species include habitat loss and degradation due to commercial and residential development, agricultural conversion, road and highway construction, off-highway vehicle use, human access and disturbance (trash dumping, trampling), military activities, alteration of hydrology, competition from non-native species, the genetic dangers of small population size, danger from random catastrophic events due to small population size and limited distribution, fire and fire suppression activities, and habitat modifications associated with drought and global climate change. (USFWS, 1998k) (USFWS, 2010ac).

San Diego Thornmint. San Diego thornmint (*Acanthomintha ilicifolia*) is an annual herb in the mint family. Leaves and stems of this plant are aromatic like many other plants in the mint family. San Diego thornmint is a small plant, growing from 2 to 6 inches tall that blooms in spring (April to June) (Miller & Jokerst, 2016) (USFWS, 2009aw). Flowers are white, two-lipped, tubular in shape, with spiny bracts and are clustered along the stem at leaf axils (USFWS, 1998p).

This species was listed as threatened in 1998 (63 FR 54938 54956, 13 October 1998). Critical habitat has been designated (73 FR 50454 50496, 26 August 2008) in several areas throughout San Diego County (USFWS, 2008c) (USFWS, 2016bx). It is endemic to San Diego County, and northwestern Baja California, Mexico, where clay lenses provide appropriate soil type, including gabbro soils derived from igneous rock (USFWS, 2008c) (USFWS, 2009aw).

San Diego thornmint prefers habitats that provide openings in shrubby coastal vegetation (typically coastal sage scrub, chaparral, and native grassland) in areas with heavy clay soils that are loose and crumbly in texture (USFWS, 2008c). Major threats to this species include habitat alteration and competition with non-native plant species, trampling/grazing, erosion, and impacts associated with hiking, biking, and off-highway vehicle use, as well as urban development and general threats from fire and climate change (USFWS, 2009aw).

San Francisco Lessingia. San Francisco lessingia (*Lessingia germanorum*, or *L. g.* ssp. *germanorum*) is an annual herb in the sunflower family. Plants grow from a basal rosette of oblanceolate leaves that broaden toward the tip, with reddish-brown, woolly stems having a spreading, branching growth habit that can range from 2 inches to over a foot tall. Stem leaves are grayish-green due to a dense covering of wooly hair, and are generally 0.3 inch, but can be up to an inch long, and are obovate to oblanceolate in outline. Leaf edges are highly variable, and may be smooth, or variously lobed or toothed. Bloom time is August to November. Tiny lemon yellow disk florets with brownish throats are aggregated into heads. Heads are 0.15 to 0.3

inches wide, and have a bell-shaped involucre that encloses 20 to 40 florets. Heads appear alone on the ends of branchlets, with only a few to hundreds of heads per plant depending on the size of the individual. Each floret produces a single dandelion-like seed (USFWS, 2003c) (USFWS, 2012t).

The species was listed in 1997 (62 FR 33368 33374, 19 June 1997) and no critical habitat has been proposed (USFWS, 1997g) (USFWS, 2016bz). It is currently known from the Presidio on the San Francisco Peninsula (where it historically was much more widely spread) in San Francisco County and San Bruno Mountain in San Mateo County (USFWS, 2003c) (USFWS, 2012t).

San Francisco lessingia occurs in openings in coastal dune scrub on remnant sand dunes and sand terraces or similarly sparsely vegetated coastal sand deposits with blowing sand, at elevations of 80 to 300 feet. Threats to the species include loss or modification of habitat, invasive non-native plants, trampling and habitat alteration by people (including dune stabilization, soil compaction by bicycling or hiking, digging by dogs), development, successional changes that accompany dune stabilization, loss of pollinators, and habitat alteration resulting from global climate change. (USFWS, 2003c) (USFWS, 2012t)

San Jacinto Valley Crownscale. San Jacinto Valley crownscale (*Atriplex coronata* var. *notatior*) is a bushy annual herb in the goosefoot family. It is mostly erect and grows from 4 to 12 inches tall. Leaves are attached directly to the stems, and are somewhat elliptic to ovate-triangular, with a grayish, scaly or scurfy appearance in the growing season. Flowers are small and relatively obscure, with separate pollen bearing and seed producing flowers in mixed clusters. As female flowers go to fruit, they develop spherical bracts with tubercles (nodules or knots) that roughly correspond in number to the teeth on the margins of the bract. Bloom time is April to May. (USFWS, 2000h) (USFWS, 2012v)

The variety was listed as threatened in 1998 (63 FR 54975 54994, 13 October 1998). It is known only from Riverside County in southern California (USFWS, 2000h) (USFWS, 2012v). No critical habitat was formally designated in 2005 (70 FR 59952 59974, 13 October 2005) or later in 2013 (78 FR 22625 22658, 16 April 2013) due to existing conservation management plans for the species.

San Jacinto Valley crownscale occurs on highly alkaline-saline, silty clays in alkali sink scrub, alkali playas, vernal pools and alkali annual grasslands subject to seasonal inundation at elevations ranging from 100 to 2,500 feet (USFWS, 2000h) (USFWS, 2012v). Threats to the variety include habitat loss, degradation, alteration, or fragmentation due to agriculture, residential and commercial development, alteration of hydrology and floodplain dynamics (channelization, diversions, or excessive flooding), off-highway vehicle recreation, trampling and grazing by livestock, discing for weed abatement or fire suppression, habitat alteration due to global climate change, and competition from non-native species. (USFWS, 2012v)

San Joaquin Adobe Sunburst. San Joaquin adobe sunburst (*Pseudobahia peirsonii*) is a small, upright annual plant in the sunflower family that grows between 4 and 18 inches tall. This plant, similar to other sunburst plants of this genus, is covered in woolly hairs along the stems and

leaves. Leaves are twice-divided, triangular in outline, and about 1 to 3 inches long (USFWS, 1997e). Flowers are arranged in daisy-like heads about one inch wide, which occur at the ends of branches, one per branch tip, and bloom between March and May (Johnson, Dale E., 2016b) (USFWS, 2007n).

This species was listed as threatened in 1997 (62 FR 5542 5551, 6 February 1997), and no critical habitat has been established (USFWS, 2016ca). This species is restricted to the southern Sacramento Valley and San Joaquin Valley of California (USFWS, 1997e).

San Joaquin adobe sunburst was named due to its preference for heavy clay or adobe-colored soils, as observed by historic collectors (USFWS, 2007n). This species typically grows in level or gently sloping areas between low hills in non-native grassland and the grassland-blue oak woodland community transition zone at elevations between approximately 400 and 2,600 feet (USFWS, 1997e) (USFWS, 2007n). Major threats to this species include residential development, competition with non-native invasive plant species, flooding, as well as general risk of environmental factors due to small and isolated populations (USFWS, 2007n).

San Joaquin Orcutt Grass. San Joaquin Orcutt grass (*Orcuttia inaequalis*) is a small, semi-aquatic clumped annual C_4 grass. Plants germinate underwater, forming a rosette of 5 to 8 cylindrical juvenile leaves. Intermediate leaves are produced as the pool warms, and have a cylindrical submerged portion and a flat, floating blade. Once the pool has evaporated, multiple pith-filled upright stems ranging from 2 to 12 inches long rise from a common fibrous root system and produce the terrestrial leaves. The flattened terrestrial leaves are about 2 to 4 inches long with the lower portion folding around the stem. Plants are grayish-green due to a covering of long, soft hairs, and produce an aromatic exudate. The top third of each stem is terminated by a head-like cluster of two dense, compact rows of groups (spikelets) of 4 to 30 florets oriented to one side of the stem. Each floret lacks petals and sepals, and is enclosed in a pair of small bracts. Bloom time is April to September. The fruit of each floret is a grain. (USFWS, 2006d) (USFWS, 2013t).

The species was listed as threatened in 1997 (62 FR 14338 14352, 26 March 1997). Critical habitat was designated in 2003 (68 FR 46684 46867, 6 August 2003) with re-evaluations of non-economic and economic exclusions in 2005 (70 FR 11140, 8 March 2005; 70 FR 46924 46999, 11 August 2005) and administrative revisions in 2006 (71 FR 7118 7316, 10 February 2006). It occurs in a narrow band along the base of the Sierra Nevada foothills in Fresno, Madera, Merced, and Tulare Counties and historically from Stanislaus County in the San Joaquin Valley of north central California, with a disjunct population (*i.e.*, not in the Valley) being more recently found in Solano County (USFWS, 2013t).

San Joaquin Orcutt grass is found in deep vernal pools and vernal lakes on alluvial fans, stream terraces, and tabletop lava flows. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, alteration of hydrology, road widening and realignment, grazing and trampling by livestock, competition from non-native invasive species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, off-highway vehicles), loss of pollinators, dangers from genetic drift and

random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2013t)

San Joaquin Wooly-threads. San Joaquin wooly-threads (*Monolopia congdonii* or *Lembertia congdonii*) is an annual herb in the sunflower family. One to several branching stems arise from the base from 1 to 18 inches, and often are trailing or spreading. Stems and leaves are densely white-wooly with tangled hairs, the leaves often less so. Leaves are alternate along the stems, and are very narrowly lanceolate with a few shallow lobes or teeth on the edges. Clusters of tiny yellow daisy-like flowering heads terminate the stems and branches, with each head containing four to seven ray florets surrounding many disc florets. Leaves are narrowly lance-shaped and sparsely toothed. Bloom time is February to May. The fruit is a minute sunflower-type seed. (USFWS, 1998a) (USFWS, 2010ad)

The species was listed as endangered in 1990 (55 FR 29361 29370, 19 July 1990) and no critical habitat has been proposed (USFWS, 2015el). It known from the southern San Joaquin Valley, Carrizo Plains, and associated foothills in Fresno, Kern, Kings, San Benito, San Luis Obispo, and Santa Barbara Counties of south central California (USFWS, 1998a) (USFWS, 2010ad).

San Joaquin wooly-threads occurs on alluvial sand, sandy loams or silts in non-native grasslands and open areas in saltbush scrub communities. Threats to the species habitat loss and degradation due to residential and commercial development, agricultural conversion, water development, road and utility construction and maintenance (including solar power development), oil and gas exploration, development and conveyance, competition with invasive non-native species and associated changes in fire regimes, off-highway vehicle use, grazing and trampling by livestock, herbicide and insecticide use, gravel and sand extraction, air pollution (nitrification), habitat alteration due to climate change, and random catastrophic events due to restricted distribution, narrow habitat requirement and small population size. (USFWS, 1998a) (USFWS, 2010ad).

San Mateo Thornmint. San Mateo thornmint (*Acanthomintha obovatoa* ssp. *duttonii*) is an annual aromatic herb in the mint family that ranges from 1.6 to 7.9 inches in height. The opposite leaves are oblong with a toothed margin and reach 0.3 to 0.5 inches long. White flowers occur in a tight structure surrounded by spined bracts, and appear between April and July. It is believed to be insect pollinated. (USFWS, 2009ax)

The subspecies was listed as endangered in 1985 (50 FR 37858 37863, 18 September 1985). The San Mateo thornmint is known or believed to occur in Fresno, Kings, Kern, Monterey, and San Luis Obispo Counties in California. To date, no critical habitat has been proposed for this subspecies (USFWS, 2009ax) (USFWS, 2016cb).

San Mateo thornmint prefers serpentine soils of chaparral, valley and foothill grasslands where it commonly occupies slopes and flats with a heavy clay soil. Threats to the subspecies include road construction, off-road vehicles, development, and vandalism. The only remaining large population in Edgewood County Park was previously damaged by vehicle use. (USFWS, 2009ax) (USFWS, 2016cb)

San Mateo Woolly Sunflower. San Mateo woolly sunflower (*Eriophyllum latilobum*) is a perennial in the sunflower family, with leafy stems that reach 12 to 16 inches high. Leaves are deeply three-cleft with a dark green surface and undersides covered with interwoven white hairs. Golden flowers appear in loose clusters and are present between April and June. Flowers are pollinated by flies and bees. (USFWS, 2009ay) (USFWS, 2016cc)

The species was listed as endangered in 1995 (60 FR 6671 6685, 3 February 1995). The San Mateo woolly sunflower is believed to occur in San Mateo, Santa Cruz, and Santa Clara Counties in California. The only known remaining population exists along 2.5 miles of Crystal Springs Road in San Mateo County. To date, no critical habitat has been proposed for this species. (USFWS, 2009ay) (USFWS, 2016cc)

San Mateo woolly sunflower prefers moist shaded sites and occurs on both serpentine and non-serpentine soils. The species inhabits steep grassy or sparsely wooded slopes and is often found growing in close proximity to coast live oak (*Quercus agrifolia*). Threats to the species include garbage dumping, road construction, soil slippage, and recreational development. (USFWS, 2009ay) (USFWS, 2016cc)

Threats to the species include garbage dumping, road construction, soil slippage, and recreational development. (USFWS, 2009ay) (USFWS, 2016cc)

Santa Ana River Woolly-star. Santa Ana River woolly-star (*Eriastrum densifolium* ssp. *sanctorum*) is a perennial, woolly-looking subshrub in the phlox family. This rounded or spreading shrub branches from the base, grows to 30 inches tall, and is entirely covered in woolly hairs, resulting in a woolly appearance (USFWS, 2010ae). Violet-blue funnel-shaped flowers are grouped in inflorescences at the ends of stems with about 20 flowers per inflorescence, rising above spiny-tipped bracts (USFWS, 2010ae) (De Groot, Gowen, & Patterson, 2016). Blooming occurs from May to September (De Groot, Gowen, & Patterson, 2016).

This subspecies was listed as endangered in 1987 (52 FR 36265 36270, 28 September 1987) and no critical habitat has been designated (USFWS, 2016cd). It is endemic to the Santa Ana River drainage in Riverside and San Bernardino Counties (USFWS, 2010ae).

Preferred habitat for Santa Ana River woolly-star includes open, well-lit areas along sandy alluvial terraces where infrequent flood events occur, and where shrublands are persistent along the drainage terrace. Major threats to this subspecies include habitat alteration or destruction through urban floodplain development, alteration of hydrology, aggregate mining, off-highway vehicle use, hybridization and climate change. (USFWS, 2010ae)

Santa Barbara Island Liveforever. Santa Barbara Island liveforever (*Dudleya traskiae*) is a perennial herb in the stonecrop family. It forms clusters of 20 to 100 leafy rosettes per plant with 25-35 leaves per rosette. Leaves range from 1.5 to inches long, and often appear a glaucous gray. Flowering is between April and May, when flowering stems arise from the basal rosettes. Flowers have 5 bright yellow petals and 10 stamens. (USFWS, 1978) (CDFW, 2014b) (USFWS, 2016ce)

The species was listed as endangered in 1978 (43 FR 17910 179, 26 April 1978). The plant is known to occur only on Santa Barbara Island (one of the Channel Islands) off coastal Santa Barbara County. No critical habitat has been designated for this species (USFWS, 1978) (CDFW, 2014b) (USFWS, 2016ce).

Santa Barbara Island liveforever is restricted to steep xeric cliffs with shallow rocky soils in maritime cactus shrub and the sea cliff phase of coastal bluff communities. Primary threats to the species include grazing rom exotic animals and competition from exotic plants erosion (USFWS, 1978) (USFWS, 2016ce) (CDFW, 2014b).

Santa Clara Valley Dudleya. Santa Clara Valley dudleya (*Dudleya setchellii*) is a low growing perennial in the stonecrop family. The fleshy and glabrous leaves are oblong and reach 1 to 3 inches long with a glaucous covering. Pale yellow flower clusters appear in late spring from flowering stems that range in height from 2 to 8 inches. (USFWS, 1995b) (USFWS, 2016cf)

The species was listed as endangered in 1995 (60 FR 6671 6685, 03 February 1995). The Santa Clara Valley dudleya is known only from Santa Clara County, where it is found in the Coyote Valley area at 14 sites with approximately 33,000 plants in total. To date, no critical habitat has been proposed for this species (USFWS, 1995b) (USFWS, 2016cf).

Santa Clara Valley dudleya inhabits rocky outcrops within serpentine grasslands at elevations between 300 and 900 feet ASL. Threats to the species include development, garbage dumping, and off-road vehicles (USFWS, 1995b) (USFWS, 2016cf).

Santa Cruz Cypress. Santa Cruz or Abrams cypress (*Cupressus abramsiana* or *Hesperocyparis abramsiana*) is a tree in the cypress family. It is an erect, branched conifer with a dense, compact, symmetrically pyramidal crown. Trees are up to 34 feet tall, with a fibrous gray bark, while leaves are small and scale-like. Pollen cones are small (0.16 of an inch) and "produce copious quantities" of wind-blown pollen. Seed-bearing cones are spherical and about 1 inch in diameter, with 8 to 10 scales; they are born near the tips of branches. Cones remain closed until a connection with the tree or branch is broken, typically from tree mortality due to fire. (USFWS, 1998j) (USFWS, 1998s) (USFWS, 2009az)

The species was listed as threatened in 2016 (81 FR 8408 8418, 19 February 2016) and no critical habitat has been proposed (USFWS, 2015em). It is endemic to the Santa Cruz Mountains of Santa Cruz and San Mateo Counties (USFWS, 1998s).

Santa Cruz cypress occurs on dry ridges above the fog belt on poorly developed, well-drained, sandy or gravelly soils in a mosaic of coastal chaparral and mixed evergreen forest at elevations of 1,000 to 2,550 feet. Threats to the species include habitat loss and degradation due to residential and commercial development, agricultural conversion of natural lands, altered fire cycles, logging, oil and gas exploration and development, genetic introgression, disease and insect infestation, competition with non-native invasive plants, vandalism, unauthorized recreational activities (*e.g.,* trailbuilding for hiking, mountain biking, off-highway vehicles, or equestrian use), and habitat alteration due to climate change. (USFWS, 1998j) (USFWS, 1998s) (USFWS, 2009az)

Santa Cruz Island Bush-Mallow. Santa Cruz Island bush-mallow (*Malacothamnus fasciculatus* var. *nesioticus*) is a small soft woody shrub in the mallow family that grows up to 6 feet tall, with slender branches (USFWS, 1997f). The branches and palm-shaped leaves of this plant are covered in star-shaped hairs, and the leaves are two-colored, dark green on the upper surface and gray on the lower surface (USFWS, 1997f). Blooming lasts from May to July, with rose-colored flowers up to 1.5 inches wide scattered near the ends of branches (USFWS, 1997f) (Slotta, Tracey, 2016).

This plant was listed as endangered in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016di). It is endemic to Santa Cruz Island, in the northern Channel Islands off the southern California coast (USFWS, 2012w).

Santa Cruz Island bush-mallow is associated with chaparral and coast scrub vegetation communities, and is found growing on rocky, south-facing slopes (USFWS, 1997f) (USFWS, 2000e). Threats to this variety are primarily due to low reproduction within the population and greater extinction threats due to the small population size, as well as competition with non-native species (USFWS, 2012w).

Santa Cruz Island Dudleya. Santa Cruz Island dudleya (*Dudleya nesiotica*) is a succulent perennial plant in the stonecrop family. This species grows to about 4 inches in height, with oval-shaped leaves in a basal rosette and several flowering stems (USFWS, 2009ba). Blooming occurs from March to June, with 6 to 12 white to pale-yellow five-petaled flowers about 0.5 inch long (McCabe, Dudleya nesiotica, 2016b) (USFWS, 2009ba).

Santa Cruz Island dudleya was listed as threatened in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016cg). This plant is known to occur only on Santa Cruz Island, off the coast of southern California (USFWS, 1997f) (USFWS, 2009ba).

This plant occurs on a low marine terrace and is associated with coastal scrub and grassland vegetation communities (USFWS, 2000e). Threats to this species include habitat destruction or alteration as a result of soil erosion and loss due to non-native ungulate grazing and trampling, competition with non-native (exotic) plant species, and dangers of random events including fire, events related to climate change, and lack of genetic viability due to the small population size. (USFWS, 2009ba)

Santa Cruz Island Fringepod. Santa Cruz Island fringepod (*Thysanocarpus conchuliferus*) is a small, delicate annual plant in the mustard family that grows with several branches to 2 to 5 inches in height (USFWS, 1997f). Leaves are narrow and linearly lobed, arranged alternatively along the stems. The stems terminate in a cluster of very small pink to lavender flowers, blooming in March and April (Al-Shehbaz, Ihsan A.; Rosatti, Thomas J., 2016). Fruits of this plant are unique in that they are round, flattened bowl-shaped fruits with perforated or lobed margins (USFWS, 2000e).

This plant was listed as endangered in in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016ch). This plant is endemic to Santa Cruz Island, one of the Channel Islands off the southern California coast (USFWS, 2009bb).

Santa Cruz Island fringepod is found on rocky outcrops on ridges and canyon slopes (USFWS, 2000e) (USFWS, 2009bb). Threats to this species are due primarily to residual habitat alteration resulting from historic ungulate herbivory, and danger of extinction from random events resulting from small population and individual numbers (USFWS, 2009bb).

Santa Cruz Island Malacothrix. Santa Cruz Island malacothrix (*Malacothrix indecora*) is an annual herb in the sunflower family that grows 4 to 18 inches tall (USFWS, 1997f). Leaves are blunt-tipped, broadly lobed and are numerous along the stems (USFWS, 1997f). Flower heads are light yellow-green, and surrounded at the base by green linear bracts. Blooming occurs from April to September (USFWS, 2010s) (Davis, W.S., 2016b).

This plant was listed as endangered in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016ci). This plant is known to occur on Santa Cruz and Anacapa Islands in the northern Channel Islands off the southern California coast (USFWS, 2010s).

Santa Cruz Island malacothrix occurs on open rocky areas with shallow soils along coast bluffs on the edge of vegetated habitat (Davis, W.S., 2016b) (USFWS, 2000e). Threats to this species include competition with non-native plants, trampling, soil erosion, and danger from random events due to the limited population size, and susceptibility to storm and wave damage and sea level rise due to climate change (USFWS, 2010s).

Santa Cruz Island Rockcress. Santa Cruz Island rockcress (*Sibara filifolia*) is a small, slender annual herb in the mustard family. Plants grow to approximately 5 to 15 inches tall, with leaves 1 to 2 inches long with a prominent midvein. Flowers bloom in April and are pink to purplish with spoon-shaped petals about 0.25 inch long. Fruits of this plant are slender, two-chambered pods up to 1 inch long with up to 30 small seeds. (USFWS, 2012x)

Santa Cruz Island rockcress was listed as endangered in 1997 (62 FR 42692 42702, 8 August 1997) and no critical habitat has been designated (USFWS, 2016cj). This plant currently occurs on San Clemente and Santa Catalina Islands, and historically was found on Santa Cruz Island but has not been found there since 1936 (USFWS, 1997d).

This rockcress has been found in a variety of habitats, but is generally found in open areas along dry rocky ridgelines. Given the range of habitats in which this species has been found, habitat preferences have not been specifically determined for this species. Santa Cruz Island rockcress appears to be generally associated with coastal prickly pear scrub or California desert thorn shrubland vegetation types. Current threats to this species include erosion and habitat impacts resulting from overgrazing of non-native animals, competition with exotic plants, fire, and dangers of random events such as fire, landslides, and disease due to small population size. (USFWS, 2012x)

Santa Cruz Tarplant. Santa Cruz tarplant (*Holocarpha macradenia*) is an aromatic annual plant in the sunflower family. This species grows to less than 2 feet tall and produces strongly scented foliage and sticky resin, similar to other tarplant species. A distinguishing characteristic of this plant is the numerous ray florets and black anthers (USFWS, 2014o). Flowers are arranged in daisy-like heads of ray and disk florets, tightly clustered at the ends of branches. They are

yellow in color, blooming from July to October (Baldwin, Holocarpha macradenia, 2016b) (USFWS, 2014o).

This species was listed as threatened in 2000 (65 FR 14898 18909, 20 March 2000). Critical habitat has been designated (67 FR 63968 64007, 16 October 2002) in Contra Costa, Santa Cruz, and Monterrey Counties (USFWS, 2002m) (USFWS, 2016ck). It is restricted to the central California coast region and typically occurs on the alluvium of coastal terrace deposits where sandy clay soils provide adequate soil moisture (USFWS, 2002m).

Santa Cruz tarplant generally grows among coastal grassland and prairie vegetation communities. Major threats to this species include habitat alteration or destruction resulting from residential and urban development, lack of rare coastal habitat management, competition with non-native plant species, and dangers from random environmental events or disease given the extremely small population size and low genetic mixing (USFWS, 2014o) (USFWS, 2002m).

Santa Monica Mountains Dudleya. Santa Monica Mountains dudleya (*Dudleya cymosa* ssp. *ovatifolia*) is a succulent perennial herb in the stonecrop family. It forms an evergreen basal rosette of fleshy, ovate leaves with pointed tips (0.8 to 2 inches long and 0.6 to 1 inches wide) which are often maroon on the underside. Fleshy, branching often reddish flowering stems rise from 1.6 to 6 inches tall with densely crowded, small fleshy, leaf-like bracts, and topped with five-lobed pale yellow flowers. Bloom time is from May to June. The fruit of each flower consists of from many-seeded pods. (USFWS, 1999c) (USFWS, 2009bc). Forms that are segregated as subspecies *agourensis* have leaves that are bluish and chalky without the maroon under-coloring, and have bright lemon yellow flowers (USFWS, 2009bc).

The subspecies was listed as threatened in 1997 (62 FR 4172 4183, 29 January 1997) including forms that have been segregated as *D. cymosa* ssp. *agourensis*. No critical habitat has been proposed (USFWS, 2015en). It is known from the Santa Monica Mountains of Los Angeles and Ventura Counties and the Santa Ana Mountains of Orange County in southern California (USFWS, 2009bc).

Santa Monica Mountains dudleya is found on shaded slopes and canyon bottoms on sedimentary or conglomerate rock in chaparral or coastal scrub communities in microhabitats that may be otherwise limited to club mosses, mosses, and lichens; *agourensis* forms are found on volcanic gravels and outcrops in chaparral or coast live oak (*Quercus agrifolia*) or California juniper (*Juniperus californicus*) woodlands. Threats to the subspecies include habitat loss, fragmentation or degradation due to residential and commercial development, destruction from fire, fire suppression or fire prevention activities, recreational activities (*e.g.*, rock climbing, hiking substrate removal or graffiti), collection by commercial and private enthusiasts, road maintenance, encroachment and competition with non-native invasive species, habitat alteration due to climate change, and dangers from genetic drift and random catastrophic or climatic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 1999c) (USFWS, 2009bc)

Santa Rosa Island Manzanita. Santa Rosa Island manzanita (*Arctostaphylos confertiflora*) is a shrub in the heath family that grows from 4 to 6.5 feet tall, but also occurs as a low-growing

form in areas with high wind exposure (USFWS, 1997f) (USFWS, 2014p). Stems of this shrub are smooth, dark purple to black in color, and are densely branched. Branches, leaf stems, and leaf bracts are covered in long, white, glandular hairs, with light green, round-ovate leaves (USFWS, 1997f). Blooming occurs from February to March, with clusters of white to pale cream urn-shaped flowers at the tips of branches (Parker, Vasey, & Keeley, 2016b) (USFWS, 2014p). The fruits are reddish-brown in color and flattened in appearance; both fruits and flowers are somewhat to sparsely covered in white hairs.

This plant was listed as endangered in in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016cl). It is endemic to Santa Rosa Island, one of the Channel Islands off the southern California coast (USFWS, 2014p).

Santa Rosa Island manzanita is found on slopes above sandstone outcrops and on sedimentary soils derived from shale and volcanic substrates, in association with mixed chaparral, mixed woodland, and Torrey pine and island pine woodland vegetation communities (USFWS, 2000e). This species is believed to reproduce and spread only by seeds and requires fire to regenerate (USFWS, 2000e). Threats to this species include residual habitat alteration from non-native ungulate herbivory that resulted in wind and water erosion and impacts to seed bank and seed beds, and dangers of random events such as disease, altered fire regime, and climate change due to small population size and distribution. (USFWS, 2014p)

***Scotts Valley Polygonum*.** Scotts Valley polygonum (*Polygonum hickmanii*) is a cushion-like annual herb in the buckwheat family. It grows only 1 to 2 inches tall, either as a simple, single stem or "profusely branching near the base." Leaves are very narrowly linear and up to 1.4 inches long, and sharply pointed at the tip. Flowers are small and white, rising from axils of leaf-like bracts. Bloom time is May to August or later as rainfall allows. The fruit is a small ovate seed (USFWS, 1998j) (USFWS, 2009bd).

The species was listed as endangered in 2003 (68 FR 16979 16990, 8 April 2003) with 287 acres of critical habitat being designated at that time. It is endemic to Scotts Valley in Santa Cruz County of coastal central California (USFWS, 2009bd).

Scotts Valley polygonum is found in level to gently sloping meadows and grasslands with thin, fine-textured soils over mudstone or sandstone bedrock at 700 to800 feet of elevation. Threats to the species include habitat loss and degradation due to residential and commercial development, utility and road construction and maintenance, landscape maintenance, alteration of hydrology, recreational activities (hiking, off-highway vehicles, bicycling), encroachment and competition with non-native invasive species, inadequate preserve design, alterations to habitat resulting from climate change, and random events due to restricted distribution, narrow habitat requirement and small population size. (USFWS, 1998j) (USFWS, 2009bd)

***Scotts Valley Spineflower*.** Scotts Valley spineflower (*Chorizanthe robusta* var. *hartwegii*) is an annual herb in the buckwheat family. It has an erect habit, growing to a foot tall. Leaves are mostly basal and broader near the tip. Involucral bracts are rose pink on the edges, with six hooked spines per white to rose colored flower. Flowers are aggregated into ball-like clusters about a half-inch across with two leaf-like bracts just below; the combination of bracts, spines

and flowers presents a pinkish aspect. Bloom time is April to June. The fruit is a small three-angled seed. (USFWS, 1998j) (USFWS, 2009be)

The variety was listed as endangered in 1994 (59 FR 5499 5510, 4 February 1994) and 237 acres of critical habitat was designated in 2002 (67 FR 37336 37353, 29 May 2002). It is endemic to local sandstones and mudstones in Scotts Valley, Santa Cruz County. (USFWS, 1998j)

The Scotts Valley spineflower occurs in meadows and grasslands on thin soils or scree over sandstone or mudstone bedrock. Threats to the variety include habitat loss and degradation due to residential and commercial development, herbicides, pesticides, altered hydrological regimes, trampling by hikers, cyclists, livestock or equestrians, off-highway vehicles, encroachment by non-native invasive species, recreational activities (e.g., paintball, golf), alterations to habitat resulting from climate change, and random events due to restricted distribution, narrow habitat requirement and small population size. (USFWS, 1998j) (USFWS, 2009be)

***Sebastopol Meadowfoam*.** Sebastopol meadowfoam (*Limnanthes vinculans*) is a multi-stemmed annual herb of the false mermaid family. Plants grow from 2 to 12 inches tall with "weak, fleshy" stems. Early seedling leaves at the base are narrowly linear and undivided, but the compound stem leaves have long stalks and 3 to 5 narrowly ovate leaflets. Flowers rise on long stalks from the upper leaf axils, and are fragrant. Flowers are bowl- to dish-shaped with 3 to 5 white, notched petals with white, green or maroon veins and long white hairs at the base; petals range from 0.4 to 0.7 inches long. Bloom time is April to May. The fruit of each flower is 1 to 5 tiny egg-shaped, warty nutlets. (USFWS, 2008h) (USFWS, 2014n)

The species was listed as endangered in 1991 (56 FR 61173 61182, 2 December 1991) and no critical habitat has been proposed (USFWS, 2015eo). It is found on the Santa Rosa Plain (in southwestern Cotati Valley) and adjacent areas of Sonoma and Napa Counties (USFWS, 2014n).

Sebastopol meadowfoam is found in vernal pools and seasonally wet swales and wet meadows. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion of natural lands, grazing and trampling by livestock, competition from non-native invasive species, alteration of hydrology, summer irrigation with wastewater, off-highway vehicles, thatch buildup, road construction and maintenance (grading, mowing and herbicide application), dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2008h) (USFWS, 2014n)

***Showy Indian Clover*.** Showy Indian clover (*Trifolium amoena*) is an annual herb in the pea family. It grows to over 2 feet tall and is hairy throughout. The compound leaves are ovate in outline and about an inch long with three leaflets. Flowers are typical pea-type flowers about a half-inch long, and are purple with white tips. They are densely clustered on the ends of flowering stems. Bloom time is April to June. The fruit of each flower is a short, plump bean pod. (USFWS, 2012y)

The species was listed as endangered in 1997 (62 FR 54791 54808, 22 October 1997). No critical habitat has been proposed (USFWS, 2015ep). It is known currently from a single natural

population in Marin County and four small experimental populations, but historically was known from seven adjacent counties on the north central coast of California (USFWS, 2012y).

Showy Indian clover occurs in various habitats, but generally in open, low wet swales, open grassy hillsides, and grasslands. Threats to the species include residential and commercial development, agricultural conversion of native wildlands, road construction and maintenance, invasive plant species, herbivory by native animals, erosion of beach bluff habitats, alterations to habitat resulting from climate change, and random events due to restricted distribution, narrow habitat requirement and small population size. (USFWS, 2012y)

Slender Orcutt Grass. Slender Orcutt grass (*Orcuttia tenuis*) is an aquatic grass. The species grows as individual stems or in small tufts that can grow 2 to 7.9 inches tall. Branching from the main stem occurs on the upper half of the stem and plants tend to have few hairs. Leaves at the base are 0.06 to 0.08 inches wide. The species has a large inflorescence, that makes up half of the plant's overall height, and contains several spikelets (USFWS, 2006j).

Slender Orcutt grass was federally listed as threatened in 1997 (62 FR 14338 14352, March 26, 1997). A total of 94,213 acres of critical habitat was designated for this species in 2006 (71 FR 7118 7316, February 10, 2006). This species is believed to occur in 15 counties of northern California (USFWS, 2006j) (USFWS, 2016cm).

Habitat for slender Orcutt grass includes vernal pools with volcanic substrates and other natural and man-made wetland systems. Vernal pools that the species typically inhabits include those in northern volcanic ashflow and northern volcanic mudflow substrates. Populations have been found between 90 and 1,756 feet. The species can be found with a variety of vegetation communities, from oak woodlands, grasslands, and mixed conifer forests. Threats to the species include urbanization and destruction of habitat, off-road vehicle use, and non-native species competition (USFWS, 2006j).

Slender-horned Spineflower. Slender-horned spineflower (*Dodecahema leptoceras* or *Centrostegia leptoceras*) is an annual herb in the buckwheat family. Plants grow from 1 to 4 inches tall from a "distinctive" basal rosette that can be 1 to 3 inches across. Leaves often turn reddish at maturity, but may die back by flowering. Bloom time is April to June. Flowers are borne in clusters of three along branching stalks, with six involucral bracts below each cluster; each bract has a spine-like awn at its base and tip, which may assist in seed dispersal. Flowers are very small (only 0.05 to 008 inches long) and each produces a single achene. A small native wasp, *Plenoculus davisii*, may be a potential pollinator. (USFWS, 2010af)

The species was listed as endangered in 1987 (52 FR 36265 36270, 28 September 1987) and no critical habitat has been proposed (USFWS, 2016cn). It is endemic to Los Angeles, San Bernardino and Riverside Counties of southwestern California (USFWS, 2010af)

Slender-horned spineflower inhabits "drought-prone alluvial benches [and terraces] subject to … rare flood events" but may be "subject to sheet or overland flows" in the foothills of the Transverse and Peninsular ranges at elevations of 656 to 2,296 feet. Vegetation is often described as scalebroom (*Lepidospartum junceum*) alluvial scrub, a transient shrubland associated with sandy or gravelly washes dependent on periodic scouring by flooding. However,

the species is sometimes found in openings in chaparral, coastal live oak or western sycamore woodlands, possibly due to succession caused by changes in fluvial processes from development, mining or flood control measures. Threats to the species include development, sand and gravel mining activities, off-highway vehicles, flood control measures or other hydrology altering activities, invasive non-native plants, trash dumping, and genetic vulnerabilities and dangers from random habitat or climatic events due to small population size and fragmented nature of the species known distribution. (USFWS, 2010af)

Slender-Petaled Mustard. Slender-petaled mustard (*Thelypodium stenopetalum*) is a short-lived perennial plant in the mustard family. This plant grows about 11 to 30 inches tall, with stems spreading out along the ground or somewhat upright. The leaves of this species are arrow-shaped at the base, about 0.4 to 2 inches long and less than 0.3 inches wide, and are thick and purple-tinged (USFWS, 1984g) (USFWS, 2011ab). Flowers grow loosely clustered near the end of the stem, blooming from May to August, with five petals that are lavender to white-colored (Al-Shehbaz, Thelypodium stenopetalum, 2016b) (USFWS, 2011ab).

This species was listed as endangered in 1984 (49 FR 34497 34500, 31 August 1984), and no critical habitat has been established (USFWS, 2016co). Slender-petaled mustard is known to occur only in the Big Bear Valley of the San Bernardino Mountains in San Bernardino County, southern California. This species is found primarily on springtime moist meadows, alkaline flats and lakeshores, and sometimes pebble plains, at elevations ranging from 5,250 to 8,200 feet where basin sagebrush (*Artemisia rothrockii*) is a dominant species. Soils in this area are typically high in clay content, allowing moisture retention and considered key to supporting this habitat type. Primary threats to this species are habitat modification or destruction through residential development, off-highway vehicle use, alteration of hydrology, competition with non-native plant species, grazing by horses, fire suppression, and recreational activities as well as vulnerability to disease, climate change, and drought given the small, isolated populations of this species. (USFWS, 2011ab).

Soft Bird's-beak. Soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*, or *Chloropyron molle* ssp. *molle*) is a hemi-parasitic annual herb in the broomrape family. Stems are erect and branched from the middle, up to about 16 inches tall. Stems and leaves are a purple tinged grayish- green due to a covering of glandular and longer non-glandular hairs with a dense coating of salt crystals exuded by the glands. Leaves are oblong and between 0.5 to 1.5 inches long, and may be unlobed or with 3 to 5 lobes. Flowers terminate the last 2 to 5 inches of the stems in short clusters. Flowers are wooly and somewhat club-shaped with petals fused into an upper bird's beak-like structure and a lower, inflated pouch-like lip. Flowers are pale cream with yellowish or greenish-yellow lower lips with purple stripes. Bloom time is July to November. The fruit of each flower is a 0.3 inch long capsule. (USFWS, 2014b)

The subspecies was listed as endangered in 1997 (62 FR 61916 61925, 20 November 1997), with critical habitat designated in 2007 (72 FR 18518 18553, 12 April 2007). It is known only from coastal Solano, Napa and Contra Costa Counties, and historically from Marin and Sonoma Counties, in the Bay region of northern California (USFWS, 2014b).

The soft bird's beak occurs in the upper middle or high marsh zones of coastal tidal and brackish marshes. Threats to the subspecies include habitat fragmentation, degradation and alteration from earlier marsh filling or dredging associated with dike-building and industrial, agricultural or residential development, competition with non-native invasive species, changes in salinity or freshwater inputs, rooting by feral pigs, trampling associated with human recreation, seed predation by native insect larvae, crude oil or refined petroleum spills, sea level rise and other habitat alteration associated with global climate change, and the genetic dangers and susceptibility to random catastrophic events due to small population size, restricted distribution, and narrow habitat requirements. (USFWS, 2014b)

Soft-leaved Paintbrush. Soft-leaved paintbrush (*Castilleja mollis*) is a hemi-parasitic perennial herb in the broomrape family, and is believed to primarily parasitize goldenbush (*Isocoma menziesii* var. *sedoides*) (USFWS, 1997f). Soft-leaved paintbrush stems are woolly hairy and grow to about 16 inches tall, with grayish leaves (USFWS, 1997f). This plant exhibits broad, fleshy inflorescences that are yellow to yellowish green, blooming from April to August (USFWS, 1997f) (Wetherwax, Chuang, & Heckard, 2016).

This plant was listed as endangered in in 1997 (62 FR 40954 40974, 31 July 1997) and no critical habitat has been designated (USFWS, 2016cp). Soft-leaved paintbrush is currently believed to occur only on Santa Rosa Island (USFWS, 2000e).

Soft-leaved paintbrush grows in coastal scrub bluff vegetation community and requires close proximity to the host plant, goldenbush. Threats to this species include habitat alteration and destruction resulting from overuse by ungulates, competition with non-native grasses, declining populations of host plants, and damage from random events such as drought, due to the small population size. (USFWS, 2007s)

Solano Grass. Solano grass (*Tuctoria mucronata*) – also variously known as Crampton's Orcutt grass, mucronate orcuttia, and Crampton's tuctoria - is a small, semi-aquatic clumped annual C_4 grass. Plants germinate underwater, forming a rosette of 5 to 8 cylindrical juvenile leaves. Once the pool has evaporated, multiple pith-filled upright stems up to 8 inches tall rise from a common fibrous root system and produce the terrestrial leaves. The flattened terrestrial leaves are about 0.4 to 1.6 inches long with the lower portion folding around the stem; edges are in-rolled, and the tip is pointed. Plants are grayish-green due to a covering of long, soft hairs, and produce an aromatic sticky exudate. The top 0.5 to 2.5 inches of each stem is terminated by a head-like cluster of 7 to 19 spirally arranged groups (spikelets) of 5 to 10 florets, with the base partially hidden in the uppermost leaves. Each floret lacks petals and sepals, and is enclosed in a pair of small, narrow bracts. The most prominent of the bracts is usually about a quarter of an inch or so long and tapers to an outward curved tip topped by a minute spiny tooth. Bloom time is June to July. The fruit of each floret is a grain. (USFWS, 2006d) (USFWS, 2009bf).

The species was listed as endangered (as *Orcuttia mucronata*) in 1978 (43 FR 44810 44811, 28 September 1978). Critical habitat was designated in 2003 (68 FR 46684 46867, 6 August 2003) with re-evaluations of non-economic and economic exclusions in 2005 (70 FR 11140, 8 March 2005; 70 FR 46924 46999, 11 August 2005) and administrative revisions in 2006 (71 FR 7118

7316, 10 February 2006). It occurs in Yolo and Solano Counties of north central California (USFWS, 2006d) (USFWS, 2009bf).

Solano grass is found in alkali vernal pools, alkaline playas, and intermittent lakes in annual grasslands. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion, discing, alteration of hydrology, road widening and realignment, grazing and trampling by livestock, competition from non-native invasive species, water contamination from herbicides, pesticides and fertilizers, inappropriate management and monitoring, garbage dumping, recreational uses (hiking, mountain biking, off-highway vehicles), dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2006d) (USFWS, 2009bf)

Sonoma Alopecurus. Sonoma alopecuris (*Alopecuris aeqaulis* var. *sonomensis*) is a rhizomatous, bunched perennial grass. Stems grow to 2.5 feet tall, mostly growing erect but often slightly bent upwards at the base. Leaf blades are slightly more than a quarter inch wide. The almost unnoticeable, violet-gray tinged florets are in a very dense elongate cluster (a "foxtail") at the end of each stem, 1 to 3 inches long and a quarter inch wide. Bloom time is May to August. The fruit of each floret is a grain. (USFWS, 2011ac).

The variety was listed as endangered in 1997 (62 FR 54791 54808, 22 October 1997). No critical habitat has been proposed (USFWS, 2015eq). It is known from six small populations in Sonoma and Marin Counties on the north central coast of California (USFWS, 2011ac).

It is found in freshwater marshes, swamps and riparian shrub lands. Threats to the variety include residential and commercial development, road construction and maintenance, landscape maintenance (mowing), grazing and hoof punch, invasive plant species, random catastrophic events due to restricted distribution, narrow habitat requirement and small population size, and alterations to habitat resulting from climate change. (USFWS, 2011ac).

Sonoma Spineflower. Sonoma spineflower (*Chorizanthe valida*) is a hairy annual herb in the buckwheat family. Leaves form a basal rosette at the base of the stem, and are up to 2 inches long and wider near the tip. Stems branch from the base, rising up to a foot tall and spreading. Small (less than 0.25 of an inch long) white to lavender or rose flowers are surrounded by 6 straight spines each. Spines are bright red at the base with white tips. Flowers appear in ball-like clusters with two green, hairy, leaf-like bracts below. Bloom time is June to August. The fruit is an elliptic, three-angled seed. (USFWS, 1998m)

The species was listed as endangered in 1992 (57 FR 27848 27859, 22 June 1992). No critical habitat has been proposed (USFWS, 2015er). It is currently limited to a single population in the Point Reyes dunes of coastal Marin County (USFWS, 2010ag).

Sonoma spineflower grows in sandy coastal prairie. The species is threatened by habitat loss or modification due to residential or commercial development, trampling by hikers, livestock or equestrians, off-highway vehicles, encroachment by non-native invasive species, sand mining, disposal of dredging spoils, dangers from random catastrophic events due to restricted

distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 1998m) (USFWS, 2010ag)

Sonoma Sunshine*.** Sonoma sunshine or Baker's stickyseed **(Blennosperma bakeri*) is an annual herb in the sunflower family. Growing to a foot tall, the multiple, branching stems and the alternately attached leaves are hairless. Leaves are 2 to 6 inches long, narrow, and somewhat threadlike, with the upper ones having 3 to 5 lobes. Stems are terminated by daisy-like flowering heads about a half inch across. Each head has 5 to 15 yellow or rarely white ray florets (the "petals" of the daisy) with red stigmas, these surrounding 30 to 70 yellow disk florets (the center of the daisy) that have white stigmas and pollen. Bloom time is March to May. The fruit of each floret is a small many-angled sunflower-like seed. (USFWS, 2008h) (USFWS, 2014n)

The species was listed as endangered in 1991 (56 FR 61173 61182, 2 December 1991) and no critical habitat has been proposed (USFWS, 2015es). It is found in the Santa Rosa Plain (Cotati Valley) and Sonoma Valley of Sonoma County (USFWS, 2014n).

Sonoma sunshine grows in shallow vernal pools, grassy swales, and seasonally wet grasslands. Threats to the species include habitat loss, fragmentation and degradation due to residential and commercial development, agricultural conversion of natural lands, grazing and trampling by livestock, competition from non-native invasive species, alteration of hydrology, summer irrigation with wastewater, off-highway vehicles, thatch buildup, road construction and maintenance (grading, mowing and herbicide application), dangers from genetic drift and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size, and alteration of habitat due to climate change. (USFWS, 2008h) (USFWS, 2014n)

***Southern Mountain Wild-buckwheat*.** Southern mountain wild-buckwheat (*Eriogonum kennedyi* var. *austromontanum*) is a low-growing woody mat-like perennial in the buckwheat family. Stems form "cushion-like leafy mats" 6 to 14 inches wide. Leaves are short (0.2 to 0.4 inches), wider at the tip, and densely covered with white hairs. Flowers are in clusters at the end of 3 to 6 inch long leafless stems. The small flowers are white to rose. Bloom time is July to September (USFWS, 2015et). Fruit is a grain-like seed.

The variety was listed as threatened in 1998 (63 FR 49006 49022, 14 September 1998) with 904 acres of critical habitat being designated in 2007 (72 FR 73092 73178, 26 December 2007). It is endemic to the San Bernardino Mountains of San Bernardino County in southern California (USFWS, 2015eu).

Southern mountain wild-buckwheat grows on montane pebble plains. Threats to the variety include habitat loss, fragmentation or degradation due to residential or commercial development, recreation development and maintenance (roads and trails), utility construction and maintenance, recreation (trampling by hikers, horseback or off-highway vehicle use), grazing and trampling by livestock, alteration of hydrology, competition with non-native species, mining, fuel-wood harvesting, fire suppression activities, and alteration of habitat due to climate change. (USFWS, 2015et)

Spreading Navarretia. Spreading naverretia (*Navarettia fossalis*) is an annual herb in the phlox family. Plants are many branched and spreading to somewhat ascending, growing only 4 to 6 inches tall. Stems are almost completely hairless. Leaves are arranged alternately along the stems and up to 2 inches long. The leaves are finely divided, and when dry, are tipped by spines. Dense flat-topped leafy flowering heads terminate the stems. The white petals of the flower are fused into a funnel-shaped tube with five linear lobes. Bloom time is May to June. The fruit of each flower is an egg-shaped, papery capsule. (USFWS, 2000h) (USFWS, 1998k) (USFWS, 2009bg)

The species was listed as threatened in 1998 (63 FR 54975 54994, 13 October 1998). It is known from western Riverside and northwestern Los Angeles Counties south to San Diego County in southern California and the adjacent state of Baja California, Mexico (USFWS, 1998k) (USFWS, 2000h) (USFWS, 2009bg). A total of 652 acres of critical habitat was designated in 2005 in Los Angeles and San Diego Counties (70 FR 60658 60694, 18 October 2005), and revised to 6,720 acres in Los Angeles, Riverside and San Diego Counties in 2010 (75 FR 62192 62255, 7 October 2010).

Spreading navarretia is found in vernal pools on clay soils, in artificial depressions in disturbed vernal pool habitat subject to similar vernal inundations, in alkali annual grasslands, and in alkali playas. Threats to the species include habitat loss, degradation and fragmentation due to residential and commercial development, agricultural conversion, pipeline, transportation and flood control construction, alteration of hydrology (wetland draining or channelization), off-highway vehicle use, livestock grazing, discing for agriculture, weed abatement and fire suppression, manure dumping, human access and disturbance (trash dumping, trampling), grading, competition from non-native species, and habitat modifications associated with global climate change. (USFWS, 1998k) (USFWS, 2000h) (USFWS, 2009bg)

Springville Clarkia. Springville clarkia (*Clarkia springvillensis*) is an erect annual herb in the evening-primrose family. It has simple or branched stems, and can reaching 3 feet tall. Leaves are bright green and range from 0.8 to 3.5 inches in length. Flowering occurs from May to July. Flowers have four purples sepals with long hairs, four lavender pink petals with a purple basal spot, and long hairs on the ovary. (USFWS, 1998n) (USFWS, 2010ah)

Springville clarkia was listed as endangered in 1998 (63 FR 49022 49035, 14 September 1998) and critical habitat has not been designated for this species. The only known populations exist in Tulare County (USFWS, 1998n) (USFWS, 2010ah) (USFWS, 2016cq).

Springville clarkia occurs in small openings and on roadsides in blue oak (*Quercus douglasii*) woodlands on granitic soils between 1,200 and 3,000 feet elevation. Threats to the species include residential development, mowing, and road maintenance (USFWS, 1998n) (USFWS, 2010ah) (USFWS, 2016cq).

Stebbins' Morning-glory. Stebbins' morning-glory (*Calystegia stebbinsii*) is a leafy perennial herb in the morning-glory family. Stems reach up to about 3.3 feet long and grow along the ground. Leaves are divided into linear, palm-like segments (USFWS, 1996c). It blossoms from

about May to June, exhibiting creamy-white to pink-tinged flowers that are on stalks about 1 to 5 inches long (Brummitt, 2016) (USFWS, 1996c).

This species was listed as endangered in 1996 (61 FR 54346 54358, 18 October 1996), and no critical habitat has been established (USFWS, 2016cr). It occurs in the vicinity of Pine Hill in western El Dorado County, and in Nevada County, in the north-central portion of the state (USFWS, 1996c) (USFWS, 2002h).

Stebbins' morning-glory is strongly associated with gabbro or serpentine soils and chaparral, occurring where there are openings in the dense vegetation (USFWS, 1996c). Major threats to this species are habitat alteration and modification resulting from urban development, alteration of fire regime, road maintenance and herbicide use, and herbivory and trampling by horses (USFWS, 2002h).

Suisun Thistle. Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*) is a biennial to perennial herb in the sunflower family. Plants persist in their first year as a short, large basal rosette of leaves. These leaves can be up to 3 feet long. When young, the upper leaf surface is covered with hairs, but usually becomes smooth and glossy as the leaves mature; the lower surface is always covered with a thick coat of white hairs. In the second year or later, a leafy stem 3 to 5 feet tall develops, typically branching from above the middle. Rarely, up to 15 stems may branch from the base of large plants. Stem leaves are considerably smaller than the basal leaves, and are more deeply lobed and spinier with bases that clasp the stem often with ear-like extensions. Stem leaves become progressively smaller as they approach the top. Flowering heads appear at the ends of short stalks and may be clustered near the top of the plant. Each egg-shaped head consists of a series of small, green spine-tipped bracts with a distinct light green, sticky ridge, with these surrounding a large number of small rose-purple disk florets. Bloom time is June to September. Each floret produces a small, sunflower-like seed. (USFWS, 2014b)

The variety was listed as endangered in 1997 (62 FR 61916 61925, 20 November 1997), with critical habitat designated in 2007 (72 FR 18518 18553, 12 April 2007). It is known only from the Suisun Marsh in Solano County in the Bay region of northern California (California Department of Fish and Wildlife, 2016a).

Suisun thistle is found in organic, peaty marsh soils in the freshwater-influenced upper tidal marsh plain, on infrequently flooded banks of tidal creeks and marsh edges. Threats to the variety include habitat fragmentation, degradation and alteration from earlier marsh filling or dredging associated with dike-building and industrial, agricultural or residential development, competition with non-native invasive species, trampling and grazing by livestock, herbivory by introduced and native insects, potential hybridization and introgression with related non-native species, sea level rise and other habitat alteration associated with global climate change, and the genetic dangers and susceptibility to random catastrophic events due to small population size, restricted distribution, and narrow habitat requirements. (USFWS, 2014b)

Thread-leaved Brodiaea. Thread-leaved brodiaea (*Brodiaea filifolia*) is a perennial herb in the false onion family. Leaves and flowering stems rise from a "dark brown, fibrous-coated" bulb-like corm. Leaves are thin and narrow, and generally shorter than the flowering stem, with 3 to 5

leaves growing each year but generally die by flowering time. Flowering stems are 8 to 16 inches tall, and topped by a cluster of flowers arranged in an umbel, with single saucer-shaped flowers terminating short stalks that radiate from a single point on the top of the stem. Flowers have 6 violet, spreading petals that are about 0.4 to 0.5 inches long. Bloom time is March to June. The fruit of each flower is a capsule. (USFWS, 2000h) (USFWS, 2009bh)

The species was listed as threatened in 1998 (63 FR 54975 54994, 13 October 1998). It is known to occur from the foothills of the San Gabriel Mountains in Los Angeles County and the foothills of the San Bernardino Mountains of San Bernardino County south to Orange, Riverside and San Diego Counties in southern California (USFWS, 2000h) (USFWS, 2009bh). A total of 597 acres of critical habitat was designated in 2005 in Los Angeles and San Diego Counties (70 FR 73820 73863, 13 December 2005) and revised in 2011to 2,947 acres in all Counties of its known distribution (76 FR 6848 6925, 8 February 2011).

Thread-leaved brodiaea occurs in grasslands, herbaceous plant communities, in openings in coastal sage scrub on gentle sloping hills, valleys, and floodplains on clay, alkaline silty-clay soils, clay lenses within loamy sand, silty loam, silty deposits with cobbles, or alkaline soils, and vernal wetlands with clay hardpans. Threat to the species include habitat loss, degradation or alteration due to residential, commercial and agricultural development, alteration of natural hydrology, channelization, discing and mowing for agriculture or fire suppression, competition with non-native species, trampling, compaction of soils, and grazing by livestock, off-highway vehicle recreation, localized manure dumping, and potential habitat alteration due to climate change. (USFWS, 2000h) (USFWS, 2009bh)

Tiburon Jewelflower. Tiburon jewelflower (*Streptanthus niger*) is an annual herb in the mustard family. The species reaches 1 to 2 feet in height with different lower and upper leaves. Lower leaves are toothed compared to the upper leaves which are not toothed. Flowers have four petals with a purple claw (a narrow stalk-like area at the base of the petal) and a broader white blade. The Tiburon jewelflower flowers from May to June and seed pods open in late June. The species is self-pollinated. (USFWS, 1995b) (USFWS, 2009bi)

The species was listed as threatened in 1995 (60 FR 6671 6685, 03 February 1995). The Tiburon jewelflower is known to occur in Marin County, on the southern Tiburon Peninsula. The entire known range of the species is contained within less than a third of a square mile. To date, no critical habitat has been proposed for the species. (USFWS, 1995b) (USFWS, 2009bi)

The Tiburon jewel flower is only found on shallow rocky serpentine soils on slopes at elevations of approximately 300 feet. Urban development is the primary threat to the species, which to date is believed to have destroyed approximately 40 percent of suitable habitat (USFWS, 1995b) (USFWS, 2009bi).

Tiburon Mariposa Lily. Tiburon mariposa lily (*Calochortus tiburonensis*) is a bulbous perennial herb in the lily family. The species has a single basal leaf that can reach up to 2 feet in height. Flowers are a yellow-green with tinges of purple and appear at the ends of branches from the approximately 20 inch long flowering stem. Seed capsules are approximately 2 inches in length. The flowering period is from May to June, and the species is thought to be pollinated primarily

by bees. Individual plants are thought to live up to 10 years and often do not reproduce until age 5 (USFWS, 1995b) (USFWS, 2009bj) (USFWS, 2016cs).

The species was listed as threatened in 1995 (60 FR 6671 6685, 03 February 1995). The Tiburon mariposa lily is known to occur in Marin County on with a single population on Ring Mountain on the Tiburon Peninsula. To date, no critical habitat exists for the species (USFWS, 1995b) (USFWS, 2009bj) (USFWS, 2016cs).

The Tiburon mariposa lily prefers rocky serpentine soils and in open areas of serpentine bunch grass at an elevation of approximately 460 feet ASL. The species is vulnerable to fire, disease, pest outbreaks, drought, and landslides due to its single, known population and limited distribution. Currently, the population has been fenced to help protect from off-road vehicle damage (USFWS, 1995b) (USFWS, 2009bj) (USFWS, 2016cs).

Tiburon Paintbrush. Tiburon paintbrush (*Castilleja affinis* ssp. *neglecta*) is a semi-woody plant in the broomrape family. The subspecies is a perennial with erect branches and stems that reach 1 to 2 feet in height. Leaves are lance shaped with none to 5 lobes, and reach 0.8 to 1.6 inches in length. Flowers are yellow with red tips and can reach 0.8 inches long. The plant flowers from April to June and seeds are shed in June and July. (USFWS, 1995b) (USFWS, 2016ct) (USFWS, 2009bk)

The subspecies was listed as threatened in 1995 (60 FR 6671 6685, 03 February 1995). The Tiburon paintbrush is known or believed to occur in Contra Costa, Marin, Napa, Santa Clara and Solano Counties in California. To date, no critical habitat has been proposed (USFWS, 1995b) (USFWS, 2016ct) (USFWS, 2009bk).

The Tiburon paintbrush occurs on north and west facing slopes in serpentine bunchgrass communities at elevations between 250 and 1,300 feet. Threats to the species include foot traffic, urban development and soil slumping. Gravel mining also poses a threat to some populations in Napa County (USFWS, 1995b) (USFWS, 2016ct) (USFWS, 2009bk).

Triple-ribbed Milk-vetch. Triple-ribbed milk-vetch (*Astragalus tricarinatus*) is a short-lived perennial in the pea family with an upright growth form, reaching from about 2 to 10 inches tall (USFWS, 2009bl). Leaves of this species are divided into fern-like leaflets, are about 1.3 to 2.7 inches long and have silvery rough hairs on the upper surfaces (USFWS, 2009bl). Blooming occurs from about February to May, with flowers clustered near the ends of floral stems (Wojciechowski & Spellenberg, 2016e). Flowers are pale cream or white colored and mature into narrow, 1 to 1.5 inch long pods that are distinctly three-sided (USFWS, 2009bl) (Wojciechowski & Spellenberg, 2016e).

This species was listed as endangered in 1998 (63 FR 53596 53615, 6 October 1998) and no critical habitat has been established (USFWS, 2016cu). It is found in Riverside and San Bernardino Counties of southern California (USFWS, 2009bl).

Triple-ribbed milk-vetch grows in the Sonoran-Mojave desert transition zone, on disturbed ridgetops or disturbed soils within washes or base of canyon scree slopes at elevations of about 1,300 to 4,000 feet. Major threats to this species include habitat disturbance from pipeline maintenance activities, residential development, altered wildlife regime, flooding, and risk of

low survival of random environmental and climate change events due to small population. (USFWS, 2009bl)

Vail Lake Ceanothus. Vail Lake ceanothus (*Ceanothus ophiochilus*) is an upright, perennial evergreen shrub in the buckthorn family that grows to about 4 to 5 feet tall. This plant has dull green, flat, egg-shaped leaves that grow opposite each other along the stems with knob-like leaf stems. Blooming occurs from February through March, with blue to pinkish-lavender flowers in umbrella-like clusters. (USFWS, 2013u)

This species was listed as threatened in 1998 (63 FR 54956 54971, 13 October 1998). Critical habitat has been designated (72 FR 54984 55010, 27 September 2007) in southwestern Riverside County, and northern San Diego County (USFWS, 2007o) (USFWS, 2016cv). This shrub is found growing near Vail Lake and the Agua Tibia Wilderness Area in southwestern Riverside County (USFWS, 2007o) (USFWS, 2013u).

Vail Lake ceanothus tends to occur on gabbro or mixed gabbro-sedimentary soils in areas of dense chaparral, often on ridge tops. Major threats to this species currently include fire and fire management practices, urban development, loss of genetic diversity due to small population size, and risk of random environmental factors such as climate change including altered precipitation patterns and temperature. (USFWS, 2013u)

Vandenberg Monkeyflower. Vandenberg monkeyflower (*Diplacus vandenbergensis* or *Mimulus fremontii* var. *vandenbergensis*) is a small, herbaceous annual flowering plant in the lopseed family. Stems of this plant are bright green and glandular with a purplish tinge (USFWS, 2014q). Each plant produces a single or a few yellow flowers, blooming between May and June.

This species was listed as endangered in 2014 (79 FR 50844 50854, 26 August 2014) with critical habitat established in 2015 (80 FR 48141 48170, 11 August 2015) in Santa Barbara County (USFWS, 2015ev) (USFWS, 2016cw). Vandenberg monkeyflower is known only from a specific landscape, Burton Mesa, in Santa Barbara County. This species is typically found in sandy openings between shrubs of the associated vegetation that includes maritime chaparral mixed with coastal scrub, oak woodland, and small patches of native grasslands. Major threats to this species include habitat modification as a result of invasive non-native plant species, human-caused wildfire, land development, and recreational use and off-high vehicle use. (USFWS, 2014q)

Ventura Marsh Milk-vetch. Ventura Marsh milk-vetch (*Astragalus pycnostachyus* var. *lanosissimus*) is a perennial plant in the pea family with a thick taproot and multiple upright stems. The stems of this plant are reddish in color and grow from 16 to 36 inches tall, with fern-like leaflets arranged like a feather and covered in silvery white hairs (USFWS, 2002n). Flowers are greenish-white to cream colored, blooming from about July to October in dense clusters (Wojciechowski & Spellenberg, 2016f) (USFWS, 2002n).

This variety was listed as endangered in 2002 (67 FR 62926 62945, 9 October 2002), and critical habitat has been established (69 FR 29081 29100, 20 May 2004) in Santa Barbara and Ventura Counties near the coast of central California (USFWS, 2016cx).

Habitat requirements of Ventura Marsh milk-vetch are not well known; however, this variety currently grows in low-elevation coastal dune swale areas where groundwater may be close to the surface, with other freshwater-dependent plants (USFWS, 2002n). Major threats to this variety include habitat alteration from urbanization and remediation activities, herbivory by insects and mammals, as well as risks presented by the small population number, such as reduced ability to survive random environmental events including drought, flood, fire, and others (USFWS, 2010ai).

Verity's Dudleya. Verity's dudleya (*Dudleya verityi*) is a succulent perennial herb in the stonecrop family. It forms multiple evergreen basal rosettes (up to 100 or so) of fleshy, lance-shaped, grayish, red-tinged leaves with pointed tips (0.8 to 2 inches long and 0.2 to 0.4 inches wide). Fleshy, branching, flowering stems rise from 2 to 6 inches tall with small fleshy, leaf-like bracts, and topped with 5-lobed lemon yellow flowers, with the lobes recurved at 90 degrees. Bloom time is May to June. The fruit of each flower consists of 5 many-seeded pods. (USFWS, 1999c) (USFWS, 2009bm).

The species was listed as threatened in 1997 (62 FR 4172 4183, 29 January 1997) and no critical habitat has been proposed (USFWS, 2015ew). It is known from Conejo Mountain area of the Santa Monica Mountains in Ventura County, southern California (USFWS, 2009bm).

Verity's dudleya occurs in a narrow band following north-facing Conejo volcanic outcrops in coastal sage scrub. Threats to the species include habitat loss, fragmentation or degradation due to residential and commercial development (particularly rock quarrying), air pollution, destruction from fire, fire suppression or fire prevention activities, collection by commercial and private enthusiasts, encroachment and competition with non-native invasive species, habitat alteration due to climate change, and dangers from genetic drift and random catastrophic or climatic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 1999c) (USFWS, 2009bm)

Vine Hill Clarkia. Vine Hill clarkia (*Clarkia imbricata*) is an annual herb in the evening-primrose family. Stems grow upright to about 2.5 feet tall, usually unbranched or with short branches in the upper parts. Stems are densely leafy, with leaves alternating and overlapping on the stem. Leaves are lance-shaped and about an inch long and a third as wide at the base. Flowers are clustered at the ends of stems and branches. Flowers are very showy, with a long slender tube that opens into four fan-shaped, lavender petals with a v-shaped purple spot extending from the middle of each petal to the tip. Bloom time is June to August. The fruit of each flower is an elongated capsule. (USFWS, 2011ad) (USFWS, 2015ex)

The species was listed as endangered in 1997 (62 FR 54791 54808, 22 October 1997). No critical habitat has been proposed (USFWS, 2015ey). It currently known from a single locality in the Sonoma Barrens area of inland Sonoma County on the north central coast of California (USFWS, 2015ex).

Vine Hill clarkia is found in acidic sandy grasslands. Threats to the species include loss of habitat through community succession (encroachment by woody species due to fire suppression), competition with non-native species, collection from the wild of plants and seed, trespassing and

vandalism, land use changes (development) and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 2015ex) (USFWS, 2011ad)

Water Howellia. The water howellia (*Howellia aquatilis)* is an aquatic winter annual ranging from 4 to 24 inches in height that flowers in July to August (USFWS, 2015ez). This plant is typically submerged or floating in water (USFWS, 1996d).

The species was listed as threatened in 1994 (59 FR 35860 35864, July 19, 1994) and no critical habitat has been proposed (USFWS, 2015ez). This species is known or believed to occur in California, Idaho, Montana, Oregon, and Washington (USFWS, 1996d); in northern California, it is limited to Mendocino and Tehama Counties (USFWS, 2015ez).

Suitable habitat for this species consists of wetlands formed by glacial potholes with a varied hydrologic regime,[139] consisting of wet conditions during winter snowmelt and spring rains, and dry conditions by late summer (USFWS, 2015ez). Important wetland habitat is often surrounded by deciduous[140] forest. The primary threats to this species and its habitat include timber harvesting, livestock grazing, invasion of non-native invasive plants, and human-induced habitat conversion from increased urbanization, agriculture, and flood control measures (USFWS, 1996d).

Webber Ivesia. The Webber ivesia (*Ivesia webberi*) is a species within the rose family (*Rosaceae*) that is endemic to northeastern California and northwestern Nevada. It is a low-growing, perennial, herbaceous plant with clusters of small yellow flowers and green/grey leaves (USFWS, 2014r). It was listed as threatened and afforded approximately 2,000 acres of critical habitat in 2014 (79 FR 8668 8677, February 13, 2014) (79 FR 31878 31883, June 3, 2014) (USFWS, 2014r) (USFWS, 2015fa).

The Webber ivesia has a limited range, occurring in only 165 acres of land in a transition zone between the Sierra Nevada and the Great Basin Desert in California and Nevada. The species was historically known to exist in 17 populations, one of which has been confirmed as extirpated and three of which may be extirpated. The species is associated with seasonally moist, rocky, clay soils which shrink when dry. It is typically found in sparsely vegetated sagebrush-bunchgrass communities. The species' endemism is a result of specific soil requirements and of limited seed dispersal. The primary threat to this species is the encroachment of non-native vegetation, causing increased competition and a change in the natural fire regime. The species is also threatened by off-highway vehicle disturbance, urban development, climate change, and trampling by livestock or feral horses. (USFWS, 2014r)

Western Lily. Western lily (*Lilium occidentale*) is an "attractive perennial member of the Liliaceae (lily family), which dies back to an underground bulb in the winter. The date by which all multiple-leaved plants have emerged can vary substantially, ranging from late April, to mid-

[139] Hydrologic regime: "The system that describes the occurrence, distribution, and circulation of water on the earth and between the atmosphere." (USEPA, 2015w)

[140] Deciduous: "Plants having structures that are shed at regular intervals or at a given stage in development, such as trees that shed their leaves seasonally." (USEPA, 2015w)

July. Seedlings and small juvenile plants produce a single above-ground leaf, while multiple-leaved plants commonly reach a height of 3 to 5 feet (maximum 7 feet). Leaves grow along the unbranched above-ground stem, ranging from 0.35 to 0.75 inches wide by 3.1-10.6 inches long. Leaves are distributed singly or in up to 9 whorls along the shoot. [Western Lily] can be distinguished from most other species of Lilium by its pendent red flowers, yellow to green centers, highly reflexed tepals, non-spreading stamens, and closely unbranched rhizomatous bulb." (USFWS, 2009bp)

Western lily was federally listed as threatened in 1994 (59 FR 42171 42176, August 17, 1994). No critical habitat has been designated for this species. Historically in California, this species was found in coastal Del Norte and Humboldt Counties (USFWS, 2016dg) (USFWS, 2009bp).

Western lily is found in two distinct soil types, including "mineral soils that possess an impermeable layer that serves to maintain moisture late into the growing season; or organic marsh soils in which a fluctuating water table exposes the bulb during a critical portion of the growing season." Threats to the species include habitat removal and degradation from agriculture and urbanization, road construction, deer herbivory, over-collection, hydrological alteration, genetic variability loss, and fungal, viral, or bacterial infections (USFWS, 2009bp).

White Sedge. White sedge (*Carex albida*) is a somewhat openly clustered grass-like perennial herb in the sedge family. It has short, fiber-covered rhizomes that help it to spread. The stems are triangular in cross-section, and up to 2 feet tall. Leaf blades are flat and 0.1 to 0.2 inches wide, and shorter than the stem. The obscure flowers are in 4 to 7 football or egg-shaped clusters at the end of the stem, with male flowers positioned above female flowers. Bloom time is May to July. The fruit is a three-sided, triangular in cross section seed. (USFWS, 2009as)

The species was listed as endangered in 1997 (62 FR 54791 54808, 22 October 1997). No critical habitat has been proposed (USFWS, 2015fb). It is known only from two remnant marshes in Sonoma County on the north central coast of California (USFWS, 2009as).

White sedge grows in fens, freshwater marshes and swamps, seeps, and moist meadows. Threats to the species include residential and urban development (both direct habitat loss and indirect effects on hydrology, runoff, pollution, etc.), agricultural conversion, landscape modifications that alter hydrology, road and utility construction and maintenance, competition with non-native invasive species, groundwater depletion, habitat alteration due to global climate change, and random catastrophic events due to restricted distribution, narrow habitat requirements and small population size. (USFWS, 2009as).

White-rayed Pentachaeta. White-rayed pentachaeta (*Pentachaeta bellidiflora*) is a small annual herb in the sunflower family. The stems are branching with narrow linear leaves. Flowering heads have yellow disk florets. The flowering period is from March to May. After flowering fruits appear as coarse-haired cypselae (USFWS, 1995b) (USFWS, 2016cz) (USFWS, 2009bn).

The species was listed as threatened in 1995 (60 FR 6671 6685, 03 February 1995). The white-rayed pentachaeta is known from San Mateo County, but historically was also found in Marin and Santa Cruz Counties in California. To date, no critical habitat has been proposed for the species (USFWS, 1995b) (USFWS, 2009bn) (USFWS, 2016cz).

The white-rayed pentachaeta occurs in serpentine grassland. Habitat for this species has largely been lost to road construction, urbanization, and off-road vehicle use (USFWS, 1995b) (USFWS, 2009bn) (USFWS, 2016cz).

Willowy Monardella. Willowy monardella (*Monardella viminea*) is a perennial herb with a woody base in the mint family, and has aromatic leaves characteristic of this family (USFWS, 2012a). Stems of this plant are densely hairy and grow from 10 to 20 inches tall, with narrow, slightly hairy leaves (Sanders, Elvin, & Brunell, 2016). White to rose-colored flowers occur in clusters at the end of the stem, blooming from June to August (Sanders, Elvin, & Brunell, 2016).

This species was listed as endangered in 1998 (63 FR 54938 54956, 13 October 1998), and critical habitat was originally designated in 2006 (71 FR 65662 65683, 8 November 2006) and revised in 2012 (77 FR 13394 13447, 6 March 2012) (USFWS, 2016da). This plant is known to occur in only three watersheds of San Diego County, north of Kearny Mesa (USFWS, 2012a), with critical habitat designated in two locations (Sycamore Canyon and West Sycamore Canyon) adjacent to the northeastern and eastern boundary of Marine Corps Air Station (MCAS) Miramar (USFWS, 2012d).

Willowy monardella is found growing in and along sandy bottoms and banks of ephemeral washes in canyons with coastal sage scrub and riparian scrub vegetation communities. Major threats to this species include alteration of hydrology, habitat degradation or alteration due to frequent fire, and impacts and competition with non-native plant species. (USFWS, 2012a).

Yadon's Piperia. Yadon's piperia (*Piperia yadonii*) is a perennial herb in the orchid family (Calflora, 2016e) (USFWS, 2004d). Stems typically reach 8 to 20 inches tall. Two to three lanceolate or oblanceolate basal leaves are present on most mature plants (4 to 5 inches long and 0.8 to 1.2 inches wide). Plants have an average of 56 flowers on but may have up to 100 located on a narrow raceme. Flowers have three sepals and three petals and are green and white in color or all creamy white if appearing late in the season (USFWS, 2004d). Plants bloom from May through August. Habitat includes moist areas between sea-level and 722 feet (Calflora, 2016e).

The species was listed as endangered in 1998 (63 FR 43100 43116, 12 August 1998). A total of 2,117 acres of critical habitat was designated for the species in 2007 in Monterey County (72 FR 60410 60450, 24 October 2007). Yadon's piperia has been found in both Monterey and Santa Cruz Counties, with the majority of populations being in Monterey County (Calflora, 2016e). The species range exists from the northern border of Santa Cruz County near Los Lomos to about 15 miles south near Palo Colorado Canyon and the Monterey Peninsula (USFWS, 2004d).

Yadon's piperia can be found in areas that retain moisture but are not inundated with well-drained sandy soils located in maritime chaparral and Monterey pine (*Pinus radiata*) forests. In maritime chaparral habitat, the species has been found to grow under dwarfed Hooker's manzanita (*Arctostaphylos hookeri*) in shallow soils. In Monterey pine forests, the species is found in the herbaceous, sparse understory stratum. Occasionally, this species has been found in previously disturbed areas, including old dirt roads and slopes near roadways. Threats to the species include urbanization and recreation altering, destroying, or fragmenting habitat, non-native plant species competition, fire suppression altering ecology of habitat, consumption by

native and non-native wildlife, and naturally-occurring variation in populations (USFWS, 2004d).

Yellow Larkspur. Yellow larkspur (*Delphinium luteum*) is a perennial herb in the buttercup family. Plants grow from tuberous but long and thin, somewhat fibrous roots. Stems grow to just under two feet tall. Leaves are fleshy and shallowly three- to five-lobed and are mostly on the lower third of the plant. Flowers appear on short stalks on the leafless top of the stem. Each flower has a cornucopia-shaped appearance, with five large, yellow, showy sepals, with one modified into an almost inch-long, rearward projecting spur, and two pairs of small, almost inconspicuous yellow petals. Bloom time is March to May. Fruit consists of three short, erect, many-seeded pods (USFWS, 2011af).

The species was listed as endangered in 2000 (65 FR 4156 4162, 26 January 2000) and 2,525 acres of critical habitat was designated in 2003 (68 FR 12834 12863, 18 March 2003). It is known from coastal Marin and Sonoma Counties of the north central coast of California (USFWS, 2015fc).

Yellow larkspur occurs on rocky areas with moderate to steep slopes with some disturbance, including active rock slides, in open coastal prairie or coastal scrub at 0 to 300 feet elevation (USFWS, 2011af). Threats to the species include habitat loss and degradation, residential and commercial development, quarrying, sheep grazing, road construction and maintenance, over collection by individual or commercial enthusiasts, alteration of habitat due to climate change, and random catastrophic events due to restricted distribution, narrow habitat requirement and small population size (USFWS, 2011af).

Yreka Phlox. Yreka phlox (*Phlox hirsuta*) is a perennial low-growing subshrub in the phlox family. Plants grow to 2 to 6 inches high, with a stout, woody base and are covered in coarse, rough hairs. Leaves are narrowly ovate, about 0.5 to 1 inch long and 0.3 inch wide, and crowded on the stem. Yreka phlox blooms from April to June, with bright rose-pink to white-colored flowers that are approximately one-half inch long (USFWS, 2000k).

Yreka phlox was listed as endangered in 2000 (65 FR 5268 5275, 3 February 2000) and no critical habitat has been designated (USFWS, 2016db). This species is endemic to serpentine soils and is known from only five locations in the vicinity of the City of Yreka in Siskiyou County (USFWS, 2006k).

Yreka phlox occurs at elevations ranging from approximately 2,800 to 4,400 feet of elevation, and is found in association with open Jeffrey pine (*Pinus jeffreyi*)-incense cedar (*Calocedrus decurrens*) forest. This species is threatened by destruction of plants and habitat as a result of residential development, competition with exotic plant species, off-road vehicle use, garbage dumping, vandalism, illegal collecting, logging road construction, timber harvesting activities, dangers from random events such as fire, drought, and disease due to small population size and range of population, and restricted habitat (USFWS, 2006k).

4.1.7 Land Use, Recreation, and Airspace

4.1.7.1 Definition of the Resource

The following summarizes major land uses, recreational venues, and airspace considerations in California, characterizing existing, baseline conditions for use in evaluating the potential environmental consequences resulting from implementing the Proposed Action or Alternatives.

Land Use and Recreation

Land use is defined as "the arrangements, activities, and inputs people undertake in a certain land cover type to produce, change, or maintain it" (Di Gregorio & Jansen, 1998). A land use designation can include one or more pieces of land, and multiple land uses may occur on the same piece of land. Land use also includes the physical cover, observed on the ground or remote sensing and mapping, on the earth's surface; land cover includes vegetation and manmade development (USGS, 2012c).

Recreational uses are activities in which residents and visitors participate. They include outdoor activities, such as hiking, fishing, boating, athletic events (e.g., golf), and other attractions (e.g., historic monuments and cultural sites) or indoor activities, such as museums and historic sites. Recreational resources can include trails, lakes, forests, beaches, recreational facilities, museums, historic sites, and other areas/facilities. Recreational resources are typically managed by federal, state, county, or local governments.

Descriptions of land uses are presented in three primary categories: forest and woodlands, agricultural, and developed. Descriptions of land ownership are presented in four main categories: private, federal, state, and tribal. Descriptions of recreational opportunities are presented in a regional fashion.

Airspace

Airspace is generally defined as the space lying above the earth, above a certain area of land or water, or above a nation and the territories that it controls, including territorial waters (Merriam Webster Dictionary, 2015b). Airspace is a finite resource that can be defined vertically and horizontally, as well as temporally, when discussing it in relation to aircraft activities. Airspace management addresses how and in what airspace aircraft fly. Air flight safety considers aircraft flight risks, such as aircraft mishaps and bird/animal-aircraft strikes. The FAA is charged with the safe and efficient use of the nation's airspace and has established criteria and limits to its use.

The FAA operates a network of airport towers, air route traffic control centers, and flight service stations. The FAA also develops air traffic rules, assigns use of airspace, and controls air traffic in U.S. airspace. "The Air Traffic Organization (ATO) is the operational arm of the FAA responsible for providing safe and efficient air navigation services to approximately 30.2 million square miles of airspace. This represents more than 17 percent of the world's airspace and includes all of the U.S. and large portions of the Atlantic and Pacific Oceans and the Gulf of Mexico" (FAA, 2014b). The ATO is composed of Service Units (organizations) that support the operational requirements.

The FAA Air Traffic Services Unit (the Unit) manages the National Airspace System (NAS) and international airspace assigned to U.S. control and is responsible for ensuring efficient use, security, and safety of the nation's airspace. FAA field and regional offices (e.g., Aircraft Certification Offices, Airports Regional Offices, Flight Standards District Offices [FSDOs], Regional Offices & Aeronautical Center, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (FAA, 2015d). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

4.1.7.2 Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, summarizes numerous federal environmental laws and regulations that, to one degree or another, may affect land use in California. However, most site-specific land use controls and requirements are governed by local county, city, and village laws and regulations. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities. The *State of California General Plan Guidelines* is the current state-level guidance for land use planning in California (California Office of Planning and Research, 2003).

Because the Nation's airspace is governed by federal laws, there are no specific California state laws that would alter the existing conditions relating to airspace for this PEIS. Division 9 of the California Public Utilities Code addresses aviation (Legislative Counsel State of California, 2015b).

4.1.7.3 Land Use

Table 4.1.7-1 identifies major land uses by coverage type in California. Forest and woodlands comprises the largest portion of land use with 34 percent of California's total land occupied by this category (Table 4.1.7-1 and Figure 4.1.7-1). Semi-desert is the second largest area of land use with 19 percent, shrub and grassland is the third at 17 percent, agriculture is the fourth largest with 10 percent, while developed areas account for approximately 6 percent of the total land area. The remaining percentage of land includes other land cover, as shown in Figure 4.1.7-1, that are not associated with major land uses. (USGS, 2011).

Table 4.1.7-1: Major Land Use in California by Coverage Type

Land Use	Square Miles	Percent of Land
Forest and Woodland	54,954	34%
Semi-Desert	31,299	19%
Shrubland and Grassland	27,262	17%
Agricultural Land	16,109	10%
Developed Land	10,171	6%
Other	23,900	15%

Source: (USGS, 2011)

Forest and Woodland

Forest and woodland areas are primarily found in the mountainous areas of the Sierra Nevada, Klamath, and Coast Ranges, and in the north and central coasts. About half of the forest and woodland areas in California are owned and managed by the federal government, most within National Forests and wilderness areas. About 40 percent of the forest and woodland areas throughout California are privately owned (USFS, 2008). Section 4.1.6 presents additional information about terrestrial vegetation.

State Forests

State forests account for 926 square miles of state land and are composed of forestlands representing the common types of forests in California. State forests are under the administration of and managed by the Department of Forestry and Fire Protection. The Department's policy states "The State forests shall be used for experimentation to determine the economic feasibility of artificial reforestation, and to demonstrate the productive and economic possibilities of good forest practices toward maintaining forest crop land in a productive condition." The forests also provide recreation opportunities, watershed protection, and wildlife habitat. (California Department of Forestry and Fire Protection, 2012)

Private Forest and Woodland

Approximately 40 percent of California's total forest and woodland, is owned collectively by private landowners; with 26 percent held by private noncorporate owners and 14 percent by private corporate owners. About than 58 percent of the privately owned forest parcels are less than 500 acres with the largest number of landowners holding parcels less than 50 acres. (California Department of Forestry and Fire Protection, 2012) For additional information regarding forest and woodland areas, see Section 4.1.6, Biological Resources, and Section 4.1.8, Visual Resources.

Semi-Desert

Land use within the semi-desert category (31,299 square miles) in California includes wildlife management areas, wilderness and wilderness study areas, national parks, state parks, recreation, DOD lands, wild horse range and management areas, minerals development and livestock grazing (BLM, 2016a) (BLM, 2016b). The majority of semi-desert areas occur within the southeastern portion of the state (Figure 4.1.7-1) and are managed by the BLM (Figure 4.1.7-2).

Shrubland and Grassland

The largest concentrations of shrubland and grassland (27,262 square miles) are located in the southern and western areas of the state (Figure 4.1.7-1). Land use in these areas varies by location and includes both private and public land ownership (Figure 4.1.7-2). Some of the uses within this category include ranching, recreation, and wildlife preservation.

Agricultural Land

Agricultural land exists in every region of the state, with the largest concentrations across the center of the state (Figure 4.1.7-1). About 10 percent of California's total land area is classified

as agricultural land (16,109 square miles). In 2012, there were 77,857 farms in California and most were owned and operated by small, family businesses, with an average farm size of 328 acres (U.S. Department of Agriculture, 2014a). Some of the state's largest agricultural uses include nuts, grapes, berries, hay, lettuce, citrus fruits, broccoli, rice, carrots, cotton, peaches, peppers, avocados, cauliflower, celery, garlic, prunes, melons, potatoes, wine, and other fruits and vegetables. Other agricultural uses include aquaculture, livestock for dairy and meat, goats, and sheep (U.S. Department of Agriculture, 2014b).

Developed Land

Developed land in California tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs. Although only 6 percent of California land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 4.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates, and Figure 4.1.7-1 shows where these areas are located within the developed land use category.

Table 4.1.7-2: Top Five Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Los Angeles/Long Beach/Anaheim	12,263,818
San Francisco/Oakland	3,332,589
San Diego	2,998,472
Riverside/San Bernardino	1,977,258
Sacramento	1,749,420
Total Population of Metropolitan Areas	**22,321,557**
Total State Population	**38,802,500**

Sources: (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015f; U.S. Census Bureau, 2015g)

4.1.7.4 Land Ownership

Land ownership within California has been classified into four main categories: private, federal, state, and tribal (Figure 4.1.7-2).[141]

Private Land

Most of the private land in California falls under the land use categories of agricultural, forest and woodland, and developed (Figure 4.1.7-1). Highly developed, urban, metropolitan areas transition into suburban, agriculture, and woodland areas, which then transition into more wild and remote areas. Private land exists in all regions of the state.

[141] Land ownership data were retrieved from the Protected Areas Database of the United States (PAD-US), produced by USGS (http://gapanalysis.usgs.gov/padus/). This dataset categorizes lands across the U.S. by conservation, land management, planning, recreation, and ownership, as well as other uses. It is an extensive dataset that contains large quantities of information relevant to the Proposed Action. The data was queried to show Owner and used USGS' PAD-US ownership symbolization for consistency. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

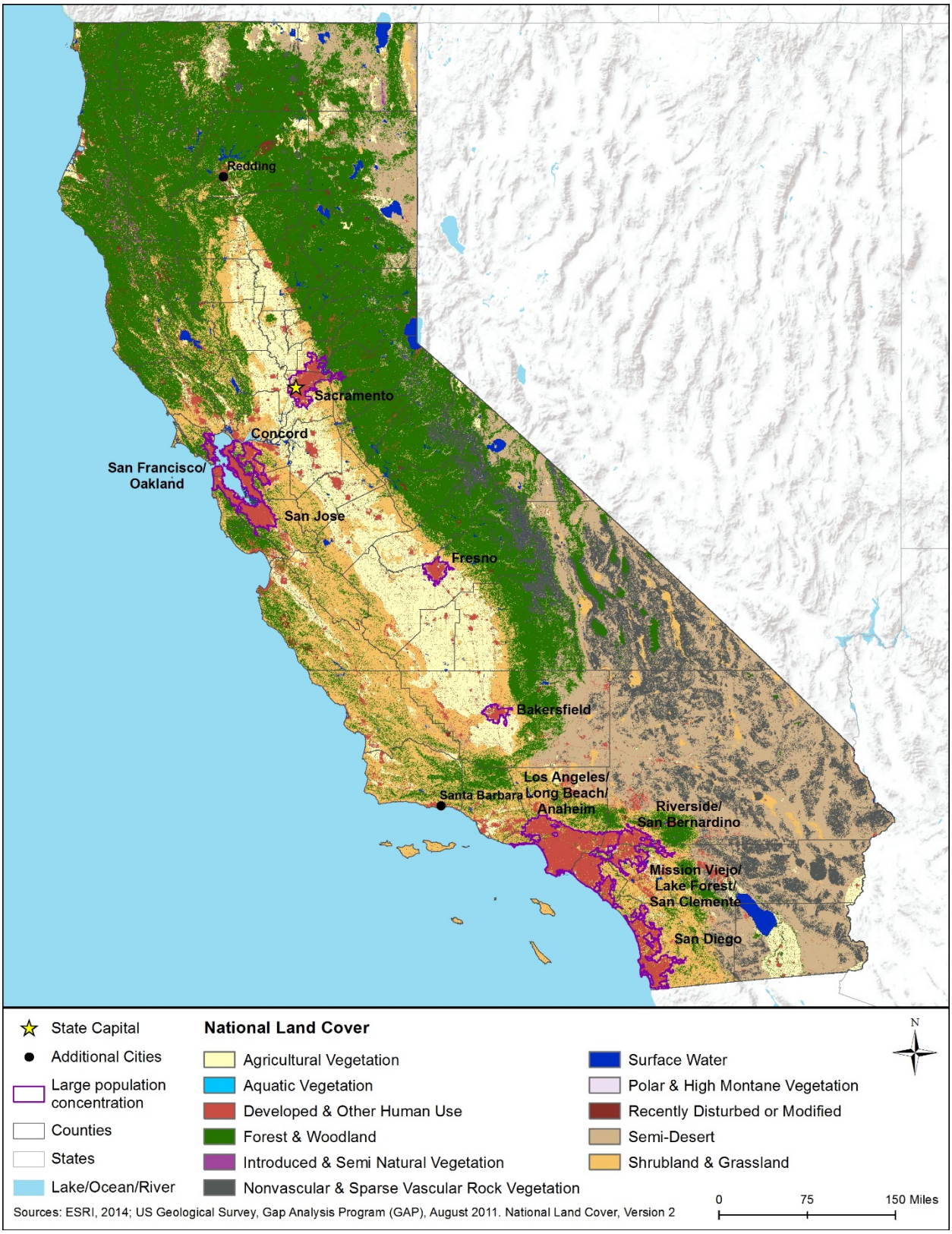


Figure 4.1.7-1: Major Land Use Distribution by Coverage Type

Federal Land

The federal government manages 76,603 square miles (47 percent) of California land with a variety of land types and uses including military bases and facilities, national wildlife refuges, national forests, national parks, monuments, historic sites, national conservation areas, and wilderness areas (USGS, 2012d) (USGS, 2014h). Seven federal agencies manage the majority of federal lands throughout the state (Table 4.1.7-3) (Figure 4.1.7-2). There may be other federal lands, but they are not shown on the map due to their small size relative to the entire state.

Table 4.1.7-3: Federal Land in California

Agency	Square Miles	Type
DOD	6,553	USACE Land and Recreation Areas, Military Bases, Ranges, Military Facilities
USFWS	682	National Wildlife Refuges
USFS	32,268	National Forests
NPS	12,230	Parks, Monuments, Historic Sites, Recreation Areas, National Seashore
BLM	24,518	National Monuments, National Conservation Areas, Wilderness Areas
BOR	352	Water Projects, Dams
Total	**76,603**	

Sources: (USGS, 2012d) (USGS, 2014h)

- The DOD owns and manages 6,553 square miles used for military bases, ranges, and military facilities (Department of Defense, 2014). In addition, there are 23 USACE reservoir recreation areas within the state (USACE, 2015a). USACE reservoirs are managed for scenic and aesthetic qualities as well as for water storage and flood mitigation (USACE, 2015b).
- The USFWS owns and manages 682 square miles consisting of 40 National Wildlife Refuges in California (USFWS, 2014a).
- The USFS owns and manages 32,268 square miles, among one Management Area (Lake Tahoe Basin Management Area) and 18 National Forests (Angeles National Forest, Cleveland National Forest, Eldorado National Forest, Humboldt-Toiyabe National Forest, Inyo National Forest, Klamath National Forest, Lassen National Forest, Los Padres National Forest, Mendocino National Forest, Modoc National Forest, Plumas National Forest, San Bernardino National Forest, Sequoia National Forest, Shasta-Trinity National Forest, Sierra National Forest, Six Rivers National Forest, Stanislaus National Forest, and Tahoe National Forest).
- The NPS manages 12,230 square miles among 27 NPS units[142] and NPS-affiliated areas, such as National Heritage Areas. There are eight National Parks, three National Recreation Areas, one National Preserve, one National Seashore, five National Historic Trails, four National Historic Sites, two National Historical Parks, and seven National Monuments in the

[142] This count is based on the NPS website "by the numbers" current as of 9/30/2014 (NPS, 2015f). Actual lists of parks and NPS affiliated areas may vary depending on when areas are designated by Congress.

state. Two of the National Parks, Redwood and Yosemite, are designated natural World Heritage Sites.

- The BLM manages 24,518 square miles of national monuments, forest reserves, national conservation areas, outstanding natural areas, and wilderness areas (BLM, 2015a).
- The BOR manages 352 square miles consisting of water projects and dams (USGS, 2012d) (USGS, 2014h).

State Land[143]

The California state government owns approximately 3,813 square miles of land composed of state parks, recreation areas, wildlife habitat, ecological reserves, public access sites, and fish hatcheries (Table 4.1.7-4). Two main state agencies, the Department of Parks and Recreation and the Department of Fish and Wildlife manage the majority of state lands Figure 4.1.7-2.

Table 4.1.7-4: State Land in California[a]

Agency	Square Miles	Representative Type
Department of Parks and Recreation	1,975	State Parks, Recreation Areas
Department of Fish and Wildlife	912	Wildlife Habitat, Ecological Reserves, Public Access Sites, Fish Hatcheries
Department of Forestry and Fire Protection	926	State Forests

Source: (USGS, 2012d) (USGS, 2014h)

[a] Acres are not additive due to overlapping boundaries of the state forests, state parks and recreation areas, and Wildlife Management Areas.

- The California Department of Parks and Recreation manages 1,975 square miles among 280 park units, including state parks, state seashores, recreation areas, historic sites, and beaches (State of California, 2015d);
- The California Department of Fish and Wildlife manages 912 square miles of wildlife areas, ecological reserves, public access areas, and fish hatcheries (California Department of Fish and Wildlife, 2015a); and
- The California Department of Forestry and Fire Protection manages 926 square miles in 8 state forests (California Department of Forestry and Fire Protection, 2012) (USGS, 2012d) (USGS, 2014h).

[143] State land use data for tables and narrative text were derived from specific state sources and may not correspond directly with USGS data that was used for developing maps and figures.

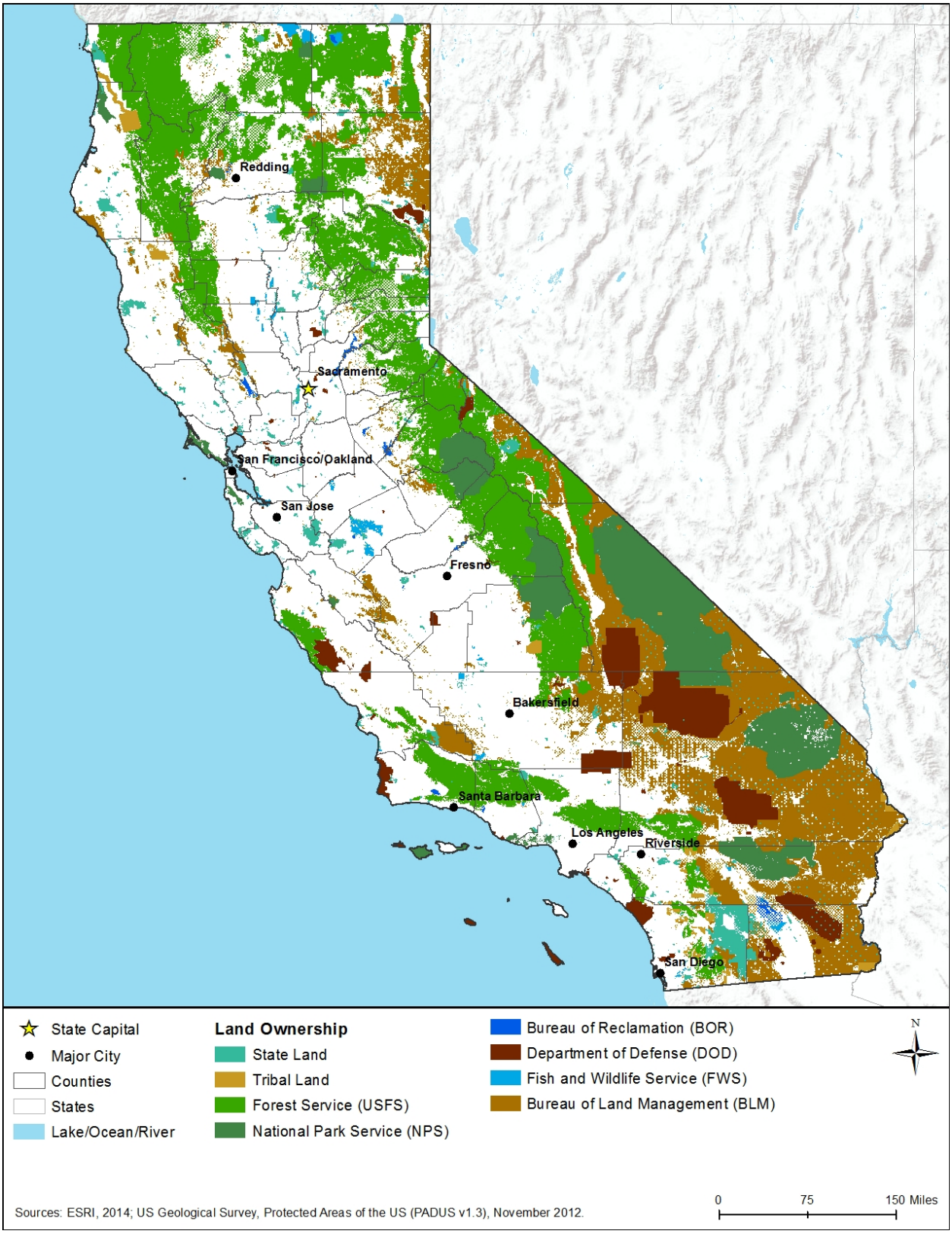


Figure 4.1.7-2: Major Land Ownership Distribution

Tribal Land

The Bureau of Indian Affairs, along with individual tribes, manages 1,618 square miles, or 0.9 percent of the total land within California (Table 4.1.7-5).[144] These lands are composed of 116 Indian Reservations currently located in the state (Figure 4.1.7-2). Figure 4.1.11-2 in Section 4.1.11, Cultural Resources, shows the locations of many of the largest reservations owned by federally recognized tribes in California.

Table 4.1.7-5: Indian Reservations and Other Land Holdings in California

Reservation Name	Square Miles
Agua Caliente Reservation	71.6
Alturas Rancheria	0.06
Augustine Reservation	1.5
Barona Reservation	11.5
Benton Paiute Rancheria	0.4
Berry Creek Rancheria	0.2
Big Bend Rancheria	0.1
Big Lagoon Rancheria	0.02
Big Pine Reservation	0.7
Big Sandy Rancheria	0.6
Big Valley Rancheria	0.3
Bishop Colony	2.2
Blue Lake Rancheria	0.1
Bridgeport Colony	0.1
Buena Vista Rancheria of Me-Wuk Indians of California	0.01
Burney Tract	1.2
Cabazon Reservation	4.6
Cahuilla Reservation	41.1
Campo Reservation	33.4
Capitan Grande Reservation	35.1
Cedarville Rancheria	0.1
Chemehuevi Reservation	68.6
Chicken Ranch Rancheria	0.1
Cloverdale Rancheria of Pomo Indians of California	0.01
Cocopah Reservation	0.03
Cold Springs Rancheria	0.2
Colorado River Reservation	92.6
Colusa Rancheria	0.6
Cortina Indian Rancheria	2
Coyote Valley Rancheria	0.2
Cuyapaipe Reservation	11.3
Death Valley Timbi-Sha Shoshone Band of California	9.5
Dry Creek Rancheria	0.2
Elk Valley Rancheria	0.2
Enterprise Rancheria	0.1
Fort Bidwell Reservation	9
Fort Independence Reservation	0.9
Fort Mojave Reservation	14.5
Fort Yuma (Quechan) Reservation	109.3

[144] Although the Bureau of Indian Affairs "manages" American Indian lands, the Bureau of Indian Affairs is different than other land management agencies as the lands are held in trust and are sovereign nations.

Reservation Name	Square Miles
Graton Rancheria	0.01
Greenville Rancheria	0.2
Grindstone Indian Rancheria	0.2
Guidiville Rancheria	0.2
Hoopa Reservation	248.7
Hopland Rancheria	0.1
Inaja and Cosmit Reservation	1.9
Ione Band of Miwok Indians of California	0.01
Jackson Rancheria	0.8
Jamul Indian Village	0.03
Karuk Tribe	1.3
La Jolla Reservation	19.3
La Posta Reservation	8
Laytonville Rancheria	0.5
Likely Rancheria	0.01
Lone Pine Reservation	0.6
Lookout Rancheria	0.1
Los Coyotes Reservation	55.4
Lower Lake Rancheria	0.01
Lytton Rancheria of California	0.01
Manchester - Point Arena Rancheria	1
Manzanita Reservation	7.9
Mechoopda Indian Tribe of Chico Rancheria, California	0.01
Mesa Grande Reservation	18.1
Middletown Rancheria	0.3
Montgomery Creek Rancheria	0.3
Mooretown Rancheria	0.2
Morongo Reservation	75.4
Northfork Rancheria	0.2
Pala Reservation	26.2
Paskenta Band of Nomlaki Indians of California	0.01
Pauma and Yuima Reservation	13.3
Pechanga Reservation	10.1
Picayune Rancheria	0.2
Pinoleville Rancheria	0.3
Potter Valley Rancheria	0.04
Quartz Valley Rancheria	1.6
Ramona Reservation	1.2
Redding Rancheria	0.1
Redwood Valley Rancheria	0.7
Resighini Rancheria	0.6
Rincon Reservation	8.6
Roaring Creek Rancheria	0.2
Robinson Rancheria	0.6
Rohnerville Rancheria	0.1
Round Valley Reservation	132.5
Rumsey Rancheria	1.4
San Manual Reservation	1.4
San Pasqual Reservation	3.2
Santa Rosa Rancheria	0.4
Santa Rosa Reservation	24.5
Santa Ynez Reservation	0.2

Reservation Name	Square Miles
Santa Ysabel Reservation	20.6
Scotts Valley Rancheria	0.1
Sheep Ranch Rancheria	<0.01
Sherwood Valley Rancheria	1
Shingle Springs Rancheria	0.4
Smith River Rancheria	0.4
Soboba Reservation	11.6
Stewarts Point Rancheria	0.1
Sulphur Bank Rancheria	0.1
Susanville Rancheria	0.4
Sycuan Reservation	1.4
Table Bluff Rancheria	0.3
Table Mountain Rancheria	0.3
Torres-Martinez Reservation	70.5
Trinidad Reservation	0.2
Tule River Reservation	128.7
Tuolumne Rancheria	0.8
Twenty-Nine Palms Reservation	0.6
United Auburn Indian Community of the Auburn Rancheria of California	0.01
Upper Lake Rancheria	1.2
Viejas Reservation	3.6
Washoe Tribe of Nevada and California - Allotments	0.7
Woodfords Community	1.1
XL Ranch	25.8
Yurok Reservation	155.7
Total	**1,618.08**

Sources: (USGS, 2012d) (USGS, 2014h)

4.1.7.5 Recreation

California's geographic and manmade features are characterized by dramatic contrasts, which support a wide variety of recreational opportunities. The diverse terrain includes six mountain ranges, a long central valley of fertile farmlands, expansive deserts, and 840 miles of coastline. Mt. Whitney and Death Valley are the highest and lowest elevation points, respectively, in the continental United States. There are very densely populated areas between San Francisco and Sacramento, and Los Angeles and San Diego, and nearly unpopulated areas in the desert regions. Tourism is a substantial industry throughout the state, capitalizing on accessibility to dramatic natural landscapes (e.g., Lake Tahoe area on the state's eastern border) and large entertainment venues in all major metropolitan areas.

On the community level, cities and towns provide an assortment of indoor and outdoor recreational facilities including, recreation centers, theaters, museums, athletic fields and courts, golf courses, multi-use trails, playgrounds, picnicking areas, theme/amusement parks, alpine (downhill) ski resorts and Nordic (cross-country skiing) centers, beaches, boat launches and marinas. Availability of community-level facilities is typically commensurate to the population's distribution and interests, and the natural resources prominent in the vicinity. The California Department of Parks and Recreation manages 280 units that include recreational, natural, cultural, and historical resources. These include state parks, recreation areas, off-road

vehicle areas, reserves, seashores, marine parks, and historic and cultural sites. The state park system has more than 4,500 miles of trails, 1,300 lakes, and 15,000 campsites (California Department of Parks and Recreation, 2015). Federally agencies, including NPS, USFS, USFWS, BLM, and the USACE, manage areas in California with substantial recreational attributes. The 27 National Parks and affiliated areas (NPS, 2015c) and 18 National Forests in California occupy 20 percent of the state's total land area (USFS, 2013). There are more than 189,000 river miles in California, including 23 rivers segments designated as "Wild and Scenic," which total almost 2,000 miles (National Wild and Scenic Rivers System, 2015b).

This section discusses key recreational opportunities and activities representative of various regions of California. The state can be categorized by nine distinct recreational regions, each of which are presented in the following sub-sections. Additional information on visual resources, such as National Scenic Byways and state-designated Byways, is presented in Section 4.1.8, Visual Resources. Additional information on culturally/historically significant resources (e.g., National Historic Sites, National Historic Landmarks, sites on the National Register of Historic Places, and Natural Heritage Areas) is available in Section 4.1.11, Cultural Resources.

North Coast Region

The North Coast Region is bounded by the Pacific Ocean on the west, Cascade Mountain Range on the east and Oregon on the north. This narrow region includes a dozen state parks, beaches, and recreation areas, and is roughly bounded on the eastern side where the Klamath, Shasta-Trinity, Six Rivers, and Mendocino National Forests begin. U.S. Highway 101 from Oregon to Leggett, followed by Highway 1 from Leggett to Bodega is the scenic access route for visitors to this region (Figure 4.1.7-3).[145] Redwood National Park and adjacent state parks, and rugged Pacific coastline and beaches, are well known for their natural beauty. Along the Pacific Ocean coast, whale-watching is popular from December to April. Fishing, swimming, rafting, hiking, off-road vehicle, and horse riding, hunting, and camping are popular in Smith River National Recreation Area. Prairie Creek Redwoods State Park, near Orick, has a unique fern-covered canyon. Humboldt Redwoods State Park's Rockefeller Forest contains the largest old-growth forest in the world. Clear Lake, a few hours from San Francisco, is popular with water sports enthusiasts. Salt Point State Park is a tourist destination for scenic coastal views and an "underwater" park (snorkeling and SCUBA diving). Mendocino County is renowned for its mushrooms, seafood, wine, and beer. Local festivals and events attract many visitors. (Visit California, 2015a)

[145] Recreational area data was retrieved from the Protected Areas Database of the United States (PAD-US), produced by USGS (http://gapanalysis.usgs.gov/padus/). This dataset categorizes lands across the U.S. by conservation, land management, planning, recreation, and ownership, as well as other uses. It is an extensive dataset that contains large quantities of information relevant to the Proposed Action. The data was queried to show the Primary Designation Type of area. To show these in the map, recognizable symbols (e.g., varying shades of green for National Parks and Forests) were used as PAD-US does not have a standard symbolization for recreational resources. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

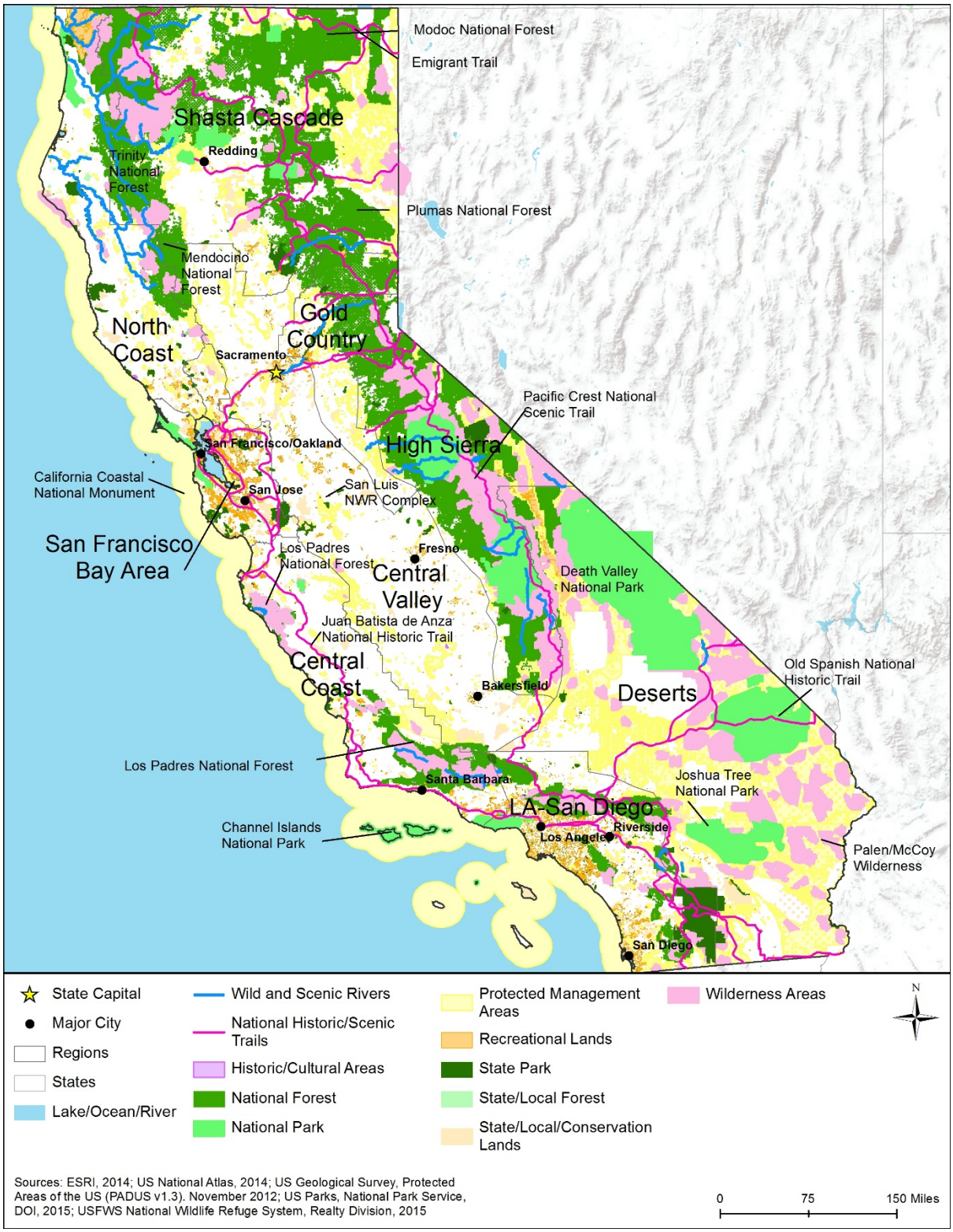


Figure 4.1.7-3: California Recreation Resources

Shasta Cascade Region

This region is in the northeast corner of the state, bounded by Oregon to the north and Nevada to the east (Figure 4.1.7-3). The recreation resources of this region are centered on the Cascade Mountain Range and the surrounding national recreation areas, national forests, wilderness areas, wildlife refuges, volcanic mountains, and associated streams, rivers, and lakes. Camping, backpacking, hiking, mountain biking, fishing, and house-boating are popular activities.

Redding, is the largest city and considered the gateway to Whiskeytown-Shasta-Trinity National Recreation Area. The 129-foot tall Burney Falls is a favorite sightseeing and photography spot. Shasta Lake, the largest reservoir in California, is popular among water-sport enthusiasts. The upper portion of the Sacramento River Valley's fertile farmlands extend into this region, and tourists are attracted to the area's orchards, vineyards, breweries, and ranches. The Lassen Volcanic National Park and Lava Beds National Monument is popular with visitors interested in unique geological features. (Visit California, 2015b)

Gold Country Region

The Gold Coast Region is bordered on the west and south by the Central Valley Region, and on east by the Sierra Nevada Mountain Range, which is the location of the former gold mines that are the namesake of the region (Figure 4.1.7-3). The state capitol, Sacramento, and other cities of the region have a wide range of cultural and historic attractions, particularly those related to the California Gold Rush era. Art museums, performing arts, sporting events, and "farm-to-fork" cuisine are also well established in Sacramento. With its many bike lanes, paths, and trails, cycling is popular means of urban transportation and recreation in the Gold Country Region. The trails through nearby Auburn State Recreation Area attract mountain bikers, horseback riders, and hikers. Whitewater rafters come to paddle the North, South, and Middle Forks of the American River. (Visit California, 2015c)

San Francisco Bay Area Region

This San Francisco Bay region encompasses the San Francisco metropolitan area, between Santa Rosa to Monterey Bay, and east to San Jose (Figure 4.1.7-3). The Golden Gate National Recreation Area crosses several counties and water boundaries in this region and has a variety of historical structures, natural areas, recreational sites, and leisure activities to entertain local residents and tourists. Point Reyes National Seashore (and three National Marine Sanctuaries) is on the Pacific Coast coastline, with the area's sea cliffs, beaches, and multi-use trails providing opportunities for wildlife viewing, kayaking, hiking, mountain biking, fishing, and backcountry camping. Napa and Sonoma Counties are renowned as "Wine Countries," drawing locals and tourists for wine tastings and fine dining. Big Basin Redwoods State Park, south of San Jose contains ancient redwoods, canyons, waterfalls, and 80 miles of hiking trails that connect to other parks, preserves, and beaches. (Visit California, 2015d)

Central Valley Region

The Central Valley Region is more than 400 miles long, occupying the center of the state (Figure 4.1.7-3). The flat, fertile farmlands of this region are economically important to the state and

nation, but also promote a local agri-tourism industry, including farm stands, farmers markets, wineries, and festivals. Fresno, the largest city of the region, has a well-developed arts district with galleries and studios, and hosts several sports and entertainment venues. (Visit California, 2015e)

High Sierra Region

The High Sierra Region is along the center eastern border of the state, between Lake Tahoe area on the north and the Sequoia National Forest on the south (Figure 4.1.7-3). Outdoor recreation resources are prominent in this region, with its abundance of national parks, national forests, wilderness areas, ski resorts, streams, rivers, and lakes. Camping, backpacking, hiking, mountain biking, fishing, snow sports, and water-based recreation are common leisure pursuits.

The California and Nevada border passes through Lake Tahoe, with the western shore of the lake being more remote, wild, and recreation-oriented. Motor boats, jet skis, sailboats, kayaks, paddleboards, and mountain bikes are used to explore this area in the summertime; while skis, snowboards, snowshoes, and snowmobiles are used in the winter. Heavenly, Squaw Valley, Sierra-at-Tahoe, and Kirkwood ski resorts are large snow sport destinations. Emerald Bay State Park, where the lakeshore can only be accessed by hiking trail or boat, is a favorite site to view and experience the natural beauty of Lake Tahoe. Yosemite National Park, a UNESCO World heritage site, encompasses almost 1,200 square miles of spectacular terrain with granite peaks, deep valleys, waterfalls, lakes, alpine meadows, and wilderness. Rock climbing is an especially popular activity there. Geology enthusiasts visit Devil's Postpile National Monument's spectacular towers of columnar basalt rock. Kings Canyon and Sequoia National Parks, Giant Sequoia National Monument, the adjacent Sierra, Inyo, and Sequoia National Forests, and Mt. Whitney form a contiguous recreational area. Mono Lake Tufa State Natural Preserve, Grover Hot Springs State Park, and the ancient bristlecone pines in the White Mountains have unique natural features that attract curious visitors (Visit California, 2015f). Hikers, backpackers, and equestrians us the Pacific Crest National Scenic Trail that passes through the center of the High Sierra Region (USFS, 2016b).

Central Coast Region

The Central Coast Region is San Francisco and Los Angeles, and bordered by the Pacific Ocean on the west and the Central Valley on the east (Figure 4.1.7-3). The Monterey Bay National Marine Sanctuary supports wildlife-viewing opportunities, especially for otters, seals, whales, and seabirds. The terrain and environment of Pinnacles National Park was created by volcanoes, earthquakes, and water; leaving towering rock formations, canyons, and caves, and received visitors interested in the area's scenic vistas, the endangered California condor, and diverse wildlife and plants. Wildlife viewing is a popular activity, as is caving, rock climbing, hiking, and camping. Highway 1 between San Francisco and Los Angeles is an internationally recognized scenic drive, especially along the rugged Big Sur coastline. Pfeiffer Big Sur and Limekiln State Parks are hiking and camping destinations. Channel Islands National Park is accessible by park concessionaire air or boat transportation, and provides opportunities for kayaking, snorkeling, scuba diving, wildlife viewing, hiking, and camping. This region also has

a mature winemaking industry that draws visitors to tasting rooms, as well as farmers markets and shops featuring food products by local artisans. (Visit California, 2015g)

Los Angeles-San Diego Region

The Los Angeles-San Diego Region includes California's most densely populated areas and several sparsely populated islands (Figure 4.1.7-3). The Santa Monica Mountains National Recreation Area, and the Channel Islands of Santa Barbara, Catalina, and Clemente provide beach activities, swimming, paddle boarding, surfing, kayaking, sailing, and multi-use trails. West of the metropolitan area are the Angeles, San Bernardino, and Cleveland National Forests with several state parks, campgrounds, lakes, and ski areas (Visit California, 2015h).

Local recreation and entertainment sites in this region include many museums, art galleries, performing arts centers, music and sports venues, gardens, and aquariums. Hollywood film studios, the Venice Boardwalk, Disneyland, Six Flags, SeaWorld, San Diego Zoo and Safari Park, and LEGOLAND are international tourist destinations. Malibu and Santa Monica beaches are popular leisure sites for the Los Angeles locals, as is "The Strand," a 22-mile coastal bike trail. Orange County's Huntington Beach is known as "Surf City U.S.A.," Newport Beach hosts national golfing and yachting events, and Laguna Beach has luxury resorts. Crystal Cove State Park is one of the most scenic coastal state parks in this region, and has popular hiking and mountain biking trails in its foothills (Visit California, 2015i).

Desert Region

The Desert Region is west of the Los Angeles-San Diego Region, and bordered by Nevada on the east, and Arizona and Mexico on the south. This region is dominated by the Great Basin, Colorado, and Mojave Deserts (Figure 4.1.7-3). Death Valley National Park's 3.3 million acres makes it the largest national park in the continental United States. Salt flats that are below sea level, sand dunes, sandstone canyons, volcanic craters, and 11,000 foot Telescope Peak are mostly visited by sightseers from the relative safety of their vehicles. Joshua Tree National Park is where the Mohave Desert meets the Colorado Desert, and is popular with rock climber and astronomers. Anza-Borrego Desert State Park, the largest state park in California, is a favored destination for those visitors wanting to view the spectacular natural environment and wildlife that the park preserves. With more than 500 miles of dirt roads, 4-wheel drive vehicles are typically used to explore this park; there are also multi-use trails and campgrounds. The Mohave National Preserve offers similar scenic and recreational opportunities. Palm Springs is the Desert Region's "oasis" and has developed as a resort destination with luxury accommodations, spas, tennis centers, and golf courses. The nearby Coachella Valley Arts and Music Festival attracts more than 150,000 fans annually. (Visit California, 2015j)

4.1.7.6 Airspace

The FAA uses the NAS to provide for aviation safety. The NAS includes Special Use Airspace (SUA) consisting of Restricted Areas, Warning Areas, and Military Operation Areas (MOAs). The FAA controls the use of the NAS with various procedures and practices (such as established

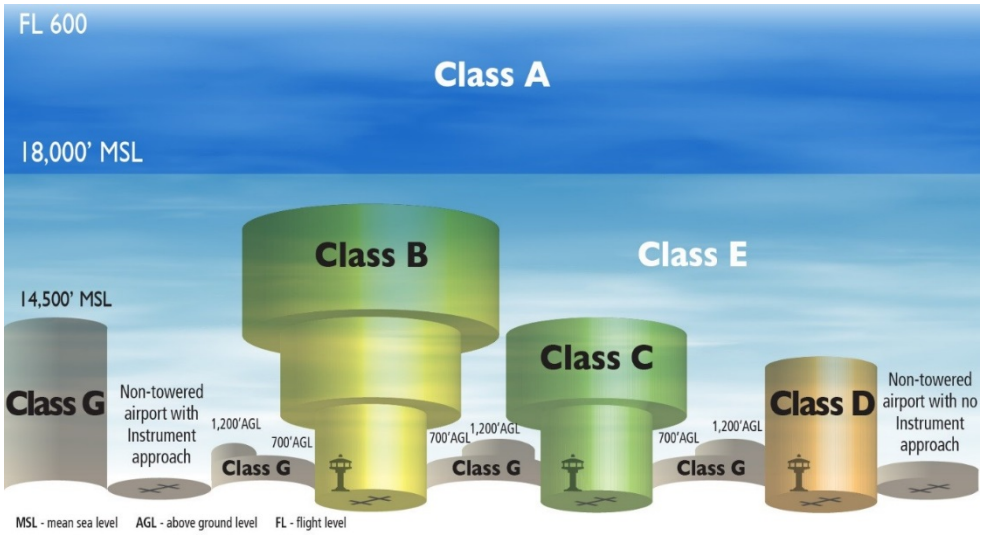
flight rules and regulations, airspace management actions, and air traffic control procedures) to ensure the safety of aircraft and protection of the public.

Airspace Categories

There are two categories of airspace or airspace areas:

1) Regulatory airspace consists of controlled airspace (Class A, B, C, D, and E airspace areas in descending order of restrictive operating rules), and restricted and prohibited areas.
2) Non-regulatory airspace consists of MOAs, warning areas, alert areas, and controlled firing areas.

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 4.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[146] service is based on the airspace classification (FAA, 2008).



Source: Derived from (FAA, 2008)

Figure 4.1.7-4: National Air Space Classification Profile

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[147]. Includes the airspace over waters off the U.S. coastlines (48 contiguous States and Alaska) within 12 Nautical Miles (NM). All operations must be conducted under Instrument Flight Rules (IFR).[148]

[146] ATC: Approved authority service to provide safe, orderly, and expeditious flow of air traffic operations (FAA, 2015a).
[147] MSL: The average level of for the surface of the ocean; "The height of the surface of the sea midway between the average high and low tides." (Merriam Webster Dictionary, 2015a)
[148] IFR: Rules for the conduct of flights under instrument meteorological condition (FAA, 2015a).

- **Class B:** Airspace from the surface up to 10,000 feet MSL near the busiest airports with heavy traffic operations. The airspace is tailored to the specific airport in several layers. An ATC clearance is required for all aircraft to operate in this area.
- **Class C:** Airspace from the surface to 4,000 feet above the airport elevation surrounding the airport. Applies to airports with an operational control tower, serviced by a radar approach control, and certain number of IFR operations or total number of passengers boarding aircrafts. Airspace is tailored in layers, but usually extends out to 10 NM from 1,200 feet to 4,000 feet above the airport elevation. Entering Class C airspace requires radio contact with the controlling ATC authority, and an ATC clearance is ultimately required for landing.
- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.
- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2008).

Uncontrolled Airspace

- **Class G:** No specific definition. Refers generally to airspace not designated as Class A, B, C, D, or E. Class G airspace is from the surface to the base of Class E airspace.

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (Table 4.1.7-6).

Table 4.1.7-6: SUA Designations

SUA Type	Definition
Prohibited Areas	"Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts."
Restricted Areas	"Airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute 14 CFR Part 73."
Warning Areas	"Airspace of defined dimensions, extending from three NM from the U.S. coast, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both."
MOAs	"Airspace of defined vertical and lateral limits established for separating certain military activities (e.g., air combat maneuvers, air intercepts, testing, etc.) from IFR traffic. Whenever an MOA is in use, non-participating IFR traffic may be cleared through a MOA if

SUA Type	Definition
	IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic."
Alert Areas	"Depicted on aeronautical charts to inform non-participating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an alert area must be conducted in accordance with CFRs, without waiver, and pilots of participating aircraft and pilots transiting the area are responsible for collision avoidance."
Controlled Firing Areas (CFAs)	"Activities that, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart CFAs since they do not cause a nonparticipating aircraft to change its flight path."
National Security Areas (NSA)	"Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 99.7. Regulatory prohibitions are issued by System Operations, System Operations Airspace and Aeronautical Information Manual (AIM) Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

Sources: (FAA, 2015a) (FAA, 2008)

Other Airspace Areas

Other airspace areas, explained in Table 4.1.7-7, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 4.1.7-7: Other Airspace Designations

Type	Definition
Airport Advisory	There are three types: • Local Airport Advisory – Operated within 10 statute miles of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. • Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. • Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: • Protect people and property from a hazard; • Provide safety for disaster relief aircraft during operations; • Avoid unsafe aircraft congestion associated with an incident or public interest event; • Protect the U.S. President, Vice President, and other public figures; • Provide safety for space operations; and • Protect in the State of Hawaii declared national disasters for humanitarian reasons.

Type	Definition
	Only those TFRs annotated with an ending date and time of "permanent" are included in this Draft PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.
Published VFRs and IRs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

Sources: (FAA, 2015a) (FAA, 2008)

4.1.7.7 Aerial System Considerations

Unmanned Aerial Systems

Unmanned Aerial Systems (UASs) are widely used by the military, private entities, public service, educational institutions, federal/state/local governments, and other agencies. The FAA's Unmanned Aircraft Systems Integration Office integrates UAS into the NAS. The *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap of 2013* addresses the actions and considerations needed to integrate UAS into the NAS "without reducing existing capacity, decreasing safety, negatively impacting current operators, or increasing the risk to airspace users or persons and property on the ground any more than the integration of comparable new and novel technologies" (FAA, 2013).

UAS at airports is a complex operational challenge with the need to separate UAS flight operations from mainstream air traffic. Separation can be achieved with specific UAS launch windows, special airports, or off-airport locations that allow the UAS to easily launch and recover. Special aviation procedures are applied to UAS flights. There must be the capability of Sense and Avoid (SAA) and Control and Communication (C2) during UAS operations. An Unmanned Aircraft (UA) must be able to see (or sense) other aircraft in the area and avoid the aircraft through corrected flight path changes. General equipment and operational requirements can include aircraft anti-collision lights, an altitude encoding transponder, cameras, sensors, and collision avoidance maneuvers. The C2 of the UA occurs with the pilot/operator, the UAS control station, and ATC. Research efforts, a component of the FAA's UAS roadmap, continue to mature the technology for both SAA and C2 capabilities.

Balloons

Moored balloons and unmanned free balloons cannot be operated in a prohibited or restricted area unless approval is obtained from the controlling agency. Balloons also cannot be operated if they pose a hazard to people and their property.

4.1.7.8 Obstructions to Airspace Considerations

The Airports Division of the FAA is responsible for the evaluation and analysis of proposed construction or alterations on airports. The FAA Air Traffic Office is responsible for

determining obstructions to air navigation as a result of construction off airports that may affect the safe and efficient use of navigable airspace and the operation of planned or existing air navigation and communication facilities. Such facilities include air navigation aids, communication equipment, airports, federal airways, instrument approach or departure procedures, and approved off-airway routes. An Obstruction Evaluation and Airport Airspace Analysis (OE/AAA) is required when there is the potential for airport construction or alteration of a facility that may impinge upon the NAS.

Per 14 CFR Part 77.9, the FAA is to be notified about construction or alterations when:

- "Any construction or alteration exceeding 200 ft. above ground level
- Any construction or alteration:
  - within 20,000 ft. of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft.
  - within 10,000 ft. of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 ft.
  - within 5,000 ft. of a public use heliport which exceeds a 25:1 surface
- Any highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards
- When requested by the FAA
- Any construction or alteration located on a public use airport or heliport regardless of height or location" (FAA, 2015e).

Construction or alternative facilities (such as towers) that are subject to FCC licensing requirements are also required to have an OE/AAA performed by the FAA Airport Division.

4.1.7.9 California Airspace

The California Division of Aeronautics of Caltrans has four offices: Office of Airports, Office of Aviation System Planning, and Office of Technical Services and Programs. The Office of Aviation Planning is responsible for "state aviation planning to include policies and the California Aviation System Plan, which is an assessment of the current and future aviation needs and implementation plan; participation in regional aviation system planning; oversight/publication of the California Airport Land Use Planning Handbook; monitoring federal and state aviation legislation; and review of Airport Land Use Compatibility Plans to include city and county land use decisions" (Caltrans, 2015d) (Caltrans, 2015e). "There are nine FAA FSDOs for California located in Oakland, Fresno, Los Angeles, Long Beach, Riverside, Sacramento, San Diego, San Jose, and Van Nuys" (FAA, 2015d).

California airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP addresses the strategic planning and future development for the state's airport system, as well as addressing key associated with their airports (NASAO, 2010).

Figure 4.1.7-5 presents the different aviation airports/facilities residing in California, while Figure 4.1.7-6 and Figure 4.1.7-7 presents the breakout by public and private airports/facilities. There are approximately 905 airports within California as presented in Table 4.1.7-7 and Figure 4.1.7-5 through Figure 4.1.7-7 (USDOT, 2015).

Table 4.1.7-8: Type and Number of California Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	247	275
Heliport	0	371
Seaplane	4	4
Ultralight	0	1
Balloonport	0	0
Gliderport	0	3
Total	**251**	**654**

Source: (USDOT, 2015)

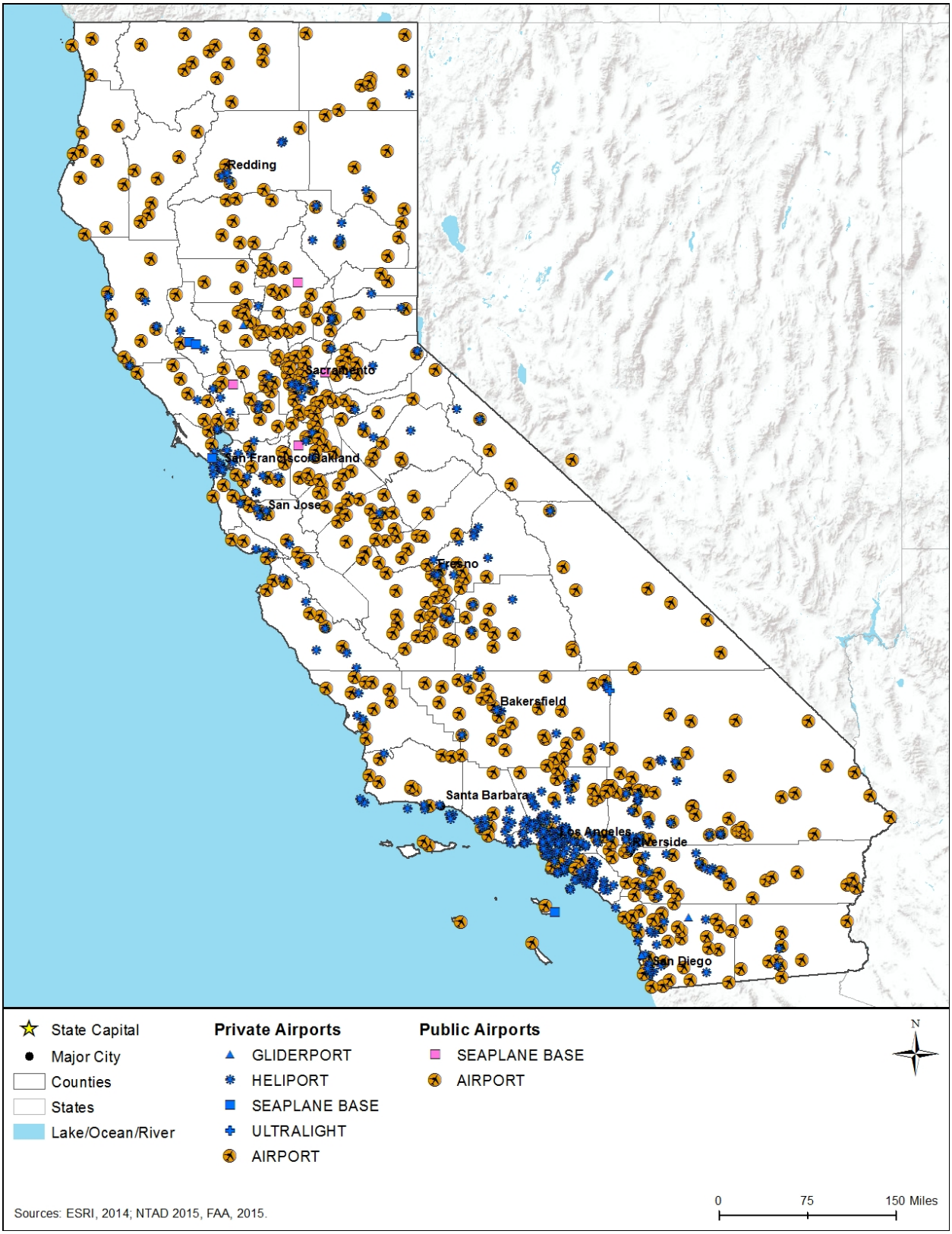


Figure 4.1.7-5: Composite of California Airports/Facilities

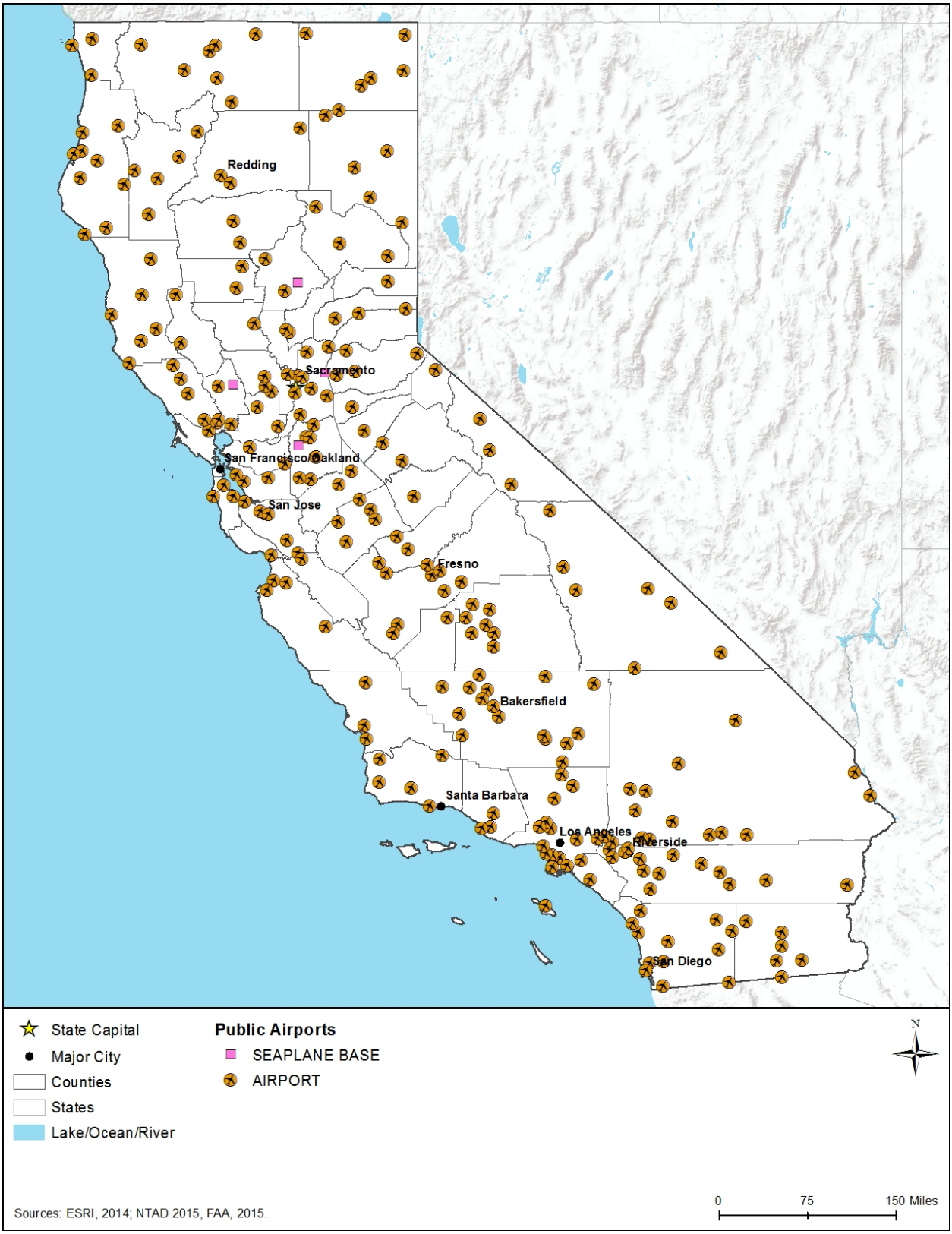


Figure 4.1.7-6: Public California Airports/Facilities

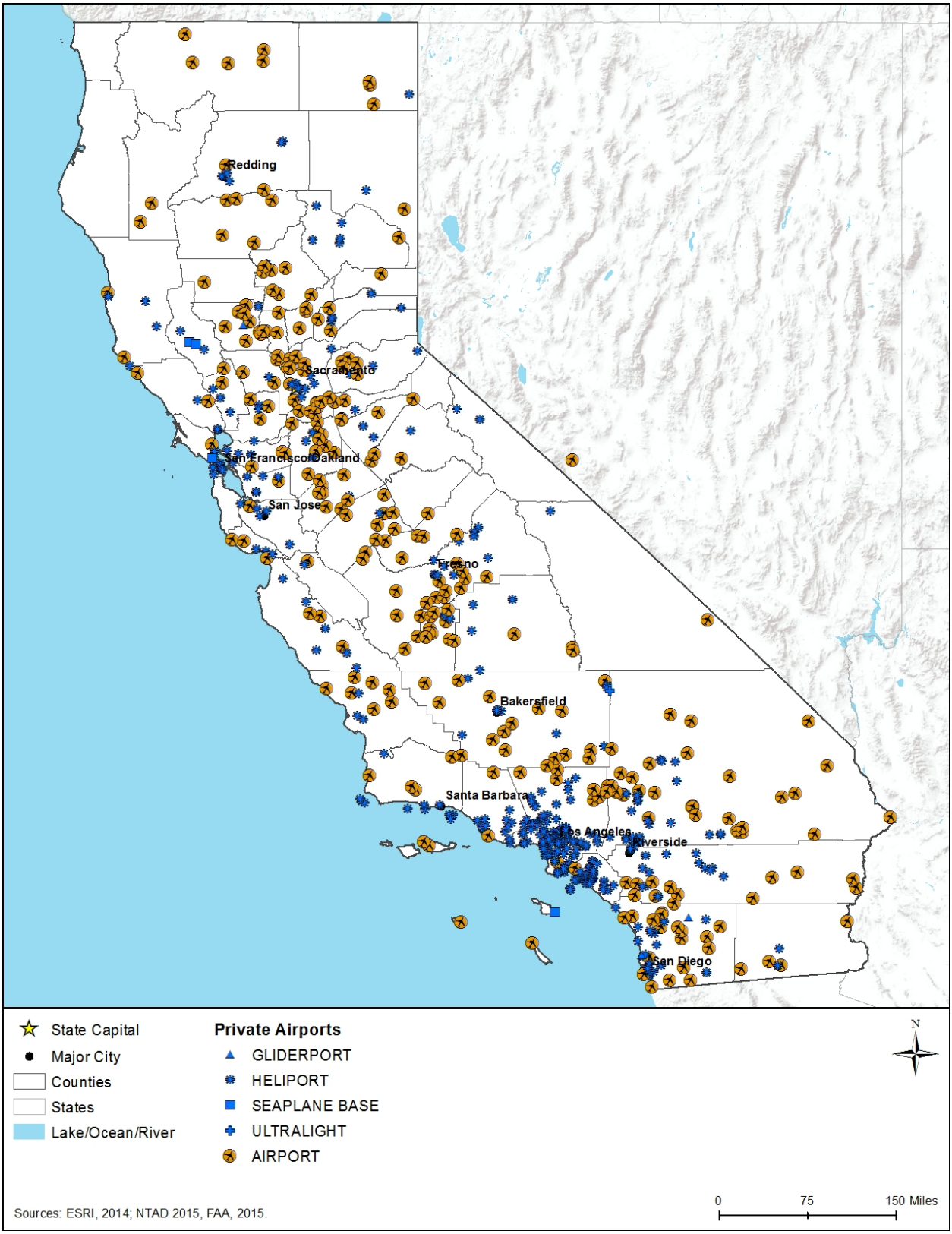


Figure 4.1.7-7: Private California Airports/Facilities

There are Class B, C, D, and E controlled airports in California as follows:

- Three Class B –
  - Los Angeles International
  - San Diego (Lindbergh Field)
  - San Francisco International
- Twelve Class C –
  - Beale Air Force Base (AFB), Marysville
  - Burbank-Glendale-Pasadena, Burbank
  - Whiteman Airport, Los Angeles
  - Fresno Air Terminal
  - Metropolitan Oakland International
  - Monterey Peninsula
  - Ontario International
  - March Field, Riverside
  - Sacramento International
  - San Jose International
  - John Wayne Airport/Orange County, Santa Ana
  - Santa Barbara Municipal
- Sixty-six Class D –
  - Meadows Field, Bakersfield
  - Camarillo
  - Camp Pendleton Marine Corps Air Station (Munn Field), Oceanside
  - McClellan-Palomar Airport, Carlsbad
  - Castle Airport, Atwater
  - Chico Municipal
  - China Lake Naval Air Weapons Station (NAWS), China Lake
  - Chino
  - Buchanan Field, Concord
  - Edwards AFB, Edwards
  - El Centro Naval Air Facility, El Centro
  - El Monte
  - Travis AFB, Fairfield

- Fullerton Municipal
- Jack Northrop Field/Hawthorne Municipal, Hawthorne
- Hayward Air Terminal
- Metropolitan Oakland International
- Imperial Beach Naval Outlying Field (NOLF), Imperial Beach
- Brown Field Municipal, San Diego
- Brackett Field, La Verne
- Gen. William J. Fox Airfield, Lancaster
- Lemoore Naval Air Station (Reeves Field), Lemoore
- Livermore Municipal, Livermore
- Vandenberg AFB, Lompoc
- Daugherty Field, Long Beach
- Los Alamitos Army Airfield, Los Alamitos
- Los Angeles International
- Santa Monica Municipal
- Modesto City-Co-Harry Sham Field, Modesto
- Mojave
- Moffett Federal Airfield, Mountain View
- San Jose International
- Palo Alto of Santa Clara County Airport, Palo Alto
- Napa County
- Oxnard
- Palm Springs Regional
- Palmdale Regional Airport/U.S. Air Force Plant 42, Palmdale
- Point Mugu NAWS, Point Mugu
- Ramona
- Redding Municipal
- Riverside March Field, Riverside
- Riverside Municipal
- Sacramento Executive
- Sacramento Mather
- Salinas Municipal
- San Bernardino International

- San Carlos
- San Clemente Island Navy Auxiliary Landing Field (Fredrick Sherman Field)
- San Diego Brown Field Municipal
- San Diego Montgomery Field
- San Diego, North Island Naval Air Station (Halsey Field)
- San Diego-Gillespie Field
- San Jose Reid-Hillview of Santa Clara County Airport, San Jose
- San Luis Obispo County-McChesney Field, San Luis Obispo
- San Nicolas Island NOLF
- Santa Maria Public
- Santa Monica Municipal
- Charles M. Schulz-Sonoma County, Santa Rosa
- Stockton Metropolitan
- Torrance Municipal
- Twentynine Palms Strategic Expeditionary Landing Field
- Van Nuys
- Burbank-Glendale-Pasadena, Burbank
- Whiteman, Los Angeles
- Southern California Logistics, Victorville
- Adelanto (FAA, 2015f).

SUAs (i.e., 33 restricted areas, 41 MOAs, and 1 alert area) located in California are as follows:

- Bullion Mountains (Restricted) –
  - East (R-2501E) – Unlimited
  - North (R-2501N) – Unlimited
  - South (R-2501S) – Unlimited
  - West (R-2501W) – Unlimited
- Fort Irwin (Restricted) –
  - R-2502E – Unlimited
  - R-2502N – Unlimited
- Camp Pendleton (Restricted) –
  - R-2503A – Surface to 2,000 feet MSL
  - R-2503B – Surface to 15,000 feet MSL

  - R-2503C – 15,000 feet MSL to FL 270
  - R-2503D – 2,000 feet MSL to 11,000 feet MSL
- Camp Roberts (Restricted) –
  - R-2504A – Surface to, but not including, 6,000 feet MSL
  - R-2504B – 6,000 feet MSL to 15,000 feet MSL
- China Lake (Restricted) –
  - R-2505 – Unlimited
  - R-2506 (South) – Surface to 6,000 feet MSL
- Chocolate Mountains (Restricted) –
  - R-2507E –Surface to FL 400
  - R-2507N North – Surface to FL 400
  - R-2507S South – Surface to FL 400
- Complex (Restricted) –
  - R-2508 – 20,000 feet MSL to unlimited
- El Centro (Restricted) –
  - R-2510A – Surface to 15,000 feet MSL
  - R-2510B – 15,000 feet MSL to FL 400
- Holtville (Restricted) –
  - R-2512 – Surface to 23,000 feet MSL
- Hunter-Liggett (Restricted) –
  - R-2513 – Surface to FL 240
- Muroc Lake (Restricted) –
  - R-2515 – Unlimited
- Vandenberg AFB (Restricted) –
  - R-2516– Unlimited
  - R-2517 – Unlimited
  - R-2534A – 500 feet above the surface to unlimited
  - R-2534B – 500 feet above the surface to unlimited
- Point Mugu (Restricted) –
  - R-2519 – Unlimited
- Trona (Restricted) –
  - R-2524 – Unlimited

- Sierra Army Depot (Restricted) –
  - R-2530 – Surface to 8,600 feet MSL
- Tracy (Restricted) –
  - R-2531 – Surface to, but not including, 4,000 feet MSL
- San Nicolas Island (Restricted) –
  - R-2535A – Surface to 100,000 feet MSL
  - R-2535B – Surface to 100,000 feet MSL (FAA, 2015g).

The 41 MOAs for California are as follows:

- Abel –
  - East – 5,000 feet MSL to, but not including, 13,000 feet MSL
  - North – 7,000 feet MSL to, but not including, FL 180
  - South – 7,000 feet MSL to, but not including, FL 180
  - Bravo – 7,000 feet MSL to, but not including, FL 180
- Bakersfield –
  - 200 feet AGL to, but not including, FL 180
- Barstow –
  - 200 feet AGL to, but not including, FL 180
- Bishop –
  - 200 feet AGL to, but not including, FL 180
- Bristol –
  - 5,000 feet MSL to, but not including, FL 180
- Buckhorn –
  - 200 feet AGL to, but not including, FL 180
- China –
  - 3,000 AGL to, but not including, FL 180
- Foothill –
  - 1 – 2,000 feet AGL to, but not including, FL 180; Except 3,000 feet AGL over wilderness areas
  - 2 – 2,000 feet AGL to, but not including, FL 180; Except 3,000 feet AGL over wilderness areas
- Hunter –
  - Low A – From 200 feet AGL up to, but not including, 11,000 feet MSL
  - Low B – From 2,000 feet AGL up to, but not including, 11,000 feet MSL

  - Low C – From 3,000 feet AGL up to, but not including, 11,000 feet MSL
  - Low D – From 1,500 feet AGL to 6,000 feet MSL
  - Low E – From 1,500 feet AGL to 3,000 feet MSL
  - High – From 11,000 feet MSL up to, but not including, FL 180
- Isabella –
  - 200 feet AGL to, but not including, FL 180; Excluding that airspace up to and including 3,000 feet AGL over Domeland Wilderness Area; and excluding that airspace up to and including 1,500 feet AGL within a three NM radius of the following airports: Rosamond, California City, Mountain Valley, Tehachapi Kern County, Inyokern-Kern County, Kelso Valley Ranch, Flying S Ranch, Kern Valley, and Sacatar-Meadows; and excluding that airspace up to and including 4,800 feet MSL within a 4.3 NM radius of Mojave Airport excluding that airspace east and parallel to a line ½ west of R-2515
- Kane –
  - East – 10,000 feet MSL to, but not including, FL 180
  - South – 10,000 feet MSL to, but not including, FL 180
  - West – 10,000 feet MSL to, but not including, FL 180
- Lemoore –
  - A – From 5,000 feet MSL to, but not including, FL 180
  - B – From 13,000 feet MSL to, but not including, FL 180
  - C – From 16,000 feet MSL to, but not including, FL 180
  - D – From 5,000 feet MSL to, but not including, FL 180
  - E – From 5,000 feet MSL to, but not including, FL 180
- Maxwell –
  - 1 – 11,000 MSL or 3,000 AGL whichever is higher to, but not including, FL 180
  - 2 – 11,000 MSL or 3,000 AGL whichever is higher to, but not including, FL 180
  - 3 – 11,000 MSL or 3,000 AGL whichever is higher to, but not including, FL 180
- Owens –
  - 200 feet AGL to, but not including, FL 180; Except 3,000 feet AGL floor over Kings Canyon National Park, Sequoia National Park, and John Muir Wilderness Area except 1,500 feet AGL within a three NM radius of the following airports: Lone Pine and Independence
- Pananint –
  - 200 feet AGL to, but not including, FL 180; Except 3,000 feet AGL floor over Death Valley National Monument except 1,500 feet AGL within a three NM radius of the following airport: Trona

- Porterville –
  - 2,000 feet AGL to, but not including, FL 180
- Roberts –
  - From 500 feet AGL up to, but not including, 15,000 feet MSL
- Saline –
  - 200 feet AGL to, but not including, FL 180; Except 3,000 feet AGL floor over Death Valley National Monument
- Shoshone –
  - 200 feet AGL to, but not including, FL 180; Except 3,000 feet AGL floor over Death Valley National Monument except 1,500 feet AGL within a three NM radius of the following airport: Shoshone
- Silver –
  - North – 200 feet AGL to 9,000 feet MSL
  - South – 200 feet AGL to 7,000 feet MSL
- Sundance –
  - 500 feet AGL to and including 10,000 feet MSL; Excluding a 1 mile radius of the Dale Skyranch Airport surface to 1,500 feet AGL and a 1 mile wide corridor, extending from the center of the airport on a straight line south to the edge of the MOA
- Whitmore –
  - 1 – 11,000 MSL or 3,000 AGL whichever is higher to, but not including, FL 180
  - 2 – 11,000 MSL or 3,000 AGL whichever is higher to, but not including, FL 180
  - 3 – 11,000 MSL or 3,000 AGL whichever is higher to, but not including, FL 180 (FAA, 2015g).

The MOAs of Oregon (Dolphin South, Goose North and South, and Hart) extend into the upper northwest corner portion of California, while the MOA of Arizona (Quail and Turtle) extends into the lower eastern corner portion of the state.

The one Alert Area is Travis – A682 – North of Travis AFB Runways 21L/03R extended centerlines surface to 6,000 feet MSL. South of Travis AFB Runways 21L/03R extended centerlines surface to 3,000 feet MSL (FAA, 2015g). The SUAs for California are presented in Figure 4.1.7-8. There is one TFR below Riverside (Figure 4.1.7-8) (FAA, 2015h). Figure 4.1.7-9 presents the MTRs in California consisting of 25 Visual Routes, 19 Instrument Routes, and 9 Slow Routes.

UAS Considerations

The National Park Service (NPS) signed a policy memorandum on June 24, 2014 that "directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on

lands or waters administered by the National Park Service" (NPS, 2014d). There are 27 National Parks in California that must comply with this agency directive (NPS, 2015d).

Obstructions to Airspace Considerations

Several references in the California statutes address airspace hazards. As defined in Chapter 1 General Provision and Definitions, Section 21017, of the California Public Utilities Code Division 9 Aviation, an airport hazard is "any structure, object of natural growth, or use of land, which obstructs the air space required for flight of aircraft in landing or taking off at an airport or which is otherwise hazardous to the landing or taking off. (Legislative Counsel State of California, 2015a). Permits and approval by Caltrans, California Division of Aeronautics, is required for structures and natural growth in and around state airports. Requirements for permits/approvals, as governed by Section 21655-21660 of the California Public Utility (PUC) code, include the following:

- "Proposed structures or enclosures within two miles, measured by air line, of that point on an airport runway, or runway proposed by an airport master plan, which is nearest the site;"
- "Build or add to the height of any structure while results in an extension more than 500 feet above the ground on which the structures rests. (Note: This is not applicable to construction of any structure if the FCC or FAA is required to approve the height.);"
- "Construct or alter any structure or allow any natural growth at a height that exceeds the obstruction standards set forth by FAA regulations." (Legislative Counsel State of California, 2015a)

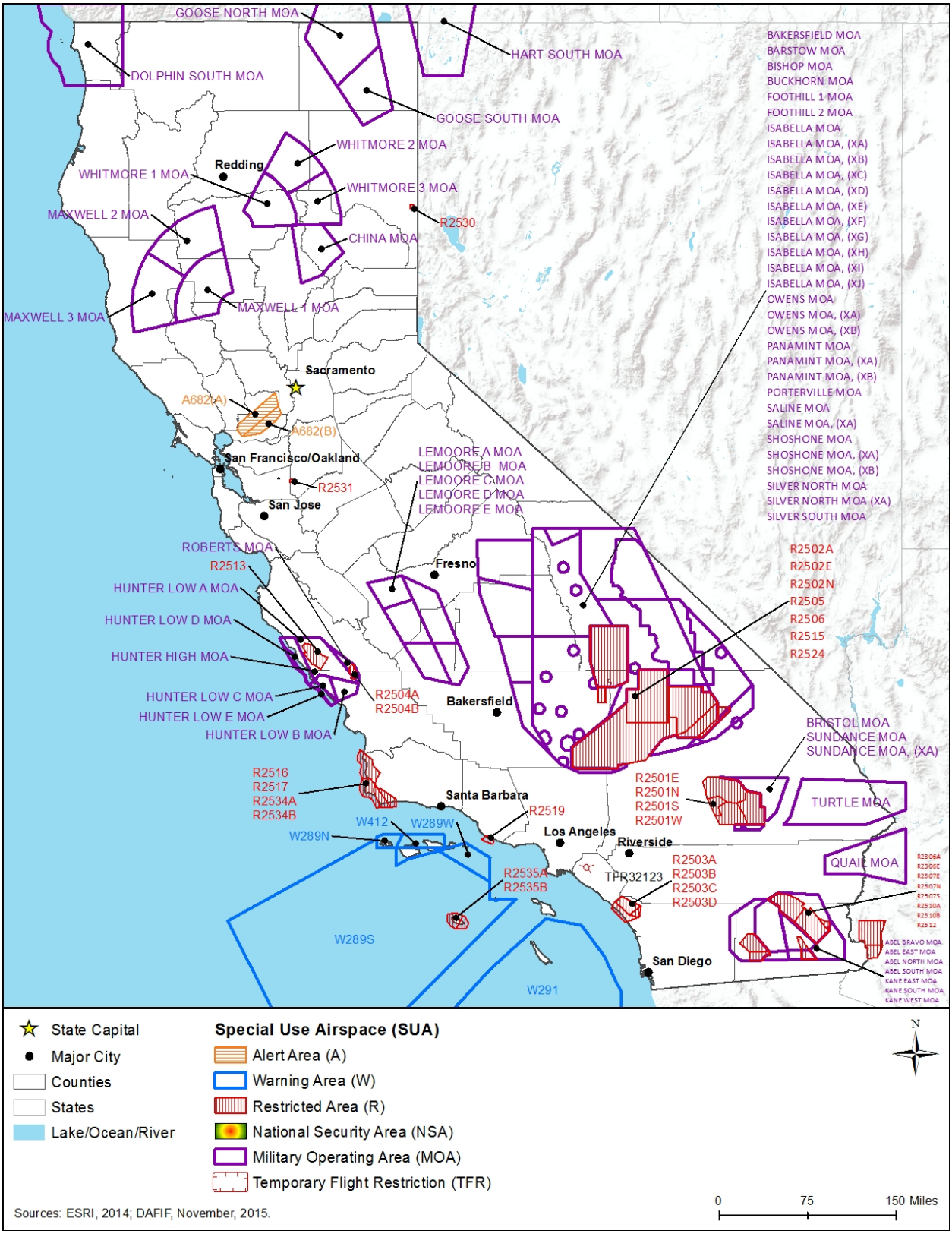


Figure 4.1.7-8: SUAs in California

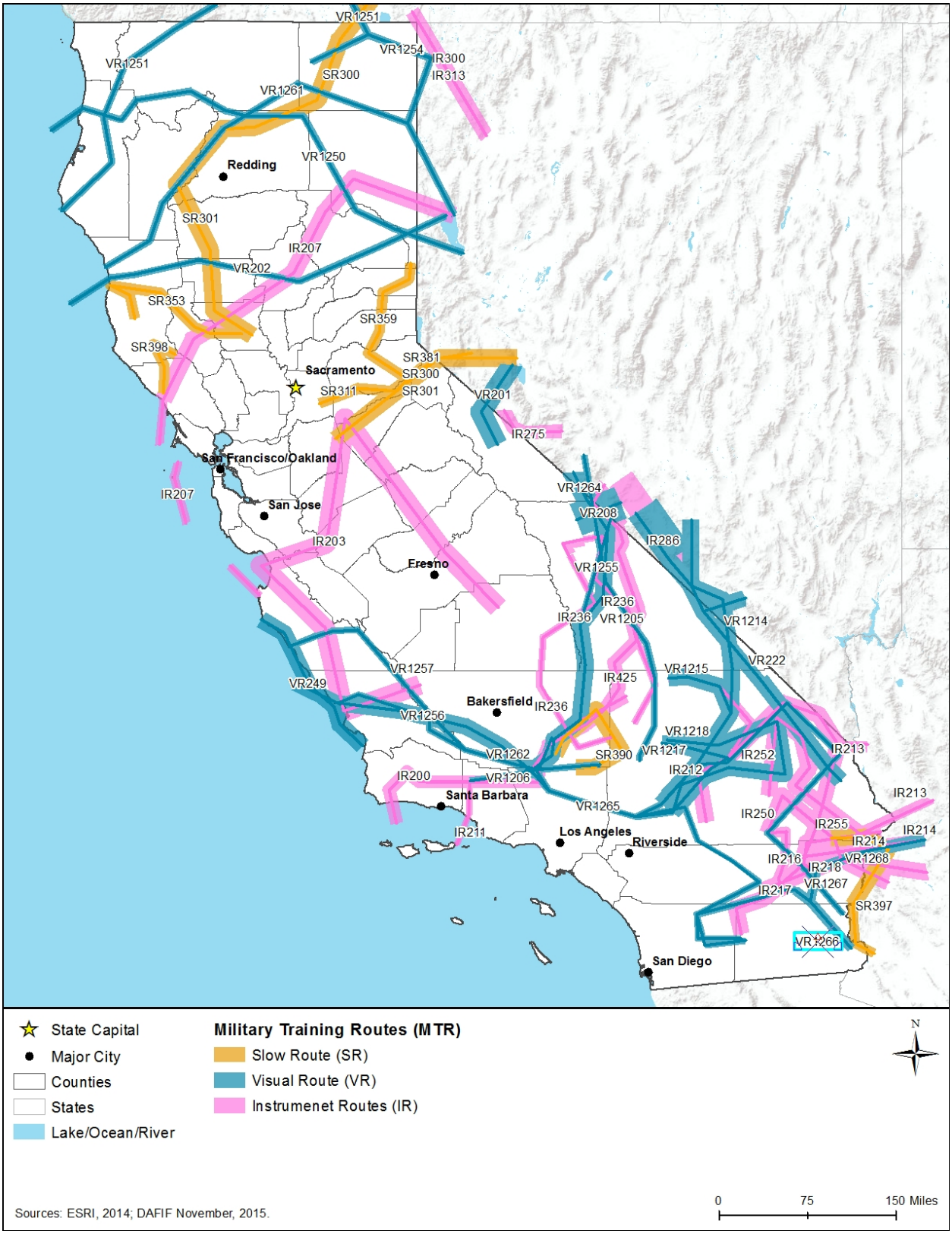


Figure 4.1.7-9: MTRs in California

4.1.8 Visual Resources

4.1.8.1 Definition of the Resource

Visual resources influence the human experience of a landscape. Various aspects combine to create visual resources, such as color, contrast, texture, line, and form. Features (e.g., mountain ranges, city skylines, ocean views, unique geological formations, rivers) and constructed landmarks (e.g., bridges, memorials, cultural resources, or statues) are considered visual resources. For some, cityscapes are valued visual resources, whereas others prefer natural areas. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for NEPA and NHPA compliance. The federal government does not have a single definition of what constitutes a visual resource; therefore, this PEIS will use the general definition of visual resources used by the Bureau of Land Management, "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)" (BLM, 1984).

4.1.8.2 Specific Regulatory Considerations

Table 4.1.8-1 presents state and local laws and regulations that relate to visual resources.

Table 4.1.8-1: Relevant California Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
California Environmental Quality Act	Public Agencies	"…requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible."
Fish and Game Code, Division 2. Department of Fish and Game [700-1940] Chapter 4.1 California Riparian Habitat Conservation Program [1385-1391]	California Department of Fish and Game	"The public interest requires the coordinated protection of rivers and riparian resources in order to maintain an equilibrium between the natural endowment of, and manmade alterations to, California's river environment, and in order to preserve the scenic beauty of these natural resources and the recreational and economic benefits they provide."
Fish and Game Code, Division 3. Department of Fish and Game Generally [2000-2948] Chapter 7.5 Wildlife and Natural Areas Conservation Program [2700-2729]	California Department of Fish and Game and Wildlife Conservation Board	"…to enjoy a great variety of recreational, aesthetic, ecological, and other uses and benefits of these biological resources."
Government Code, Title 5, Division 1. Cities and Counties, Part 1. Chapter 2.5 Open Space Maintenance Districts, Article 1 [50575-50628]	Cities and Counties	"Open space" or "open area" means any space or area characterized by great natural scenic beauty or whose existing openness, natural condition, or present state of use, if retained, would enhance the present or potential value of abutting or surrounding urban development, or would maintain or enhance the conservation of natural or scenic resources."

State Law/Regulation	Regulatory Agency	Applicability
Government Code, Title 5, Division 1. Cities and Counties, Part 1. Chapter 6.6 Open-Space Easement Act of 1974	Cities and Counties	"…that the rapid growth and spread of urban development is encroaching upon, or eliminating open-space lands which are necessary not only for the maintenance of the economy of the state, but also for the assurance of the continued availability of land for the production of food and fiber, for the enjoyment of scenic beauty, for recreation and for the use and conservation of natural resources."
McAteer-Petris Act of 1965	San Francisco Bay Conservation and Development Commission	"Protect the Bay as a great natural resource for the benefit of present and future generations."
The California Coastal Act of 1976	California Coastal Commission	"…the permanent protection of the state's natural and scenic resources is a paramount concern to present and future residents of the state and nation."
California Wildlife, Coastal, and Park Land Conservation Act of 1988	State, County, and City Agencies	"Wildlife, coastal, and park land conservation is in the public interest and is necessary to keep these lands in open-space, natural, and recreational uses, to provide clean air and water, to protect significant environmental and scenic values of wildlife and plant habitat, riparian and wetland areas, and other open-space lands, and to provide opportunities for the people of California to enjoy, appreciate, and visit natural environments and recreational areas."

In California, there are many management plans, protection acts, and conservancy acts for specific areas to protect visual resources throughout the state, including resources of Morro Bay, the Delta, Suisun Marsh, Baldwin Hills, Sacramento-San Joaquin Delta, San Gabriel and Lower Los Angeles Rivers and Mountains, San Diego River, and Santa Monica Mountains. The various acts declare "each area has unique resources that must be protected, thereby protecting the landscape and scenic resources." (State of California Legislature, 2015)

In addition to the state laws and regulations, many cities, counties, and localities have plans that include management for scenic or visual resources. Viewsheds and scenic vistas are increasingly important to the state's towns and cities as they look at the future planning of their municipalities.

4.1.8.3 Character and Visual Quality of the Existing Landscape

As reported elsewhere in this PEIS, California has a wide range of landscapes and topography. On the west is the Pacific coastline with bays, sandy beaches, rocky coast, dunes, bluffs, and steep cliffs. There are several chains of islands off the coast, two of the larger chains are the Channel Islands west of Los Angeles and the Farallon Islands west of San Francisco (California Department of Fish and Wildlife, 2015b). Just inland of the northern coast is temperate rainforest of dense redwoods, the tallest trees on Earth (NPS, 2015e). Inland to the north and south is the Coastal Range of mountains that meet the northern and central valleys and the deserts of the south. The central valley is prime agricultural land. Further east is the major mountain range in the state, the Sierra Nevadas, which flow into the Cascade Range to the north and the Mojave Desert to the south. Within the Sierra Nevadas, the highest point of California

can be found, Mt. Whitney at 14,494 feet. Other focal points within the Sierra Nevadas include Lake Tahoe, the largest alpine lake in the U.S., and Yosemite National Park, famous for the sheer granite walls and cliffs (USGS, 2014i). To the south-southeast, the lowest point in the state is Death Valley, 282 feet below sea level, within the Mojave Desert (USGS, 2009). The Cascade Mountains in the north contain extinct volcanoes including Mount Lassen and Mount Shasta, which still exhibit some remnants of volcanism, including hot springs, fumeroles, and other geothermal activity (USGS, 2014j).

While the natural resources of California are world-renowned, the same is true for many of the populated areas in the state. San Francisco is famous for the Golden Gate Bridge, the city skyline, steep hills with colorful Victorian homes, Golden Gate Park, and the San Francisco Bay. Los Angeles is the largest city in the state with its recognizable skyline, mansions, freeways, and nearby Hollywood and the beaches to the west. Coastal towns in the north continue the Victorian architecture and history from San Francisco. From San Francisco to the south, the Spanish Missions dot the coastal and inland cities. In the mountains and foothills of the Sierras and Cascades, historic gold rush towns and settlements are still preserved. The famous wine country north of the Bay Area has quaint towns surrounded by rolling hills and vineyards. (State of California, 2015a)

California has considered the management and protection of scenic resources of its parks, scenic highways, cities, counties, and other special areas (Table 4.1.8-1). Those policies allow for consideration and protection of visual resources in certain landscapes. While the state and many municipalities have regulation of scenic and visual resources, not all scenic areas within the state have been identified or have policy or regulations for management or protection by the state. The areas listed below have additional management, significance, or protection through state or federal policy, as well as being identified as visually significant areas.

4.1.8.4 Visually Important Historic Properties and Cultural Resources

Visual and aesthetic qualities of historic properties can contribute to the overall importance of a particular site. Such qualities relate to the integrity of the appearance and setting of these properties or resources. Viewsheds (the natural and manmade environment visible from one or more viewing points) can also contribute to the significance of historic properties or cultural resources. Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 4.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In California, there are 2,672 NRHP listed sites, which include 144 National Historic Landmarks, 1 National Monument, 4 National Historic Sites, and 2 National Historical Parks (NPS, 2015f). Some State Historic Sites, State Heritage Areas, and State Historic Districts may also be included in the NRHP, whereas others are not designated at this time.

The *Secretary of the Interior's Standards for the Treatment of Historic Properties* addresses four aspects: preservation, rehabilitation, restoration, and reconstruction, whereas *The Guidelines for the Treatment of Cultural Landscapes*, both authored by the NPS, provides guidance for applying protections to all aspects of the historic and cultural landscape, such as forests, gardens,

trails, structures, ponds, and farming areas, to meet the Standards (NPS, 1995). The Standards "require retention of the greatest amount of historic fabric, including the landscape's historic form, features, and details as they have evolved over time," which directly protects historic properties and the visual resources therein (NPS, 1995). The BLM issued a 1997 Memorandum of Understanding with the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers regarding the manner in which BLM will meet its responsibilities under the National Historic Preservation Act (USDOI, BLM, 2004). In addition, BLM is required to manage scenic resources under the Federal Land Policy and Management Act of 1976 (FLPMA) and Manuals 8100 and 8140 protecting cultural resources. BLM conducts visual resource inventories for all of the public lands they manage during their land use planning process, about every 10 to 15 years.

World Heritage Sites

Sites are designated World Heritage sites if they reflect "the world's cultural and natural diversity of outstanding universal value" (UNESCO, 2015). To be included on the World Heritage List, sites must meet 1 of 10 criteria reflecting cultural, natural, or artistic significance (UNESCO, 2015). World Heritage sites are diverse and range from archaeological remains, national parks, islands, buildings, city centers, and cities. The importance of World Heritage-designated properties can be attributed to cultural or natural qualities that may be considered visual resources or are visually sensitive at these sites. In California, Yosemite National Park and Redwood National and State Parks are designated natural World Heritage sites (Figure 4.1.8-4) (NPS, 2015g). More information on these National Parks is presented in Parks and Recreation Areas, below.

National Historic Landmarks

National Historic Landmarks (NHL) are defined as "nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States" (NPS, 2015h). In California, many NHLs are composed of historic Spanish missions, gold rush forts and towns, and military sites. Other types of historic properties include homes, ranches, churches, civic buildings, and natural sites (Figure 4.1.8-1). The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities, among other attributes, that may be considered visual resources or visually sensitive at these sites. There are 145 NHLs in California, which include a variety of historic structures but also include historic stopovers along travel routes and natural areas (Figure 4.1.8-2). The scenic and visual resources of these landmarks and surrounding areas are managed for consistency with the historic resource and aesthetics of the landscape (NPS, 2015i).

By comparison, there are over 2,500 NHLs in the United States (NPS, 2015j). Figure 4.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive.

Figure 4.1.8-1: Representative Sample of Some Historic and Cultural Areas that May Be Visually Sensitive

Figure 4.1.8-2: Donner Memorial State Park near Donner Camp Sites National Historic Landmark, Sierra Nevada Mountains

Source: (State of California, 2015c)

National Historical Parks

There are two National Historical Parks in California (Figure 4.1.8-1). National Historical Parks differ from National Monuments in that "the National Historical Park designation generally applies to historic parks that extend beyond single properties or buildings and requires an act of Congress" (NPS, 2015k).

Rosie the Riveter WWII Home Front National Historical Park is in the city of Richmond. This small historic World War II site is focused on education and preserves historic resources of the World War II era (NPS, 2015l).

San Francisco Maritime National Historical Park is a collection of historic ships in San Francisco Bay and two nearby buildings housing a museum and visitor center. Scenic vistas of the Golden Gate Bridge and the bay can be seen from the ships. (NPS, 2015m)

National Historic Sites

California has one National Memorial (Port Chicago Naval Magazine National Memorial) and four National Historic Sites (Eugene O'Neill, Fort Point, John Muir, and Manzanar National Historic Sites). These sites encompass literary, environmental, and World War II history within a variety of scenic landscapes including the Sierra Nevada Mountains, Mojave Desert, San Francisco Bay, wetlands, oak woodlands, and coastal foothills. (NPS, 2015f)

National Historic Trails

Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Trails are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass" (Figure 4.1.8-1) (NPS, 2012b).

There are four National Historic Trails in California: the California, Juan Bautista de Anza, Old Spanish, and Pony Express National Historic Trails. The scenic resources along the trails may

be protected within the various agencies' jurisdictions. These trails track the pathway of historic travelers across the west, including trail ruts, historic sites, and structures. Visual resources along the trails include historic buildings, geologic features, mountain peaks, valleys, meadows, forests, and foothills. (NPS, 2015f)

Figure 4.1.8-3: View of the Historic Mojave Road along the Old Spanish National Historic Trail within the Mojave National Preserve

Source: (NPS, 2015n)

State Historic Sites

California features 14 state historic sites featuring Spanish missions, gold rush encampments, American Indian sites, and other historical structures and locations. The following sites highlight history and culture, as well as a variety of scenic resources including rolling foothills, majestic oak forests, rich valleys, and river views (State of California, 2015b):

- California State Capitol Museum
- California State Railroad Museum
- Colonel Allensworth State Historic Park
- Columbia State Historic Park
- Governor's Mansion
- Leland Stanford Mansion
- Marshall Gold Discovery State Historic Park
- Monterey State Historic Park
- Petaluma Adobe State Historic Park
- Railtown 1897
- San Juan Bautista State Historic Park
- Sonoma State Historic Park
- State Indian Museum
- Sutter's Fort

4.1.8.5 Parks and Recreation Areas

Parks and recreation areas include NPS, BLM, Forest Service, or other public lands; state parks, forests, or trails; and other protected areas used for recreational activities. Public lands under federal ownership are subject to NEPA, and visual and aesthetic resources are considered in their NEPA analysis. Public lands, parks and recreation areas often contain scenic resources and are

visited because of their associated visual or aesthetic qualities. Figure 4.1.8-4 identifies parks and recreational resources that may be visually sensitive in California.[149]

[149] The natural areas data were retrieved from the Protected Areas Database of the United States (PAD-US), produced by USGS (http://gapanalysis.usgs.gov/padus/). This dataset categorizes lands across the U.S. by conservation, land management, planning, recreation, and ownership, as well as other uses. It is an extensive dataset that contains large quantities of information relevant to the Proposed Action. The data was queried and further combined by the Primary Designation Type into classifications that fit the multiple types of land applicable for Natural Areas. For this map, recognizable symbols (e.g., varying shades of green for National Parks and Forests) were used as PAD-US does not have a standard symbolization for natural areas. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

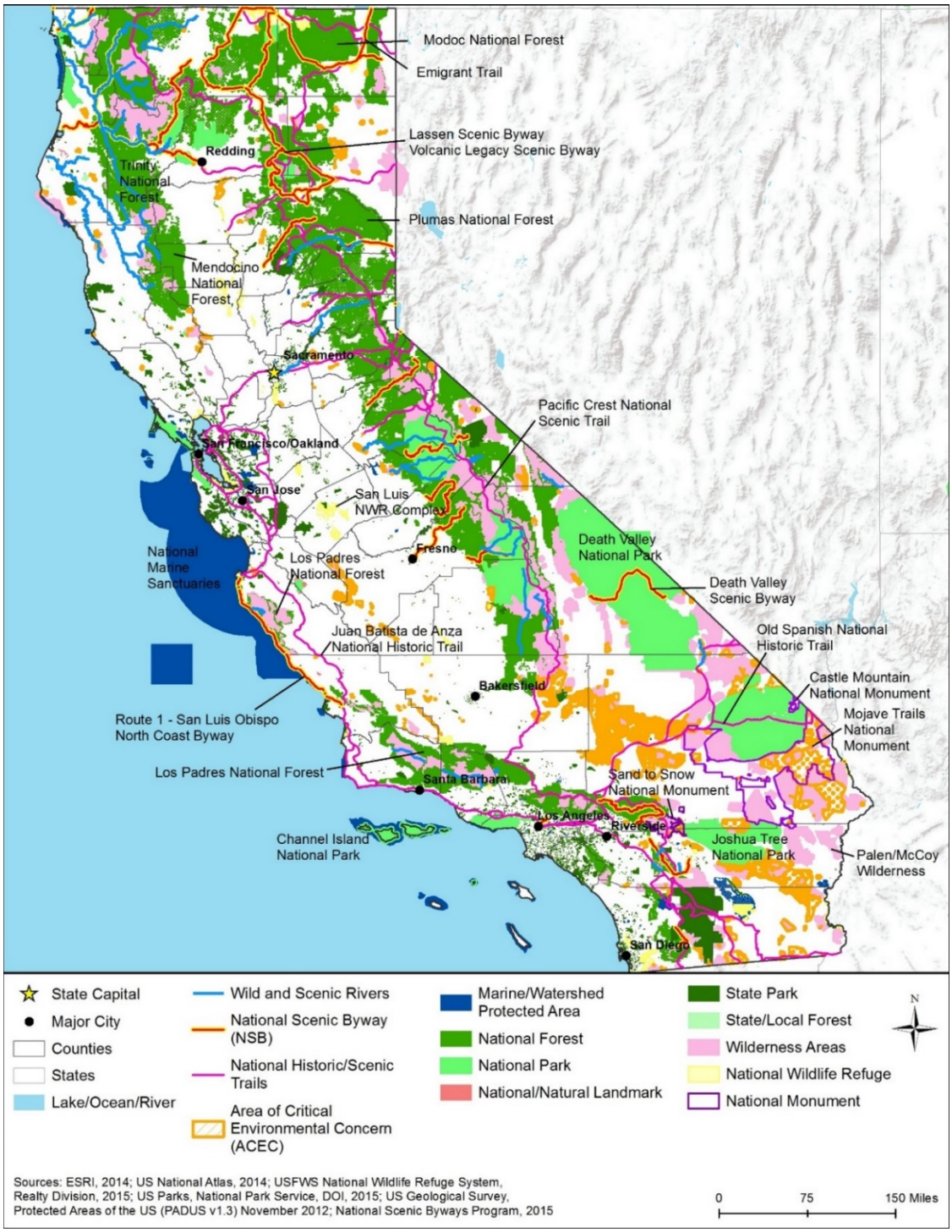


Figure 4.1.8-4: Natural Areas that May be Visually Significant

National Park Service

National Parks are managed by the NPS, and contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation and are maintained for the public's use. There are 27 officially designated NPS units[150] and several other NPS-affiliated properties in California. Specifically, there are eight National Parks, three National Recreation Areas, one National Preserve, one National Seashore, five National Historic Trails, four National Historic Sites, two National Historical Parks, and seven National Monuments. Two of the National Parks, Redwood and Yosemite are designated natural World Heritage Sites, and are considered natural treasures with universal value (Figure 4.1.8-4) (NPS, 2015g). These two very different parks contain spectacular scenery, unique landscapes, and valuable ecosystems. Redwood National Park and State Parks have stands of giant redwoods and miles of undeveloped Pacific coastline, rolling coastal hills, oak woodlands, and winding rivers (NPS, 2015k). Yosemite National Park is the Sierra Nevada Mountains (Figure 4.1.8-5). Carved from glaciers, the granite cliffs, valleys, and waterfalls are the focal points of the park. Other visual resources of Yosemite National Park are steep alpine peaks, meadows, and lakes. (NPS, 2015f)

Figure 4.1.8-5: Half Dome, Yosemite National Park and World Heritage Site

Source: (NPS, 2015f)

Golden Gate National Recreation Area is a combination of numerous sites and monuments with a range of visual resources. Alcatraz Island and the Presidio of San Francisco offer views of the bay and Golden Gate Bridge. Muir Woods National Monument and Marin Headlands offer ocean vistas, redwood forest, coastal hills, and misty mountaintops (NPS, 2015o). Table 4.1.8-2 identifies some National Parks and affiliated areas located in California with their scenic values.

Table 4.1.8-2: National Park Service Lands and Scenic Values

Name	Acres	Scenic Values
Channel Islands National Park	342,161	Pacific Ocean, coastal views, rocky cliffs, islands, beaches, hills, forest
Death Valley National Park	3,400,000	Mojave Desert, mountain views, unique geology,
Joshua Tree National Park	792,510	Mojave Desert, Colorado Desert, Joshua trees, unique geology
Lassen Volcanic National Park	106,372	Hydrothermal areas, volcanism, mountains, meadows, forest, streams, lakes

[150] This count is based on the NPS website "by the numbers" current as of 9/30/2014 (NPS, 2015f). Actual lists of parks and NPS affiliated areas may vary here depending on when areas are designated by Congress.

Name	Acres	Scenic Values
Pinnacles National Park	26,000	Volcanic remnants, unique geology, canyons, forest
Redwood National and State Parks and Word Heritage Site	131,983 (71,715 federal, 60,268 state)	Pacific coast, steep cliffs, redwood forest, oak woodland, rolling hills, beaches, streams
Sequoia and Kings Canyon National Parks	865,964	High mountain peaks, giant sequoia groves, alpine forest, lakes, rivers, meadows
Yosemite National Park (Figure 4.1.8-5)	748,036	Granite cliffs, rocky peaks, waterfalls, valleys, meadows, alpine lakes, rivers, giant sequoia groves
Golden Gate National Recreation Area	80,000	San Francisco Bay, city views, ocean views, islands, historic structures
Santa Monica Mountains National Recreation Area	23,185	Beaches, coastline, mountains, forest, valleys, city views
Whiskeytown National Recreation Area	39,000	Mountain peaks, lake, forest, streams, waterfalls
Mojave National Preserve	1,600,000	Mountains, canyons, volcanic remnants, Joshua trees, sand dunes, mesas, desert
Point Reyes National Seashore	71,000	Ocean views, cliffs, beaches, rolling hills, grassland, forest

Source: (NPS, 2015f)

The National Monuments in California encompass many cultural sites representing the native inhabitants of the lands prior to Spanish and European settlement, as well as historic sites from the later settlers (Figure 4.1.8-4). The monuments also represent the unique landforms and scenery within California such as redwood forest, ancient volcanoes, volcanic remnants, and rocky Pacific coastline. The following National Monuments within California contain a variety of visual resources (NPS, 2015f):

- Cabrillo
- Castle Mountains
- Cesar E. Chavez
- Devils Postpile (National Park Service 2015l)
- Lava Beds
- Muir Woods
- World War II Valor in the Pacific

For additional information regarding parks and recreation areas, see Section 4.1.7, Land Use, Recreation, and Airspace.

Bureau of Land Management

The BLM manages 24,518 square miles throughout California (Figure 4.1.8-4) (BLM, 2016c). These lands are managed under a multiple use mandate (FLPMA) meaning that BLM must allow many uses of the lands, from recreation, to livestock grazing, forestry, wildlife habitat, and energy development (BLM, 1976). The BLM uses their visual resources management system to "identify and evaluate scenic values to determine the appropriate levels of management" (BLM, 2016d). Lands classified with high scenic values are assigned management that prevents or reduces impacts to the visual resources, protecting the scenic landscape (BLM, 2016d). BLM lands with high scenic values are less likely to be developed or have the visual resources disturbed. Management varies among uses and resources, some areas, like lands adjacent to wild

and scenic rivers, will be managed for high quality visual resources. Other areas, such as where energy development is occurring, may be managed for lower quality visual resources.

In California, BLM manages 7 national monuments, 8 segments of wild and scenic rivers, a national conservation area, a forest reserve, segments of all 4 national historic trails, and over 3.8 million acres of wilderness. The scenic resources range from beaches, coastline, mountains, alpine peaks, desert, rivers, lakes, valleys geologic features, redwood forest, grassy hills, and oak woodlands. (BLM, 2015b) (BLM, 2016e) (BLM, 2016f) (BLM, 2015c) (BLM, 2015d) (BLM, 2016g)

U.S. Forest Service

There are 18 National Forests in California covering over 20 million acres (Figure 4.1.8-4) (USFS, 2013). The USFS conducts inventories of the forestlands, and assigns scenic resource categories from which they manage for scenic and visual resources (USFS, 1995). The scenic inventories are conducted during their land and resource management planning process about every 10 to 15 years and used to manage the forest landscape and to protect areas of high scenic integrity (USFS, 1995). The following are the 18 National Forests and 1 Management Area in California (USFS, 2013) (USFS, 2016a):

- Angeles National Forest
- Cleveland National Forest
- Eldorado National Forest
- Humboldt-Toiyabe National Forest
- Inyo National Forest
- Klamath National Forest
- Lake Tahoe Basin Management Area
- Lassen National Forest
- Los Padres National Forest
- Mendocino National Forest
- Modoc National Forest
- Plumas National Forest
- San Bernardino National Forest
- Sequoia National Forest
- Shasta-Trinity National Forest
- Sierra National Forest
- Six Rivers National Forest
- Stanislaus National Forest
- Tahoe National Forest

The National Forest System lands in California encompass scenic resources in the Sierra Nevada Mountains, the Cascades, the Trinity Alps, Kings Range, Pacific Ocean, redwood forest, sequoia groves, alpine forest, lakes, waterfalls, rivers, foothills, and grassland (USFS, 2013).

U.S. Army Corps of Engineers Recreation Areas

There are 23 USACE reservoir recreation areas in California (Figure 4.1.8-4) (USACE, 2015a). The USACE reservoirs are managed for scenic and aesthetic qualities as well as for water storage and flood mitigation (USACE, 2015b). The following is a list of USACE dams, reservoirs, lakes and other recreation areas in California (USACE, 2015a):

- Black Butte Lake
- Mojave River Dam

- Brea Dam
- Carbon Canyon Dam
- Eastman Lake
- Fullerton Dam
- Hansen Dam
- Harry L. Englebright Lake
- Hensley Lake
- Kaweah Lake
- Lake Sonoma
- Martis Creek Lake
- Mendocino Lake
- New Hogan Lake
- Pine Flat Lake
- Prado Dam
- San Francisco Bay Model Regional Visitor Center
- Santa Fe Dam
- Santa Margarita Lake
- Sepulveda Dam
- Stanislaus River Parks
- Success Lake
- Whittier Narrows Dam

Bureau of Reclamation

The Bureau of Reclamation manages 36 reservoirs and recreation areas in California, most often in partnership with state and federal agencies (Figure 4.1.8-4) (Recreation.gov, 2014). The areas are primarily for water storage and secondary recreation use. The managing agencies that consider visual resources in their planning processes may apply management to protect scenic resources within these areas. (Bureau of Reclamation, 2015)

National Scenic Trails and State Recreation Trails

The Pacific Crest National Scenic Trail (PCT) travels over some of the most rugged and scenic country in the west (Figure 4.1.8-4). The trail starts at the California-Mexico border and crosses 2,650 miles through the western states to Canada. The PCT spans numerous mountain ranges in southern California and crosses the Mojave Desert before ascending into the Sierra Nevada Mountains. The trail passes through Sequoia, Yosemite, and Lassen Volcanic National Parks eventually leading to the southern Cascade Range prior to crossing the Oregon border (Figure 4.1.8-6). "The PCT is one of the original National Scenic Trails established by Congress in the 1968 National Trails System Act. It is administered by the USFS. The Forest Service partners with the Bureau of Land Management, NPS, California State Parks, and the Pacific Crest Trail Association to provide effective management and protection of the trail." (USFS, 2016b)

Figure 4.1.8-6: Devils Postpile, one of the many scenic views from the Pacific Crest Trail

Source: (National Park Service 2015l)

There are 92 National Recreation Trails in California (National Recreation Trails, 2016). "National Recreation Trails may be designated by the Secretary of Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization" (USFS, 2016c). The National Trails System Act authorized the designation of National Recreational Trails near urban areas (American Trails, 2015). There are over 1,100 National Recreation Trails across the nation administered by the U.S. Forest Service, USACE, USFWS, local or state governments, and non-profit organizations (National Recreation Trails, 2015). In California, trails range from the 0.40 mile Donner Camp Trail to the 96.00 mile Tahoe Rim Trail (National Recreation Trails, 2016).

State Parks

There are 280 state parks covering over 5 million acres in California. "The state park system includes state parks, state natural reserves, state historic parks, state historic monuments, state beaches, state recreation areas, state vehicular recreation areas, state seashores, and state marine parks." These parks contain every scenic resource available in California from coast to alpine forests, desert to sandy beaches, and include a diverse array of history and culture (Figure 4.1.8-7) (California Department of Parks and Recreation, 2016a).

Figure 4.1.8-7: Mono Lake Tufa State Natural Reserve

Source: (California Department of Parks and Recreation, 2016b)

4.1.8.6 Natural Areas

The abundance of natural areas varies by state depending on the amount of public or state lands managed within each state. Although many natural areas may not be managed specifically for visual resources, these areas are allowed protection for their natural resources and the resulting management protects these scenic resources. Figure 4.1.8-4 identifies natural areas that may have sensitive visual resources.

Rivers Designated as National or State Wild, Scenic or Recreational

California has about 189,454 miles of rivers federally designated as wild, scenic, and recreational (Figure 4.1.8-4) (National Wild and Scenic Rivers System, 2016). National wild, scenic, or recreational rivers are those rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-1287). The scenic resources of these rivers are protected by the federal designations and management of the various agencies (National Wild and Scenic Rivers System, 2016). The following rivers and creeks have sections designated as wild, scenic, or recreational:

- Amargosa River
- American River (Lower)
- American River (North Fork)
- Bautista Creek
- Big Sur River
- Black Butte River
- Cottonwood Creek
- Eel River
- Feather River
- Fuller Mill Creek
- Kern River
- Kings River
- Klamath River
- Merced River
- Owens River Headwaters
- Palm Canyon Creek
- Piru Creek
- San Jacinto River (North Fork)
- Sespe Creek
- Sisquoc River
- Smith River
- Trinity River
- Tuolumne River

"The California Wild and Scenic Rivers Act (Public Resources Code Sec. 5093.50 et seq.) was passed in 1972 to preserve designated rivers possessing extraordinary scenic, recreation, fishery, or wildlife values" (USDA Farm Service Agency, 2006). Some of the following rivers and creeks are also federally designated as wild, scenic, or recreational (Foothill Conservancy, 2014):

- Albion River
- American River (Lower and North Fork)
- Cache Creek
- East Fork Carson River
- Eel River (North, Middle, South Forks, main stem)
- Gualala River
- Klamath River
- McCloud River
- Salmon River (North and South Forks) and Wooley Creek
- Scott River
- Smith River (North, Middle, and South Forks) and Tributaries
- South Yuba River
- Trinity River
- Van Duzen River
- West Walker River and Leavitt Creek

National Wildlife Refuges (NWR) and State Wildlife Management Areas

There are 40 NWRs and Wildlife Management Areas in California, covering a combined 2.3 million acres within California, Nevada, and southern Oregon (Figure 4.1.8-4) (USFWS, 2016cy). Many of these refuges are rivers, lakes, salt marsh, or wetlands and surrounding habitat; however, other refuges are found in the desert and on coastal islands. The following wildlife refuges protect habitat for waterfowl, migratory birds, and other wildlife (USFWS, 2016do):

- Antioch Dunes NWR
- Bitter Creek NWR
- Blue Ridge NWR
- Butte Sink Wildlife Management Area
- Castle Rock NWR
- Clear Lake NWR
- Coachella Valley NWR
- Colusa NWR
- Delevan NWR
- Don Edwards San Francisco Bay NWR
- Ellicott Slough NWR
- Farallon NWR (Figure 4.1.8-8)
- Grasslands Wildlife Management Area
- Merced NWR
- Modoc NWR
- North Central Valley Wildlife Management Area
- Pixley NWR
- Sacramento NWR
- Sacramento River NWR
- Salinas River NWR
- San Diego NWR
- San Diego Bay NWR
- San Joaquin River NWR
- San Luis NWR
- San Pablo Bay NWR

- Guadalupe-Nipomo Dunes NWR
- Hopper Mountain NWR
- Humboldt Bay NWR
- Kern NWR
- Kesterton NWR
- Lower Klamath NWR
- Marin Islands NWR
- Seal Beach NWR
- Sonny Bono Salton Sea NWR
- Stone Lakes NWR
- Sutter NWR
- Tijuana Slough NWR
- Tule Lake NWR
- Willow Creek-Lurline Wildlife Management Area

Figure 4.1.8-8: Farallon National Wildlife Refuge

Source: (USFWS, 2016dc)

There are over 190 wildlife areas and ecological reserves managed by the California Department of Fish and Wildlife to protect and conserve over a million acres of wildlife habitat. These areas contain protected habitat for plants and animals without disturbance from development and habitat loss. (California Department of Fish and Wildlife, 2016b)

National Natural Landmarks

There are 36 National Natural Landmarks (NNL) in California (NPS, 2016d). NNLs are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and geological resources, regardless of land ownership type" (NPS, 2016e). NNLs "are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (NPS, 2016e). The following landmarks may be considered visual resources or visually sensitive:

- Amboy Crater
- Anza-Borrego Desert
- Lake Shasta Caverns
- Miramar Mounds

- Audubon Canyon
- American River and Phoenix Park Vernal Pools
- Año Nuevo State Reserve
- Black Chasm Cave
- Burney Falls
- Cinder Cone Natural Area
- Cosumnes River Preserve
- Deep Springs Marsh
- Dixon Vernal Pools
- Elder Creek
- Emerald Bay
- Eureka Dunes
- Fish Slough
- Guadalupe-Nipomo Dunes
- Imperial Sand Hills
- Irvine Ranch Natural Landmarks
- Mitchell Caverns and its "Winding Stair" cave
- Mt. Diablo State Park
- Mount Shasta
- Pixley Vernal Pools
- Point Lobos
- Pygmy Forest at Van Damme State Park
- Rainbow Basin
- La Brea Tar Pits (Rancho La Brea)
- San Andreas Fault
- San Felipe Creek
- Sand Ridge Wildflower Preserve
- Sharktooth Hill
- Tijuana River Estuary
- Torrey Pines State Reserve
- Trona Pinnacles
- Turtle Mountain

(NPS, 2016d)

Wilderness

In 1964, Congress enacted the Wilderness Act of 1964 as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. A designation as a National Wilderness Area is the highest level of conservation protection given by Congress to federal lands. This Act defined wilderness as land untouched by man and primarily affected only by the "forces of nature" and as that which "may also contain ecological, geological, or other features of scientific, education, scenic, or historical value" (NPS, 2015p). Over 106 million acres of federal public lands have been designated as wilderness areas in the United States. These designated wilderness areas are managed by the NPS, USFS, BLM, and USFWS (NPS, 2015p). In California, there are 149 designated wilderness areas covering over 14,965,700 acres (Figure 4.1.8-4) (Wilderness.net, 2016).

4.1.8.7 Additional Areas

Federal or State Scenic and Historic Byways

There are seven National Scenic Byways in California (FHWA, 2016a). National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which

would be considered visual resources or visually sensitive. The National Scenic Byways Program is managed by the U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA) (FHWA, 2016b). The following National Scenic Byways all contain scenic vistas and resources.

- Arroyo Seco National Historic Parkway spans 9.5 miles in Southern California with scenic vistas, landscaping, and classic architecture (FHWA, 2016c).
- Death Valley National Scenic Byway travels 81.5 miles through the desert with mountain vistas, sand dunes, and wide-open views, along with cultural and historic sites (FHWA, 2016d).
- Ebbetts Pass National Scenic Byway travels 61.0 miles through California with glacially carved mountain, forest, river, lake, butte, and mountaintop vistas, along with cultural and historic sites (FHWA, 2016e).
- Route 1-Big Sur Coast Highway travels 72.0 miles through California highlighting the Pacific coastline, including steep cliffs, redwood forest, misty bluffs, and rolling hills (FHWA, 2016f).
- Route 1-San Luis Obispo North Coast Byway spans 57.0 miles along the Pacific coast, encompassing a variety of scenery including rolling hills, oak woodlands, steep cliffs, lush farmland, historic and cultural sites, and hilltop vistas (Figure 4.1.8-9) (FHWA, 2016g).
- Tioga Road/Big Oak Flat Road National Scenic Byway crosses 64.0 miles through the Sierra Nevada Mountains and Yosemite National Park highlighting glacier-carved peaks, giant sequoia groves, meadows, alpine lakes, and mountaintop vistas (FHWA, 2016h).
- Volcanic Legacy Scenic Byway travels 500.0 miles through California and Oregon including Lassen Volcanic National Park. This scenic byway includes steaming hot springs, volcanic craters, lava flows, high mountains, pristine lakes, streams, and meadows, along with cultural and historic sites. (FHWA, 2016i).

Figure 4.1.8-9: Wildflowers and Oak Woodland along the Route 1-San Luis Obispo North Coast Byway

Source: (FHWA, 2016j)

There are 59 California Scenic Highways throughout the state covering 1,325.8 miles (Caltrans, 2015f).[151] "The stated intent (Streets and Highway Code Section 260) of the California Scenic Highway Program is to protect and enhance California's natural beauty and to protect the social and economic values provided by the state's scenic resources (Caltrans, 2016b). In addition, there are 7 county scenic highways covering 77.1 miles that follow the same scenic highway program requirements as the 58 state scenic highways (Caltrans, 2015g).

4.1.9 Socioeconomics

4.1.9.1 Definition of the Resource

NEPA requires consideration of socioeconomics in NEPA analysis; specifically, Section 102(A) of NEPA requires federal agencies to "insure the integrated use of the natural and social sciences…in planning and in decision making" (42 U.S.C. § 4332(A)). Socioeconomics refers to a broad, social science-based approach to understanding a region's social and economic conditions. It typically includes population, demographic descriptors, economic activity indicators, housing characteristics, property values, and public revenues and expenditures. When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of FirstNet projects, and in addition, FirstNet projects may affect the socioeconomic conditions of a region.

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet's mission is to provide public safety broadband and interoperable emergency communications coverage

[151] The total number of State Scenic Byways may not include those segments of National Scenic Byways that are also designated as State Scenic.

throughout the nation. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes.

The financial arrangements for deployment and operation of the FirstNet network may have socioeconomic implications. Section 1.1 frames some of the public expenditure and public revenue considerations specific to FirstNet; however, this is not intended to be either descriptive or prescriptive of FirstNet's financial model or anticipated total expenditures and revenues associated with the deployment of the Nationwide Public Safety Broadband Network (NPSBN). This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898. This PEIS addresses environmental justice in a separate section (Section 4.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use and recreation (Section 4.1.7, Land Use, Recreation, and Airspace), infrastructure (Section 4.1.1, Infrastructure), and aesthetic considerations (Section 4.1.8, Visual Resources).

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau[152] (Census Bureau) and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this PEIS. In all cases, this section uses the most recent data available for each geography at the time of writing. At the county, state, region, and United States levels, the data are typically for 2013 or 2014. For smaller geographic areas, this section uses data from the Census Bureau's American Community Survey (ACS). The ACS is the Census Bureau's flagship demographic estimates program for

[152] For U.S. Census Bureau sources, a URL (see references section) that begins with "http://factfinder.census.gov" indicates that the American FactFinder (AFF) interactive tool can be used to retrieve the original source data via the following procedure. If the reference's URL begins with "http://dataferrett.census.gov," significant socioeconomic expertise is required to navigate this interactive tool to the specific data. However, the data can usually be found using AFF. As of May 24, 2016, the AFF procedure is as follows: 1) Go to http://factfinder.census.gov. 2) Select "Advanced Search," then "Show Me All." 3) Select from "Topics" choices, select "Dataset," then select the dataset indicated in the reference; e.g.,"American Community Survey, 2013 1-Year Estimates" or "2012 Census of Governments." Click "Close." Note: ACS is the abbreviation in the AFF for the American Community Survey. SF is the abbreviation used with the 2000 and 2010 "Summary Files." For references to the "2009-2013 5-Year Summary File," choose "2013 ACS 5-year estimates" in the AFF. 4) Click the "Geographies" box. Under "Select a geographic type," choose the appropriate type; e.g.,"United States – 010" or "State – 040" or "... County – 050" then select the desired area or areas of interest. Click "Add to Your Selections," then "Close." For Population Concentration data, select "Urban Area - 400" as the geographic type, then select 2010 under "Select a version" and then choose the desired area or areas. Alternatively, do not choose a version, and select "All Urban Areas within United States." Regional values cannot be viewed in the AFF because the regions for this PEIS do not match Census Bureau regions. All regional values were developed by downloading state data and using the most mathematically appropriate calculations (e.g., sums of state values, weighted averages, etc.) for the specific data. 5) In "Refine your search results," type the table number indicated in the reference; e.g.,"DP04" or "LGF001." The dialogue box should auto-populate with the name of the table(s) to allow the user to select the table number/name. Click "Go." 6) In the resulting window, click the desired table under "Table, File, or Document Title" to view the results. If multiple geographies were selected, it is often easiest to view the data by clicking the "Download" button above the on-screen data table. Choose the desired comma-delimited format or presentation-ready format (includes a Microsoft Excel option). In some cases, the structure of the resulting file may be easier to work with under one format or another. Note that in most cases, the on-screen or downloaded data contains additional parameters besides those used in the FirstNet PEIS report table. Readers must locate the FirstNet PEIS-specific data within the Census Bureau tables. Additionally, the data contained in the FirstNet tables may incorporate data from multiple sources and may not be readily available in one table on the Census site.

years other than the decennial census years. This PEIS uses the 2009-2013 ACS, which is based on surveys (population samples) taken across that five-year period; thus, it is not appropriate to attribute its data values to a specific year. It is a valuable source because it provides the most accurate and consistent socioeconomic data across the nation at the sub-county level.

The remainder of this section addresses the following subjects: regulatory considerations specific to socioeconomics in the state, communities and populations, economic activity, housing, property values, and taxes.

4.1.9.2 Specific Regulatory Considerations

Research for this section did not identify any specific state, local, or tribal laws or regulations that are directly relevant to socioeconomics for this PEIS.

4.1.9.3 Communities and Populations

This section discusses the population and major communities of California (CA) and includes the following topics:

- Recent and projected statewide population growth,
- Current distribution of the population across the state, and
- Identification of the largest population concentrations in the state.

Statewide Population and Population Growth

Table 4.1.9-1 presents the 2014 population and population density of California in comparison to the West region[153] and the nation. The estimated population of California in 2014 was 38,802,500. The population density was 249 persons per square mile (sq. mi.), which was substantially higher than (more than double) the population density of the region (98 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, California was the largest state by population among the 50 states and the District of Columbia, third largest by land area, and had the 12th greatest population density (U.S. Census Bureau, 2015a; U.S. Census Bureau, 2015b).

Table 4.1.9-1: Land Area, Population, and Population Density of California

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
California	155,779	38,802,500	249
West Region	624,241	61,039,316	98
United States	3,531,905	318,857,056	90

Sources: (U.S. Census Bureau, 2015a; U.S. Census Bureau, 2015b)

Population growth is an important aspect for this PEIS given FirstNet's mission. Table 4.1.9-2 presents the population growth trends of California from 2000 to 2014 in comparison to the West

[153] The West region comprises the states of Arizona, California, Idaho, Nevada, Oregon, and Washington. Throughout the socioeconomics section, figures for the West region represent the sum of the values for all states in the region, or an average for the region based on summing the component parameters. For instance, the population density of the West region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

region and the nation. The state's annual growth rate increased slightly in the 2010 to 2014 period compared to 2000 to 2010, from 0.96 percent to 1.02 percent. The growth rate of California in the 2010 to 2014 period was slightly lower than the growth rate of the region (1.08 percent) and higher than the growth rate of the nation (0.81 percent).

Table 4.1.9-2: Recent Population Growth of California

Geography	Population			Numerical Population Change		Rate of Population Change (AARC)[a]	
	2000	2010	2014 (estimated)	2000 to 2010	2010 to 2014	2000 to 2010	2010 to 2014
California	33,871,648	37,253,956	38,802,500	3,382,308	1,548,544	0.96%	1.02%
West Region	51,610,010	58,469,720	61,039,316	6,859,710	2,569,596	1.26%	1.08%
United States	281,421,906	308,745,538	318,857,056	27,323,632	10,111,518	0.93%	0.81%

Sources: (U.S. Census Bureau, 2015c; U.S. Census Bureau, 2015a)
[a] AARC = Average Annual Rate of Change (compound growth rate)

Demographers prepare future population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore, Table 4.1.9-3 presents projections of the 2030 population from two sources that are national in scope and use different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data, and analysis service. The table provides figures for numerical change, percentage change, and annual growth rate based on averaging the projections from the two sources. The average projection indicates California's population will increase by approximately 6.5 million people, or 16.6 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.97 percent, which is consistent with the historical growth rate from 2010 to 2014. The projected growth rate of the state is slightly lower than that of the region (1.03 percent) and higher than that of the nation (0.80 percent).

Table 4.1.9-3: Projected Population Growth of California

Geography	Population 2014 (estimated)	Projected 2030 Population			Change Based on Average Projection		
		UVA Weldon Cooper Center Projection	ProximityOne Projection	Average Projection	Numerical Change 2014 to 2030	Percent Change 2014 to 2030	Rate of Change (AARC)[a] 2014 to 2030
California	38,802,500	45,984,332	44,533,261	45,258,797	6,456,297	16.6%	0.97%
West Region	61,039,316	73,661,854	70,107,981	71,884,918	10,845,602	17.8%	1.03%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.6%	0.80%

Sources: (U.S. Census Bureau, 2015a) (ProximityOne, 2015) (UVA Weldon Cooper Center, 2015)
[a] AARC = Average Annual Rate of Change (compound growth rate)

Population Distribution and Communities

Figure 4.1.9-1 presents the distribution and relative density of the population of California. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density – therefore, areas that are solid in color are particularly high in population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 2015d).

This map also presents the 10 largest population concentrations in the state, outlined in purple. These population concentrations reflect contiguous, densely developed areas as defined by the Census Bureau based on the 2010 census (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015e). These population concentrations often include multiple incorporated areas as well as some unincorporated areas.

Other groupings of brown dots on the map represent additional, but smaller, population concentrations. Dispersed dots indicate dispersed population across the less densely settled areas of the state. The very sparsely populated areas of the eastern portions of the state include the mountainous Shasta Cascade region in the northeast, the Sierra Nevada mountain range along much of the middle portion of the state's east side, and the desert region in the southeast. For more information about these regions, see Section 4.1.7, Land Use, Recreation, and Airspace.

Table 4.1.9-4 provides the populations of the 10 largest population concentrations in California, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[154] In 2010, the largest population concentration by far was the Los Angeles/Long Beach/Anaheim area, which had approximately 12.1 million people. The state had five other population concentrations over a million. The smallest of the 10 population concentrations was the Bakersfield area, with a 2010 population of 523,994. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Bakersfield area, with an annual growth rate of 2.84 percent.

Table 4.1.9-4 also shows that the top 10 population concentrations in California accounted for 70.0 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 63.7 percent of the entire state's growth.

Table 4.1.9-4: Population of the 10 Largest Population Concentrations in California

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)[a]
Bakersfield	396,125	523,994	532,863	10	127,869	2.84%
Concord	552,624	615,968	625,348	8	63,344	1.09%

[154] Census Bureau boundaries for these areas are not fixed. Area changes from 2000 to 2010 may include accretion of newly developed areas into the population concentration, Census Bureau classification of a subarea as no longer qualifying as a concentrated population due to population losses, and reclassification by the Census Bureau of a subarea into a different population concentration. Thus, population change from 2000 to 2010 reflects change within the constant area and change as the overall area boundary changes. Differences in boundaries in some cases introduce anomalies in comparing the 2000 and 2010 populations and in calculation of the growth rate presented in the table.

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)[a]
Fresno	554,92	654,628	662,018	7	99,705	1.67%
Los Angeles/Long Beach/Anaheim[b]	11,789,487	12,150,996	12,263,818	1	361,509	0.30%
Mission Viejo/Lake Forest/San Clemente[c]	533,015	583,681	589,347	9	50,666	0.91%
Riverside/San Bernardino	1,506,816	1,932,666	1,977,258	4	425,850	2.52%
Sacramento	1,393,498	1,723,634	1,749,420	5	330,136	2.15%
San Diego	2,674,436	2,956,746	2,998,472	3	282,310	1.01%
San Francisco/Oakland	2,995,769	3,281,212	3,332,589	2	285,443	0.91%
San Jose	1,538,312	1,664,496	1,691,768	6	126,184	0.79%
Total for Top 10 Population Concentrations	23,935,005	26,088,021	26,422,901	NA	2,153,016	0.87%
California (statewide)	33,871,648	37,253,956	37,659,181	NA	3,382,308	0.96%
Top 10 Total as Percentage of State	70.7%	70.0%	70.2%	NA	63.7%	NA

Sources: (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015f) (U.S. Census Bureau, 2015g)

[a] AARC = Average Annual Rate of Change (compound growth rate)
[b] The 2000 population presented here is for the "Los Angeles/Long Beach/Santa Ana" urbanized area.
[c] The 2000 population presented here is for the "Mission Viejo" urbanized area.

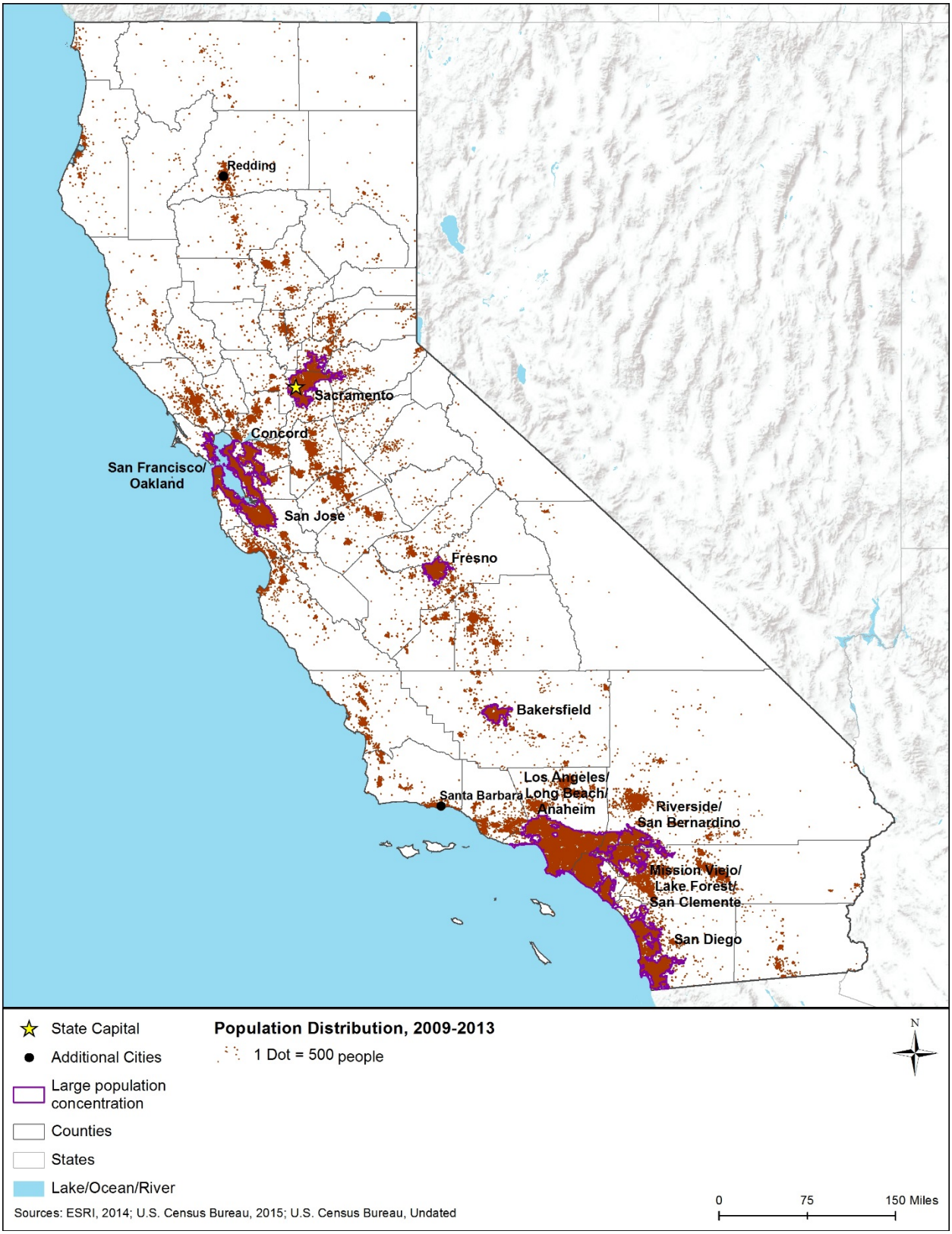


Figure 4.1.9-1: Population Distribution in California, 2009–2013

4.1.9.4 Economic Activity, Housing, Property Values, and Government Revenues

This section addresses other socioeconomic topics that are potentially relevant to FirstNet. These topics include:

- Economic activity,
- Housing,
- Property values, and
- Government revenues.

Social institutions – educational, family, political, public service, military, and religious – are present throughout the state. The institutions most relevant to FirstNet projects are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 4.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 4.1.9-5 compares several economic indicators for California to the West region and the nation. The table presents two indicators of income[155]–per capita and median household–as income is a good measure of general economic health of a region.

Per capita income is total income divided by the total population. As a mathematical average, the very high incomes of a relatively small number of people tend to bias per capita income figures upwards. Nonetheless, per capita income is useful as an indicator of the relative income level across two or more areas. As shown in Table 4.1.9-5, the per capita income in California in 2013 ($29,513) was $855 higher than that of the region ($28,658), and $1,329 higher than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 4.1.9-5 shows that in 2013, the MHI in California ($60,185) was $3,114 higher than that of the region ($57,071), and $7,935 lower than that of the nation ($52,250).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the unemployment rate as the number of unemployed individuals who are looking for work divided

[155] The Census Bureau defines income as follows: "'Total income' is the sum of the amounts reported separately for wage or salary income; net self-employment income; interest, dividends, or net rental or royalty income or income from estates and trusts; Social Security or Railroad Retirement income; Supplemental Security Income (SSI); public assistance or welfare payments; retirement, survivor, or disability pensions; and all other income. Receipts from the following sources are not included as income: capital gains, money received from the sale of property (unless the recipient was engaged in the business of selling such property); the value of income "in kind" from food stamps, public housing subsidies, medical care, employer contributions for individuals, etc.; withdrawal of bank deposits; money borrowed; tax refunds; exchange of money between relatives living in the same household; gifts and lump-sum inheritances, insurance payments, and other types of lump-sum receipts." (California Department of Conservation, 2015c)

by the total number of individuals in the labor force. Table 4.1.9-5 compares the unemployment rate in California to the West region and the nation. In 2014, California's statewide unemployment rate of 7.5 percent was higher than the rate for both the region (7.2 percent) and the nation (6.2 percent).[156]

Table 4.1.9-5: Selected Economic Indicators for California

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
California	$29,513	$60,185	7.5%
West Region	$28,658	$57,071	7.2%
United States	$28,184	$52,250	6.2%

Sources: (BLS, 2015a; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k)

Figure 4.1.9-2 and Figure 4.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015i) and unemployment in 2014 (BLS, 2015a) varied by county across the state. These maps also incorporate the same population concentration data as Figure 4.1.9-1 (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015e). Following these two maps, Table 4.1.9-6 presents MHI and unemployment for the 10 largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to those on the maps. Nonetheless, both the maps and the table help portray differences in income and unemployment across California.

Figure 4.1.9-2 shows that, in general, counties with a 2013 MHI above the national median were located in the western portions of the state and near Sacramento. Many of these counties were around the state's largest population concentrations. Most of the remainder of the state had MHI levels below the national average. The counties classified in the lowest MHI grouping were in the northern portion of the state. Table 4.1.9-6 shows that the 2009–2013 MHI in the 10 largest population concentrations ranged from $46,554 (Fresno area) to $99,497 (Concord area); the state median was $61,094.

Figure 4.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that the great majority of counties had unemployment rates above the national average. Only a small number of counties, around the San Francisco bay area, the counties including and north of Santa Barbara, and in a portion of the greater Los Angeles urbanized area, had unemployment rates below the national average (that is, better employment performance). When comparing unemployment in the population concentrations to the state average, Table 4.1.9-6 shows that the 2009–2013 unemployment rates in the 10 largest population concentrations ranged from 7.8 percent (Mission Viejo/Lake Forest/San Clemente area) to 15.0 percent (Riverside/San Bernardino area); the state average was 11.5 percent.

Detailed employment data provide useful insights into the nature of a local, state, or national economy. Table 4.1.9-7 provides figures on employment percentages by type of worker and by industry based on surveys conducted in 2013 by the Census Bureau. By class of worker (type of

[156]The timeframe for unemployment rates can change quarterly.

worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers was slightly lower in California than in the West region and the nation. The percentage of government workers was slightly lower in the state than in the region and nation. The percentage of self-employed workers in California was higher than in the region and the nation.

By industry, California has a mixed economic base and some notable figures in the table are as follows. California in 2013 had a considerably lower percentage (more than two percentage points difference) in "educational services, and health care and social assistance" than the nation. The state had a notably higher percentage (more than one percentage point difference) in "professional, scientific, management, administrative, and waste management services" than did the nation. The rest of the values for California were within one percentage point of the region and nation.

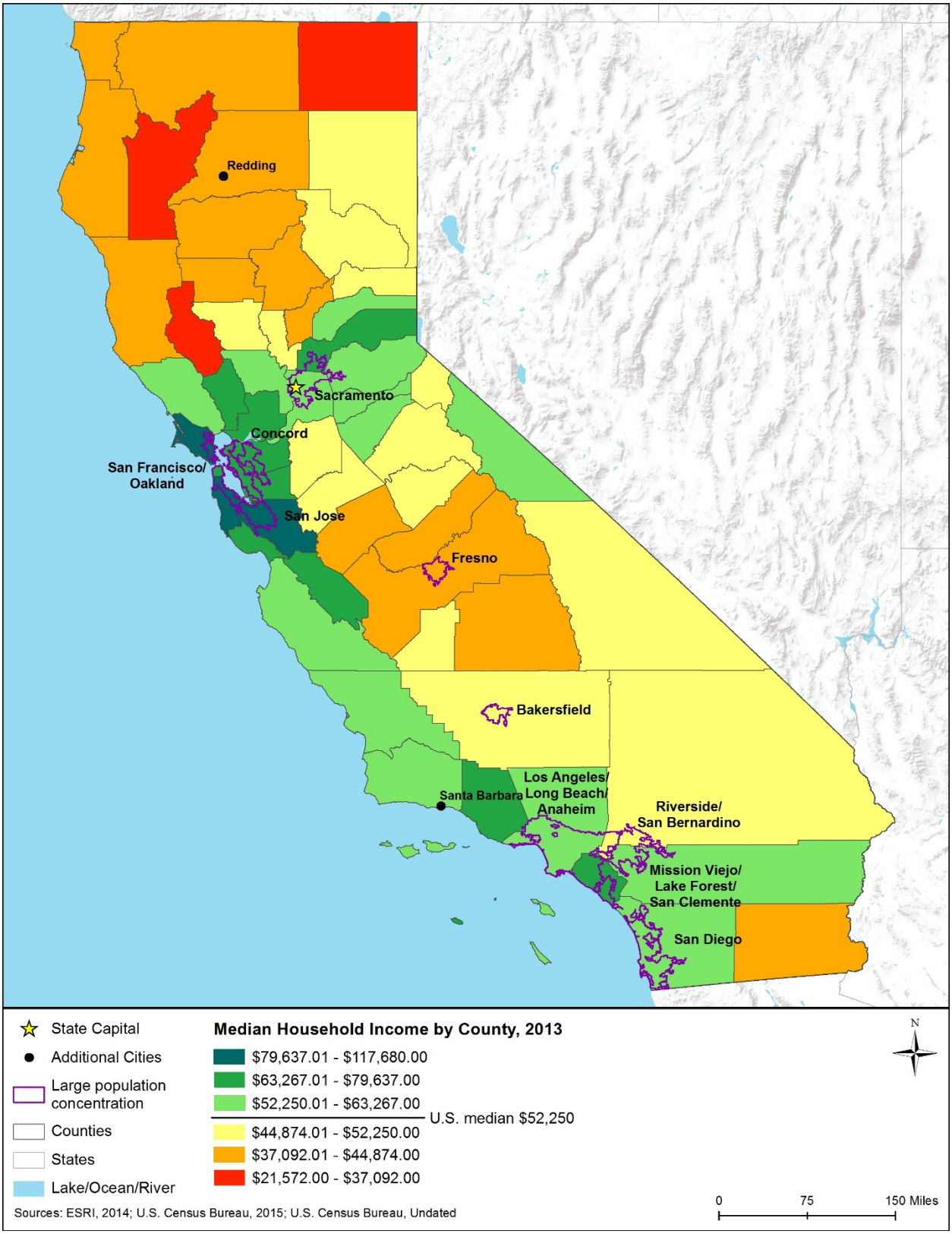


Figure 4.1.9-2: Median Household Income in California, by County, 2013

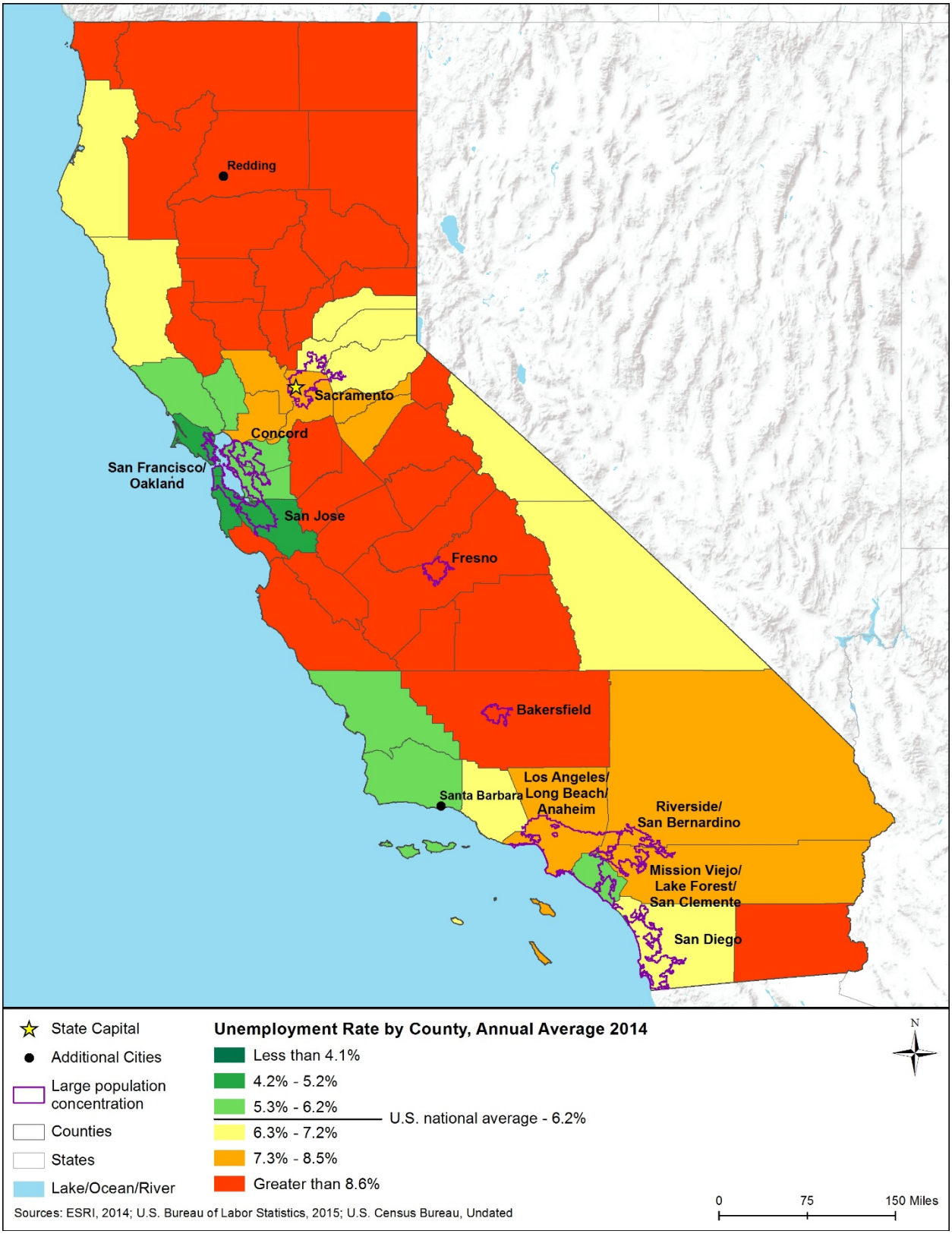


Figure 4.1.9-3: Unemployment Rates in California, by County, 2014

Table 4.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in California, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Bakersfield	$50,673	13.4%
Concord	$99,497	8.4%
Fresno	$46,554	14.6%
Los Angeles/Long Beach/Anaheim	$58,702	11.1%
Mission Viejo/Lake Forest/San Clemente	$91,881	7.8%
Riverside/San Bernardino	$55,852	15.0%
Sacramento	$58,616	13.0%
San Diego	$62,580	10.0%
San Francisco/Oakland	$74,840	9.4%
San Jose	$91,806	9.6%
California (statewide)	$61,094	11.5%

Source: (U.S. Census Bureau, 2015l)

Table 4.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	California	West Region	United States
Civilian Employed Population 16 Years and Over	17,132,696	26,912,315	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	78.1%	78.4%	79.7%
Government workers	13.5%	13.9%	14.1%
Self-employed in own not incorporated business workers	8.3%	7.5%	6.0%
Unpaid family workers	0.2%	0.2%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	2.4%	2.5%	2.0%
Construction	6.1%	6.1%	6.2%
Manufacturing	9.8%	9.5%	10.5%
Wholesale trade	3.1%	2.9%	2.7%
Retail trade	11.3%	11.6%	11.6%
Transportation and warehousing, and utilities	4.6%	4.7%	4.9%
Information	2.9%	2.6%	2.1%
Finance and insurance, and real estate and rental and leasing	6.3%	6.3%	6.6%
Professional, scientific, management, administrative, and waste management services	12.8%	12.3%	11.1%
Educational services, and health care and social assistance	20.8%	20.9%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	10.2%	10.9%	9.7%
Other services, except public administration	5.3%	5.2%	5.0%
Public administration	4.4%	4.6%	4.7%

Source: (U.S. Census Bureau, 2015m)

Table 4.1.9-8 presents employment shares for selected industries for the 10 largest population concentrations in the state. The table reflects survey data taken by the Census Bureau from 2009 to 2013. Thus, its figures for the state are slightly different from those in Table 4.1.9-7 for 2013.

Table 4.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in California, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Bakersfield	6.3%	5.2%	1.2%	8.2%
Concord	5.6%	3.9%	3.4%	17.6%
Fresno	5.5%	4.8%	1.5%	9.5%
Los Angeles/Long Beach/Anaheim	5.7%	5.0%	3.8%	12.5%
Mission Viejo/Lake Forest/San Clemente	5.2%	3.1%	2.6%	16.3%
Riverside/San Bernardino	7.9%	7.0%	1.3%	8.8%
Sacramento	6.0%	4.5%	2.3%	11.8%
San Diego	5.6%	3.7%	2.3%	14.6%
San Francisco/Oakland	5.0%	4.8%	3.4%	17.5%
San Jose	4.9%	2.7%	4.0%	19.1%
California (statewide)	6.0%	4.6%	2.8%	12.6%

Source: (U.S. Census Bureau, 2015l)

Housing

The housing stock is an important socioeconomic component of communities. The type, availability, and cost of housing in an area reflect economic conditions and affect quality of life. Table 4.1.9-9 compares California to the West region and nation on several common housing indicators.

As shown in Table 4.1.9-9, in 2013, California had a higher percentage of housing units that were occupied (91.7 percent) than the region (89.9 percent) or nation (87.6 percent). Of the occupied units, California had a lower percentage of owner-occupied units (53.8 percent) than the region (56.8 percent) or nation (63.5 percent). The percentage of detached single-unit housing (also known as single-family homes) in California in 2013 (58.1 percent) was lower than the region (60.3 percent) and the nation (61.5 percent). The homeowner vacancy rate in California (1.3 percent) was lower than the rate for the region (1.6 percent) and the nation (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015h). The vacancy rate among rental units in California (4.2 percent) was lower than in the region (5.1 percent) and the nation (6.5 percent).

Table 4.1.9-9: Selected Housing Indicators for California, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
California	13,791,262	91.7%	53.8%	1.3%	4.2%	58.1%
West Region	23,159,156	89.9%	56.8%	1.6%	5.1%	60.3%
United States	132,808,137	87.6%	63.5%	1.9%	6.5%	61.5%

Source: (U.S. Census Bureau, 2015n)

Table 4.1.9-10 provides housing indicators for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does present variation in these indicators for population concentrations across the state and compared to the state average for the 2009 to 2013 period.

Table 4.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in California, 2009–2013

Area	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Bakersfield	177,419	92.4%	56.8%	2.2%	5.5%	71.8%
Concord	48,009	93.5%	60.5%	1.6%	6,2%	59.3%
Fresno	230,463	92.3%	52.7%	1.9%	6.8%	64.8%
Los Angeles/Long Beach/Anaheim	4,229,594	93.9%	48.2%	1.3%	4.3%	49.1%
Mission Viejo/Lake Forest/San Clemente	234,547	93.1%	70.1%	1.5%	5.2%	54.8%
Riverside/San Bernardino	591,160	92.6%	62.8%	2.4%	7.0%	70.9%
Sacramento	679,996	93.1%	59.0%	2.0%	6.2%	66.3%
San Diego	1,118,428	92.4%	53.0%	1.9%	4.7%	50.2%
San Francisco/Oakland	1,342,733	92.9%	49.9%	1.3%	4.0%	44.3%
San Jose	597,177	95.8%	56.8%	1.0%	3.1%	52.7%
California (statewide)	13,726,869	91.4%	55.3%	1.8%	4.9%	58.1%

Source: (U.S. Census Bureau, 2015o)

Property Values

Property values have important relationships to both the wealth and affordability of communities as an indicator of cost of living. Table 4.1.9-11 provides indicators of residential property values for California and compares these values to values for the West region and nation. The figures on median value of owner-occupied units are from the Census Bureau's ACS, based on owner estimates of how much their property (housing unit and land) would sell for if it were for sale (U.S. Census Bureau, 2015h).

The table shows that the median value of owner-occupied units in California in 2013 ($373,100) was considerably higher than the corresponding values for the West region ($301,787) and the nation ($173,900).

Table 4.1.9-11: Residential Property Values in California, 2013

Geography	Median Value of Owner-Occupied Units
California	$373,100
West Region	$301,787
United States	$173,900

Source: (U.S. Census Bureau, 2015n)

Table 4.1.9-12 presents residential property values for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does show variation in property values for population concentrations across the state and compared to the state average for the 2009 to 2013 period. The median property value for these 10 communities ranged from $167,600 in the Bakersfield area to $650,700 in the San Jose area; the state median value was $366,400. The lowest and highest property values were generally in the same areas that had the lowest and highest median household incomes (Table 4.1.9-6).

Table 4.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in California, 2009–2013

Area	Median Value of Owner-Occupied Units
Bakersfield	$167,600
Concord	$622,900
Fresno	$200,600
Los Angeles/Long Beach/Anaheim	$441,500
Mission Viejo/Lake Forest/San Clemente	$575,700
Riverside/San Bernardino	$225,500
Sacramento	$257,800
San Diego	$401,300
San Francisco/Oakland	$604,200
San Jose	$650,700
California (statewide)	$366,400

Source: (U.S. Census Bureau, 2015o)

Government Revenues

State and local governments obtain revenues from many sources. FirstNet projects may affect flows of revenue sources between different levels of government due to program financing and intergovernmental agreements for system development and operation. Public utility taxes[157] are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. These revenue streams are typically highly localized and therefore are best considered in the deployment phase of FirstNet. State and local governments may obtain some additional revenues related to telecommunications infrastructure.

Table 4.1.9-13 shows that state and local governments in California received more total revenue in 2012 on a per capita basis than their counterpart governments in the region and nation. Levels per capita of intergovernmental revenues[158] from the federal government were similar for the California state government to counterpart governments in the region, and lower than for counterparts in the nation. Local governments in California had somewhat higher levels per capita of intergovernmental revenues from the federal government than local governments in the region and nation. State and local governments in California reported per capita revenue levels from property taxes that were consistent with those reported by their counterparts in the region and nation. General sales taxes on a per capita basis were similar on a per capita basis for California, the region, and nation for state government and for local governments. Selective sales taxes, and public utility taxes[159] specifically, were lower on a per capita basis for the California state government, and higher for California local governments, when compared to counterpart governments in the region and nation. Individual and corporate income tax revenues, on a per capita basis, were higher for the California state government than for those governments in the region and nation. Local governments in California reported no revenue from individual or corporate income taxes.

Table 4.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		California		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$250,971	$252,050	$371,456	$354,200	$1,907,027	$1,615,194
Per capita		$6,597	$6,626	$6,217	$5,928	$6,075	$5,145
Intergovernmental from Federal	($M)	$54,145	$11,122	$87,391	$15,822	$514,139	$70,360
Per capita		$1,423	$292	$1,463	$265	$1,638	$224
Intergovernmental from State	($M)	$0	$87,966	$0	$117,358	$0	$469,147

[157] Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006).
[158] Intergovernmental revenues are those revenues received by one level of government from another level of government, such as shared taxes, grants, or loans and advances (U.S. Census Bureau, 2006).
[159] Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006).

Type of Revenue		California		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Per capita		$0	$2,312	$0	$1,964	$0	$1,495
Intergovernmental from Local	($M)	$3,281	$0	$4,161	$0	$19,518	$0
Per capita		$86	$0	$70	$0	$62	$0
Property Taxes	($M)	$2,080	$49,486	$4,982	$71,927	$13,111	$432,989
Per capita		$55	$1,301	$83	$1,204	$42	$1,379
General Sales Taxes	($M)	$31,254	$9,701	$52,737	$14,896	$245,446	$69,350
Per capita		$822	$255	$883	$249	$782	$221
Selective Sales Taxes	($M)	$10,088	$4,885	$19,137	$7,418	$133,098	$28,553
Per capita		$265	$128	$320	$124	$424	$91
Public Utilities Taxes	($M)	$766	$3,043	$1,368	$4,323	$14,564	$14,105
Per capita		$20	$80	$23	$72	$46	$45
Individual Income Taxes	($M)	$55,024	$0	$65,157	$0	$280,693	$26,642
Per capita		$1,446	$0	$1,091	$0	$894	$85
Corporate Income Taxes	($M)	$7,949	$0	$9,219	$52	$41,821	$7,210
Per capita		$209	$0	$154	$1	$133	$23

Sources: (U.S. Census Bureau, 2015p) (U.S. Census Bureau, 2015q)

Note: This table does not include all sources of government revenue. Summation of the specific source rows does not equal total revenue.

4.1.10 Environmental Justice

4.1.10.1 Definition of the Resource

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO (see Section 1.8.12, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations).[160] The fundamental principle of environmental justice as stated in the EO is, "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (Executive Office of the President, 1994). Under the EO, each federal agency must "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Office of the President, 1994). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (U.S. Department of Commerce, 2013).

[160] See https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice.

In 1997, the Council on Environmental Quality (CEQ) issued *Environmental Justice: Guidance under the National Environmental Policy Act (NEPA)* to assist federal agencies in meeting the requirements of the EO (CEQ, 1997a). Additionally, the USEPA Office of Environmental Justice (USEPA, 2015i) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015j).

The CEQ guidance provides several important definitions and clarifications that this PEIS utilizes:

- Minority populations consist of "Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic."
- Low-income populations consist of individuals living in poverty, as defined by the U.S. Census Bureau (Census Bureau).
- Environmental effects include social and economic effects. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment" (CEQ, 1997a).

4.1.10.2 Specific Regulatory Considerations

In 1999, California passed its first environmental justice law, Senate Bill 115, designating the Governor's Office of Planning and Research (OPR) as the lead and coordinating agency for environmental justice-related programs and several other state programs. This legislation formally defined environmental justice as the "the fair treatment of people of all races, cultures and income with respect to development, adoption and implementation of environmental laws, regulations and policies." California Government Code § 65040.12(c) (Governor's Office of Planning and Research, 2003)

As directed by the legislation, OPR's responsibilities include:

- Consulting with state agencies and other stakeholders and the public.
- Serving as a clearinghouse of information and central point of contact for environmental justice efforts.
- The OPR Environmental Justice Coordinating Committee, consisting of the directors of all State Agencies, Boards, Departments, and Constitutional Offices, coordinates California's environmental justice efforts. The Coordinating Committee meets quarterly to encourage the state agencies to incorporate environmental justice into their missions, policies, programs, and activities.
- The Environmental Justice Steering Committee, consisting of representatives of state agency and department directors, meets monthly to identify ways in which the state can address concerns through statutory, regulatory, or policy and practice reform. The committee makes recommendations to the OPR Director and acts as environmental justice liaisons for their

respective departments/agencies to achieve coordinated state responses to environmental justice issues. (Governor's Office of Planning and Research, 2003)

Furthermore, this law required CalEPA to develop a model environmental justice mission statement for its boards, departments, and offices. Several CalEPA agencies developed their own EJ programs, strategies, pilot projects and/or other activities and provide information about these programs on their websites. (Governor's Office of Planning and Research, 2003)

Subsequent Legislation:

- Senate Bill 89, passed in 2000, required the creation of a working group and a public advisory committee to assist CalEPA in the development of an interagency strategy for environmental justice.
- AB 1553 required OPR to develop guidelines for local agencies when addressing EJ issues in its general plans.
- Senate Bill 1110 required OPR to develop advisory guidelines for addressing EJ matters in city and county general plans. It is a technical amendment, replicating the requirements of AB 1553. (University of California, Hastings College of Law, 2010)

Federal laws relevant to environmental justice are summarized in Section 1.8, Overview of Relevant Federal Laws and Executive Orders.

4.1.10.3 Environmental Setting: Minority and Low-Income Populations

Table 4.1.10-1 presents 2013 data on the composition of California's population by race and by Hispanic origin. The state's population has a percentages of individuals who identify as Black/African American (5.9 percent) that is considerably lower than that of the nation (12.6 percent) and similar to that of the region (5.2 percent). The state's population has higher percentages of individuals who identify as Asian (13.6 percent) or Some Other Race (12.9 percent) than the populations of the region and the nation. (Those percentages are, for Asian, 10.5 percent and 5.1 percent respectively; and for Some Other Race, 10.0 percent and 4.7 percent respectively.) The state's percentage of persons identifying as White (61.9 percent) is substantially lower than that of the West region (68.3 percent) or the nation (73.7 percent).

The percentage of the population in California that identifies as Hispanic (38.4 percent) is considerably higher than in the West region (31.5 percent), and the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. California's All Minorities population percentage (61.2 percent) is considerably higher than that of the West region (51.2 percent) and the nation (37.6 percent).

Table 4.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for California (16.8 percent) is similar to that for the West region (16.6 percent) and higher than that for the nation (15.8 percent).

Table 4.1.10-1: Population by Race and Hispanic Status, 2013

Geography	Total Population (estimated)	Race							Hispanic	All Minorities[a]
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races		
California	38,332,521	61.9%	5.9%	0.7%	13.6%	0.4%	12.9%	4.5%	38.4%	61.2%
West Region	60,262,888	68.3%	5.2%	1.3%	10.5%	0.4%	10.0%	4.3%	31.5%	51.2%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

Source: (U.S. Census Bureau, 2015r)
[a] "All Minorities" is defined as all persons other than Non-Hispanic White. Because some Hispanics identify as both Hispanic and of a non-White race, "All Minorities" is less than the sum of Hispanics and non-White races.

Table 4.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
California	16.8%
West Region	16.6%
United States	15.8%

Source: (U.S. Census Bureau, 2015s)

4.1.10.4 Environmental Justice Screening Results

Analysis of environmental justice in a NEPA document typically begins by identifying potential environmental justice populations in the project area. Appendix B, Environmental Justice Methodology, presents the methodology used in this PEIS to screen each state for the presence of potential environmental justice populations. The methodology builds on CEQ guidance and best practices used for environmental justice analysis. It uses data at the census-block group level; block groups are the smallest geographic units for which regularly updated socioeconomic data are readily available at the time of writing.

Figure 4.1.10-1 visually portrays the results of the environmental justice population screening analysis for California. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015d) (U.S. Census Bureau, 2015t) (U.S. Census Bureau, 2015u) (U.S. Census Bureau, 2015v) and Census Bureau urban classification data (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015e).

Figure 4.1.10-1 shows that a high proportion of California has high potential for environmental justice populations. The distribution of these high potential areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations. The distribution of areas with moderate potential for environmental justice populations is also fairly even across the state.

It is important to understand how the data behind Figure 4.1.10-1 affect the visual impact of this map. Block groups have similar populations (hundreds to a few thousand individuals) regardless of population density. In sparsely populated areas, a single block group may cover tens or even

hundreds of square miles, while in densely populated areas, block groups each cover much less than a single square mile. Thus, while large portions of the state outside the areas defined as large population concentrations show moderate or high potential for environmental justice populations, these low density areas reflect modest numbers of minority or low-income individuals compared to the potential environmental justice populations within densely populated areas. The overall effect of this relative density phenomenon is that the map visually shows large areas of the state having environmental justice potential, but this over-represents the presence of environmental justice populations.

It is also very important to note that Figure 4.1.10-1 does not definitively identify environmental justice populations. It indicates *degrees of likelihood of the presence* of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. Block group data may under- or over-represent the presence of these localized communities. For instance, in the large block groups in sparsely populated regions of the state, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the moderate potential category draws a wide net for potential environmental justice populations. As discussed in Appendix B, the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. Before FirstNet deploys projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Such analyses could tier off the methodology of this PEIS.

This map also does not indicate whether FirstNet projects would have actual impacts on environmental justice populations. An environmental justice effect on minority or low-income populations only occurs if the effect is harmful, significant (according to significance criteria), and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (CEQ, 1997a). The Environmental Consequences section (Section 4.2) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

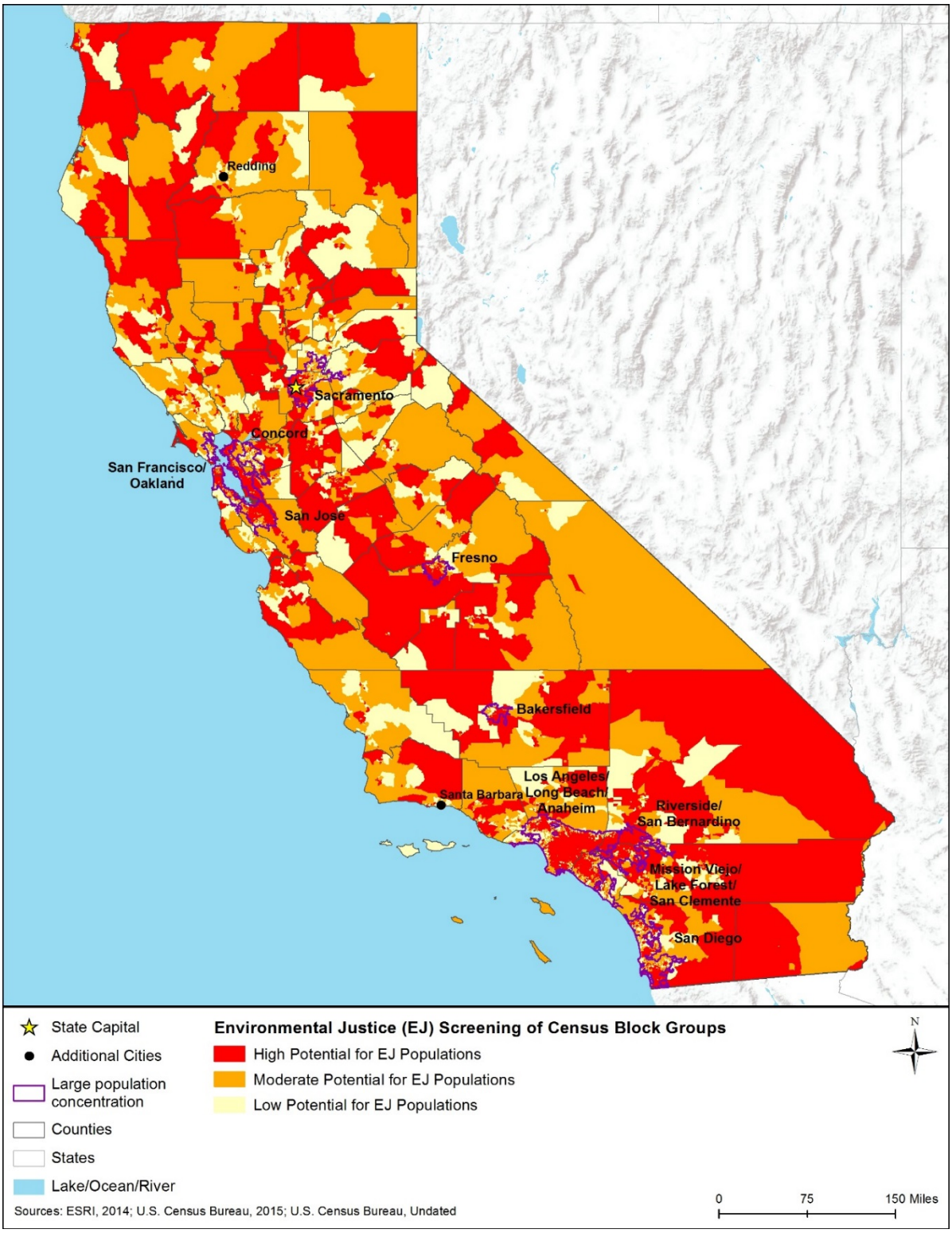


Figure 4.1.10-1: Potential for Environmental Justice Populations in California, 2009–2013

4.1.11 Cultural Resources

4.1.11.1 Definition of Resource

For the purposes of this Programmatic Environmental Impact Statement (PEIS), Cultural Resources are defined as:

> Natural or manmade structures, objects, features, locations with scientific, historic, and cultural value, including those with traditional religious or cultural importance and any prehistoric or historic district, site, or building included in, or eligible for inclusion in, the National Register of Historic Places (NRHP).

This definition is consistent with the how cultural resources are defined in the:

- The statutory language and implementing regulations for Section 106 of the NHPA, formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- The statutory language and Implementing regulations for the Archaeological Resources Protection Act of 1979 (ARPA), 16 U.S.C. 470cc(c) and 43 CFR 7.3(a);
- The statutory language and implementing regulations for the Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3001(3)(D) and 43 CFR 10.2(d);
- NPS's program support of public and private efforts to identify, evaluate, and protect America's historic and archaeological resources (NPS, 2016f); and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to American Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

4.1.11.2 Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Cultural Resources include the NHPA (detailed in Section 1.8, Overview of Relevant Federal Laws and Executive Orders), the American Indian Religious Freedom Act (AIRFA), ARPA, and NAGPRA. Appendix C, Environmental Laws and Regulations, summarizes these pertinent federal laws.

The California Environmental Quality Act (CEQA) is similar to NEPA (California Office of Historic Preservation, 2005). While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations.

Table 4.1.11-1 presents state and local laws and regulations that relate to cultural resources.

Table 4.1.11-1: Relevant California Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CEQA (Public Resources Code Section 2011 et seq.)	Various California state agencies, including the California Office of Historic Preservation (COHP)	CEQA parallels NEPA and NHPA for state and local actions.

4.1.11.3. Cultural Setting

Human beings have inhabited present day California for more than 14,000 years (Potter, 2011). Most of what archaeologists know about the prehistory of California comes from archaeological excavations, interactions with the indigenous populations during the Protohistoric (contact) Period, and ethnographic research. California has 194 archaeological sites listed in the National Register of Historic Places (NRHP).

Archaeologists typically divide the state into cultural regions with specific progressions of societal evolution, which are in turn associated with certain environmental settings and societies' adaptations to those settings. For example, the subsistence strategy of desert inhabitants is different from that of coastal area inhabitants. The sequences of cultural change in the archaeological record are organized into understandable periods that are demarcated by artifacts, subsistence strategies, and other cultural expressions.

Archaeological sites in California are generally found within the first two or three meters of the surface, with significant variability throughout the state. They are present in all geographic regions including coasts, islands, deserts, forests, temperate rainforests, high deserts, and mountains. Many of California's archaeological sites have been disturbed by development, and may contain deposits in both shallow and deeper levels of soil.

The following discussion summarizes California's prehistoric periods and the proto-historic (contact) period. Section 4.1.11.4 presents an overview of the initial human habitation in California and the cultural development that occurred before European contact. Section 4.1.11.5 discusses the federally recognized American Indian tribes with a cultural affiliation to the state. Section 4.1.11.6 provides a current list of significant archaeological sites in California and tools that the state has developed to ensure their preservation. Section 4.1.11.7 documents the historic context of the state since European contact and Section 4.1.11.8 summarizes the architectural context of the state during the historic period.

4.1.11.4. Prehistoric Setting

There are numerous sequences for California's prehistoric past, resulting from the variability and complexity of California's American Indian societies, as well as the different physiographic regions American Indians have inhabited both historically and in the present. The following overview uses the cultural periods that most archaeologists employ to describe the prehistoric periods of the Central Coast (from the northern San Diego region through southern San Francisco and the Bay Area): the Paleoindian Period (12000 - 8000 B.C.), the Millingstone/Early

Archaic Period (8000 - 3500 B.C.), the Early Period (3500 B.C. - 600 B.C.), the Middle Period (600 B.C. - A.D. 1250), and the Late Protohistoric Periods (A.D. 1250 - 1769). American Indians have historically inhabited all of the physiographic regions of California, including the interior deserts and the islands along the coast (Figure 4.1.3-1).

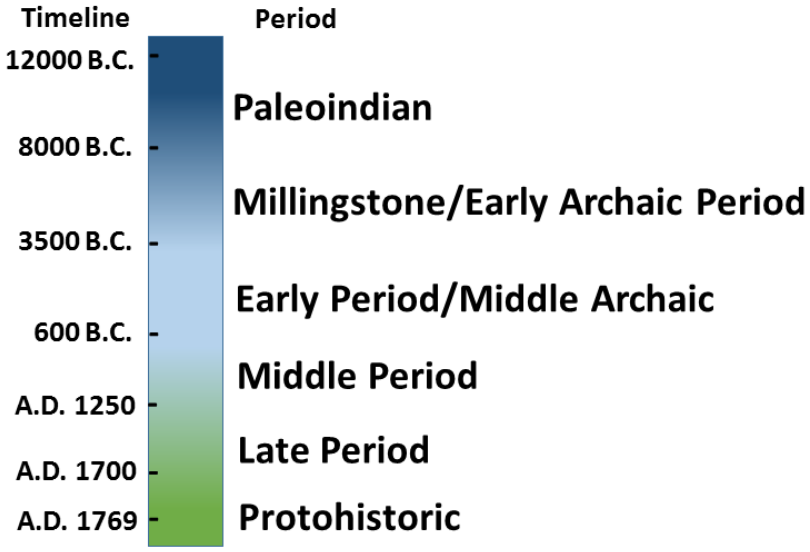


Figure 4.1.11-1: Timeline of Prehistoric Human Occupation

Source: (Society for California Archaeology, 2016)

Paleoindian Period (12000 - 8000 B.C.)

The Paleoindian Period ranges from 12000 to 8000 B.C. and includes the oldest archaeological sites in California. These sites were occupied by the earliest settlers from Asia who crossed the Bering Land Bridge in the terminal Pleistocene, probably following Pleistocene fauna (Dillon, 2002). The earliest cultures in California lived in small nomadic groups and used large fluted projectile points (commonly known as "Clovis" or "Folsom" projectile points), which are associated with large game hunting (Erlandson, Rick, Jones, & Porcasi, 2007).

The Paleoindian Period Western Pluvial Lakes archaeological assemblage is from a culture that occupied California's Great Basin in the Terminal Pleistocene and Early Holocene Epochs, when there were numerous lakes, marshes, estuaries, and freshwater islands throughout the region. These wetlands attracted hunter-gatherers from further north, who followed the migration of ducks and geese into the area. The crescent-shaped stone tools in the Western Pluvial Lakes archaeological assemblage were possibly associated with the hunting of wetland waterfowl (Moss, 2013).

Aboriginal Californians also settled along the Pacific coastline where they had hunter-gatherer-fisher subsistence strategies, which eventually included the use of watercraft. Paleoindian archaeological sites excavated on the Channel Islands (west of present day Los Angeles) show the use of smaller and more delicate projectile points. These tools are believed to have been

adaptations to changes in the type of game and food that these groups were hunting (Rondeau, 2007).

The notable lack of evidence for milling stones during this period suggests that California's Paleoindians societies likely relied more heavily on meat and fish than on plants and seeds that needed to be ground or processed.

Archaic Period (10,000 to 3,000 B.C.)

The Millingstone/Early Archaic Period (also referred to as the Millingstone Horizon Period) ranges from 8000 to 3500 B.C., and is associated with a more sedentary and specialized form of subsistence. This period marked a shift from large game hunting to plant and seed gathering. These plants and seeds were processed with mortars, pestles, hand stones, and portable grinding stones known as metates, which are cultural markers that distinguishes this period from the preceding Paleoindian Period. Once thought to be isolated to southern California, archaeologists have determined that the Millingstone Horizon Period spanned both northern and southern California during the Early Holocene (Fitzgerald, 1999). This period is also noted for human burials under rock cairns (Wallace, 1955). It is important to note that the Millingstone Horizon Period also contains archaeological sites where ground stones do not dominate the archaeological assemblage due to environmental and cultural factors leading to alternative subsistence strategies, such as a continued heavier reliance on game meat and fish (Fitzgerald, 1999).

The Salinas River Crossing Site in San Luis Obispo County is an example of a typical site from the Millingstone Horizon Period, with handstones and groundstones greatly outnumbering projectile points. This site, and other sites from the Millingstone Horizon Period, also demonstrates that small animals were more prominent than larger game, which were likely hunted with traps and other methods of capture (McGuire, 1994).

The Early Period/Middle Archaic Period ranged from 3500 to 600 B.C. and is marked by the emergence of cut shell beads, which became important economically and symbolically throughout American Indian prehistory to the present. These beads were fashioned into necklaces, made primarily from purple olive (*Olivella biplicata)* and abalone (*Haliotis asinina)* shells, and were traded among American Indian societies throughout the state. As a currency, the beads led coastal American Indians to engage in shell bead manufacture and served to integrate regional economies and environments through widespread trade (Farmer, 2008).

In addition, the Early Period/Middle Archaic Period is characterized by a drier and warmer climate throughout the state. This resulted in the stabilization of watersheds and the shrinking of lakes throughout the state, such as Tulare Lake (in the southern San Joaquin Valley) and Lake Cahuilla (in southeastern California and northeastern Baja California, Mexico) (Rosenthal, White, & Sutton, 2007). This may have prompted American Indian societies to shift their subsistence strategies to more terrestrial and mammalian types of protein sources, as well as coastal subsistence strategies focused on fish, shellfish, and sea mammals (Rosenthal, White, & Sutton, 2007).

The Early Period/Middle Archaic Period is also been known as the "Hunting Culture" period because it is marked by large quantities and varieties of stemmed and notched projectile points.

This sudden increase in the quantity of projectile points in archaeological sites indicates an addition to the Millingstone Horizon culture; the resurgence of hunting did not displace the milling culture – it expanded subsistence strategies among California American Indians during this period. Commonly hunted animals during this period included deer, rabbits, sea otters, and fish (Jones, 2007).

Middle Period (600 B.C. - A.D. 1250)

The Middle Period of California prehistoric history is poorly defined, partially because the period is characterized by variation and transition. The "variation" that is seen stems from the fact that many archaeological sites show traits of both the Early Period and Late Period, while the "transition" relates to the fact that the material record was shifting from a less complex trade network, including more scattered settlements and seemingly less complex societies, to a series of complex chiefdoms. The more complex chiefdoms had densely populated settlements and regional economic integration, both of which have masked clear delineation of Middle Period (Cartier, 1988).

In the Central Valley and other interior parts of California, the Middle Period has been described as a shift towards larger sedentary villages near perennial water sources. Archaeological sites found near these water sources are generally rich in projectile points, atlatls, and shell beads (Hughes, 1994). At an archaeological site at Rincon Point, south of present day Carpinteria, CA, the transition into the Middle Period was found also to be associated with a broadening of food sources diet. Due to population increases and pressures on terrestrial resources, there was a shift towards increased exploitation of marine resources including fish, shellfish, and sea mammals (Peterson, 1984).

Late Period (A.D. 1250 - 1769)

The indigenous population of California reached its peak during the Late Period, and cultures became more complex in correlation with population increases and densities. A new kind of emphasis on sedentism, status ascription, and religious and ceremonial integration are hallmarks of this period (Milliken, et al., 2007). Burials during this time are marked by considerable investments in wealth for the dead. The quantity and types of shell beads throughout California rose sharply during the Late Period, with beads made with multiple perforations out of purple olive and abalone shells (Fredrickson, 1973).

The complex chiefdoms along the central California coast were composed primarily of non-agricultural hunters and gatherers. The Chumash of the Santa Barbara area and Channel Islands reached a high level of cultural complexity, with a large, complex trade network composed of inhabitants of the Channel Islands, coastal areas, mountains, and interior valleys who shared similar religious, economic, social, cultural, and political perspectives. This society was defined by specialized labor status and inherited status and wealth (Arnold, 1996). For example, the Channel Islands became a kind of "mint" where Chumash Native Californians specialized in producing large amounts of manufactured goods to be traded throughout the Central California region. There are archaeological sites on Santa Cruz Island where hundreds of thousands of artifacts from shell bead manufacturing activities have been found on a single site (Brandoff &

Reeves, 2014). In the mainland interior, hunters would trade processed animal skins and bones with the coastal and islands communities.

Protohistoric Period (A.D. 1519 to 1769)

The Protohistoric Period is characterized by the intrusion of Spanish colonial culture into the geography and lifeways of California's American Indians, beginning with Juan Rodriguez Cabrillo's voyage to San Diego Bay in 1542. The first presidio (military structure) and permanent village of Cosoy in 1769. Cosoy was initially settled by the Kumeyaay and was occupied from the Middle Archaic through the Protohistoric Period. This archaeological site, known as the Charles H. Brown Site, shows a clear transition from the Late Period to the Protohistoric Period through the presence of Spanish ceramics, glass beads, and other introduced technologies (LaRose, 2009). The Brown Site is remarkable because through its study it is possible to see the indigenous population's resistance to colonialism, as a portion of the Kumeyaay moved into the Presidio and Mission, while others stayed behind in resistance to Christian spirituality and Spanish power (Ezell, 1987) (LaRose, 2009).

Throughout southern California, numerous American Indian archaeological sites show the sudden presence of glass beads and other European goods. The glass beads (primarily from Italy) were traded between the Spanish and California American Indians, and became valuable symbolic and economic items. The introduction of these European beads are correlated with a decline in manufacture of purple olive shell beads throughout California (Arkush, 1993) (Farmer, 2008).

Most prominently, the Protohistoric Period is noted for massive displacements of American Indian populations throughout California. These populations were both voluntarily and forcefully brought into Spanish areas of power and used as labor in the construction of presidios and missions throughout the state (Sandos, 2004).

4.1.11.5 Federally Recognized Tribes of California

According to the Bureau of Indian Affairs and the National Conference of State Legislators, the State of California is home to more people of American Indian descent than any other state in the country. Currently, there are 111 federally recognized American Indian groups in California. Federally recognized tribal reservation locations are highlighted in bold in Figure 4.1.11-2.

Table 4.1.11-2: List of Federally Recognized Tribes of California

Agua Caliente Band of Cahuilla Indians of the Agua Caliente Indian Reservation	Greenville Rancheria	Quechan Tribe of the Fort Yuma Indian Reservation (Arizona and California)
Alturas Indian Rancheria	Grindstone Indian Rancheria of Wintun-Wailaki Indians of California	Ramona Band or Village of Cahuilla Mission Indians of California
Augustine Band of Cahuilla Indians	Guidiville Rancheria of California	Redding Rancheria
Bear River Band of the Rohnerville Rancheria	Habematolel Pomo of Upper Lake	Redwood Valley Rancheria of Pomo Indians of California
Berry Creek Rancheria of Maidu Indians of California	Hoopa Valley Tribe	Resighini Rancheria

Big Lagoon Rancheria	Hopland Band of Pomo Indians	Rincon Band of Luiseño Mission Indians of the Rincon Reservation
Big Pine Band Paiute Tribe of the Owens	Inaja Band of Diegueño Mission Indians of the Inaja and Cosmit Reservation	Robinson Rancheria of Pomo Indians of California
Big Sandy Rancheria of Western Mono Indians of California	Ione Band of Miwok Indians of California	Round Valley Indian Tribes of the Round Valley Reservation
Big Valley Band of Pomo Indians of the Big Valley Rancheria	Jackson Band of Miwuk Indians	Rumsey Indian Rancheria of Wintun Indians of California
Blue Lake Rancheria	Jamul Indian Village of California	San Manual Band of Serrano Mission Indians of the San Manuel Reservation
Bridgeport Indian Colony	Karuk Tribe	San Pasqual Band of Diegueño Mission Indians of California
Buena Vista Rancheria of Me-Wuk Indians of California	Kashia Band of Pomo Indians of the Stewart's Point Rancheria	Santa Rosa Indian Community of the Santa Rosa Rancheria
Cabazon Band of Mission Indians	La Jolla Band of Luiseño Mission Indians of the La Jolla Reservation	Santa Rosa Band of Cahuilla Indians (formerly the Santa Rosa Band of Cahuilla Mission Indians of the Santa Rosa Reservation)
Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria	La Posta Band of Diegueño Mission Indians of the La Posta Indian Reservation	Santa Ynez Band of Chumash Mission Indians of the Santa Ynez Reservation
Cahuilla Band of Mission Indians of the Cahuilla Reservation	Los Coyotes Band of Cahuilla & Cupeno Indians of the Los Coyotes Reservation	Lipay Nation of Santa Ysabel (Previously listed as the Santa Ysabel Band of Diegueño Mission Indians of the Santa Ysabel Reservation)
Cahto Indian Tribe of the Laytonville Rancheria	Lower Lake Rancheria	Scotts Valley Band of Pomo Indians of California
California Valley Miwok Tribe	Lytton Rancheria of California	Sheep Ranch Rancheria of Me-Wuk Indians
Campo Band of Diegueño Mission Indians of the Campo Indian Reservation	Manchester Band of Pomo Indians of the Manchester-Point Arena Rancheria	Sherwood Valley Rancheria of Pomo Indians of California
Capitan Grande Band of Diegueño Mission Indians of California: Barona Group of Capitan Grande Band of Mission Indians of the Barona Reservation; Viejas (Baron Long) Group of Capitan Grande Band of Mission Indians of the Viejas Reservation Cedarville Rancheria	Manzanita Band of Diegueño Mission Indians of the Manzanita Reservation	Shingle Springs Band of Miwok Indians, Shingle Springs Rancheria (Verona Tract)
Chemehuevi Indian Tribe of the Chemehuevi Reservation	Mechoopda Indian Tribe of Chico Rancheria	Smith River Rancheria
Cher-Ae Heights Indian Community of the Trinidad Rancheria	Mesa Grande Band of Diegueño Mission Indians of the Mesa Grande Reservation	Soboba Band of Luiseño Indians
Chicken Ranch Rancheria of Me-Wuk Indians of California	Middletown Rancheria of Pomo Indians of California	Susanville Indian Rancheria

Cloverdale Rancheria of Pomo Indians of California	Mooretown Rancheria of Maidu Indians of California	Sycuan Band of the Kumeyaay Nation (formerly the Sycuan Band of Diegueno Mission Indians of California)
Cold Springs Rancheria of Mono Indians of California	Morongo Band of Cahuilla Mission Indians of the Morongo Reservation	Table Bluff Reservation-Wiyot Tribe
Colorado River Indian Tribes of the Colorado River Indian Reservation (Arizona and California)	Northfork Rancheria of Mono Indians of California	Table Mountain Rancheria of California
Cortina Indian Rancheria of Wintun Indians of California	Paiute-Shoshone Indians of the Bishop Community of the Bishop Colony	Torres-Martinez Desert Cahuilla Indians (formerly the Torres-Martinez Band of Cahuilla
Coyote Valley Band of Pomo Indians of California	Paiute-Shoshone Indians of the Lone Pine Community of the Lone Pine Reservation	Mission Indians of California)
Death Valley Timbi-Sha Shoshone Tribe	Pala Band of Luiseño Mission Indians of the Pala Reservation	Tule River Indian Tribe of the Tule River Reservation
Dry Creek Rancheria of Pomo Indians	Paskenta Band of Nomlaki Indians of California	Tuolumne Band of Me-Wuk Indians of the Tuolumne Rancheria of California
Elem Indian Colony of Pomo Indians of the Sulphur Bank Rancheria	Pauma Band of Luiseño Mission Indians of the Pauma & Yuima Reservation	Twenty-Nine Palms Band of Mission Indians of California
Elk Valley Rancheria	Pechanga Band of Luiseño Mission Indians of the Pechanga Reservation	United Auburn Indian Community of the Auburn Rancheria of California
Enterprise Rancheria of Maidu Indians of California	Picayune Rancheria of Chukchansi Indians of California	Upper Lake Band of Pomo Indians
Ewiiaapaayp Band of Kumeyaay Indians	Pinoleville Pomo Nation (formerly the Pinoleville Rancheria of Pomo Indians of California)	Utu Utu Gwaitu Paiute Tribe of the Benton Paiute Reservation
Federated Indians of Graton Rancheria	Pit River Tribe (includes XL Ranch, Big Bend, Likely, Lookout, Montgomery Creek and	Washoe Tribe (Carson Colony, Dresslerville Colony, Woodfords Community, Stewart Community and Washoe Ranches) (California and Nevada)
Fort Bidwell Indian Community of the Fort Bidwell Reservation of California	Roaring Creek Rancherias)	Wilton Rancheria
Fort Independence Indian Community of Paiute Indians of the Fort Independence Reservation	Potter Valley Tribe (formerly the Potter Valley Rancheria of Pomo Indians of California)	Wiyot Tribe (formerly the Table Bluff Reservation-Wiyot Tribe)
Fort Mojave Indian Tribe (Arizona, California and Nevada)	Quartz Valley Indian Community of the Quartz Valley Reservation of California	Yurok Tribe of the Yurok Reservation

Source: (National Conference of State Legislatures, 2015)

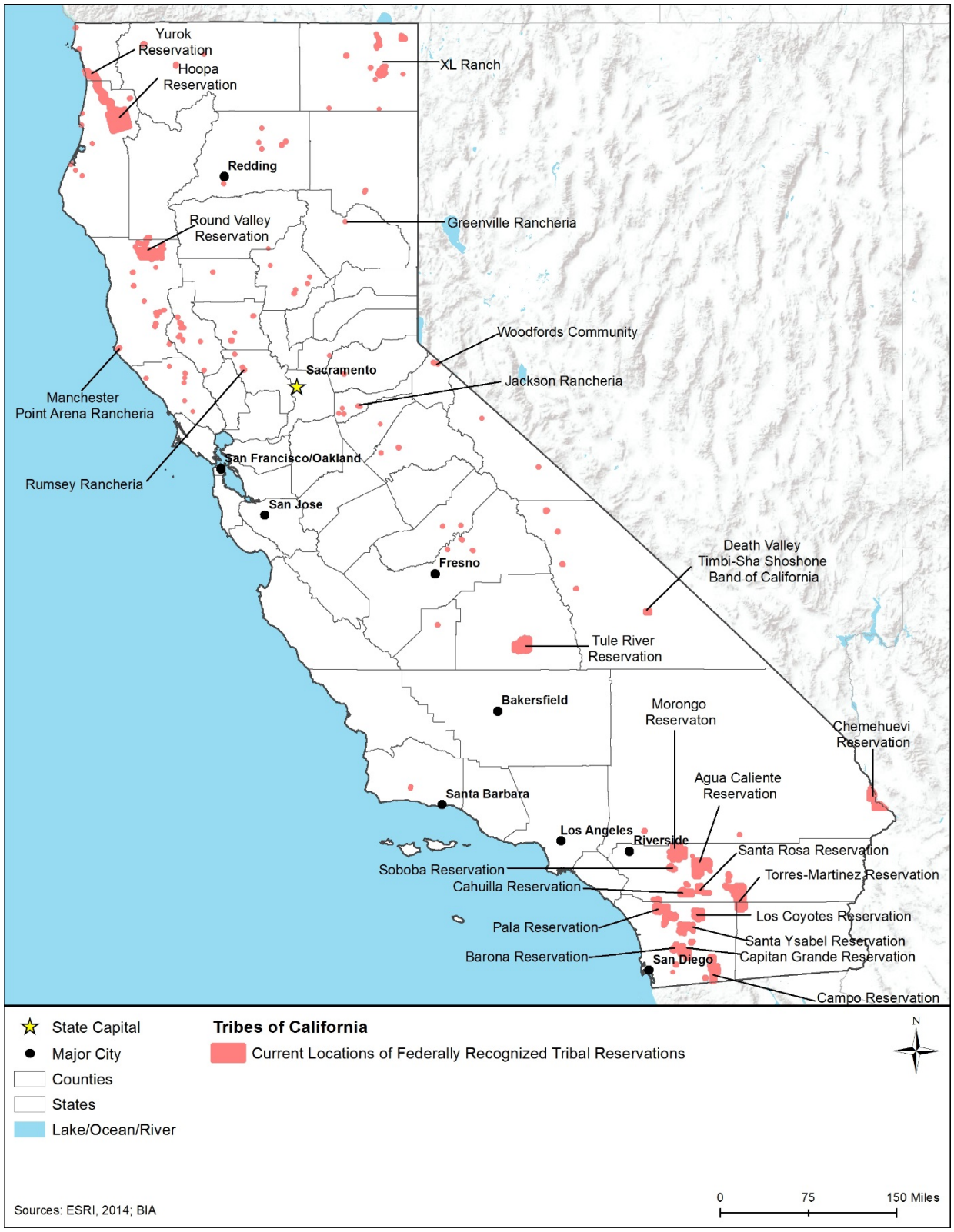


Figure 4.1.11-2: Federally Recognized Tribal Reservations in California

4.1.11.6 Significant Archaeological Sites of California

As previously mentioned in Section 4.1.11.3, there are 194 designated archaeological sites in California listed on the NRHP. Table 4.1.11-2 lists the names of the sites, the city they are closest to, and type of site. The list includes both prehistoric and historic archaeological sites. The number of archaeological sites may increase with the discovery of new sites. A current list of NRHP sites are listed on the NPS NRHP website at http://www.nps.gov/nr/ (NPS, 2015q).

Table 4.1.11-2: NRHP Listed Archaeological Sites in California

Closest City	Site Name	Type of Site
Acton	CA-LAN-1946	Prehistoric
Agua Dulce	CA-LAN-540	Prehistoric
Agua Dulce	Vasquez Rocks	Prehistoric
Anacapa Island	SS WINFIELD SCOTT (Steamship)	Shipwreck
Anderson Springs	Archaeological Site No. Ca-Lak-711	Prehistoric
Atascadero	Archaeological Site 4 SLO 834	Prehistoric
Azusa	CA-LAN-1302	Prehistoric
Baker	Aiken's Wash National Register District	Prehistoric
Baker	Archaeological Site CA-SBR-140	Prehistoric
Barstow	Bitter Spring Archaeological Site (4-SBr-2659)	Historic, Historic - Aboriginal, Prehistoric, Military
Barstow	Fossil Canyon Petroglyph Site	Prehistoric
Barstow	Rodman Mountains Petroglyphs Archaeological District	Prehistoric
Big Sur	USS MACON (airship remains)	Historic, Military
Bishop	Pawona Witu	Historic - Aboriginal, Prehistoric
Bishop	Chalfant Petroglyph Site	Historic - Aboriginal, Prehistoric
Bishop	Yellow Jacket Petroglyphs	Prehistoric
Blythe	Archaeological Sites CA-RIV-504 and CA-RIV-773	Historic - Aboriginal, Prehistoric
Blythe	Blythe Intaglios	Historic - Aboriginal
Blythe	McCoy Spring Archaeological Site	Prehistoric
Bodega Bay	Bodega Bay	Historic, Historic - Aboriginal, Prehistoric
Bodega Bay	Ranch Site, The	Prehistoric
Bodie Hills	Dry Lakes Plateau	Prehistoric
Borrego Springs	Anza Borrego-Palo Verde Site, S-2	Prehistoric
Borrego Springs	Anza Borrego-Sin Nombre, S-4	Prehistoric
Borrego Springs	Anza Borrego-Spit Mountain Site, S-3	Prehistoric
Brentwood	CA-CCO-548/H	Prehistoric
Burney	Lake Britton Archaeological District	Historic - Aboriginal, Prehistoric
California Valley	Carrizo Plain Rock Art Discontiguous District	Historic - Aboriginal, Prehistoric, Military
Camp Pendleton	Las Flores Site	Prehistoric
Canby	Anklin Village Archaeological Site	Historic - Aboriginal, Prehistoric

Closest City	Site Name	Type of Site
Canby	Black Cow Spring	Prehistoric
Canby	Core Site	Prehistoric
Canby	Cuppy Cave	Prehistoric
Canby	Mildred Ann Archaeological Site	Historic - Aboriginal, Prehistoric
Canby	Skull Ridge	Prehistoric
Canby	Skull Spring	Prehistoric
Canyon Country	CA-LAN-1258	Prehistoric
Carmichael	Nisenan Village Site	Prehistoric
Castaic	CA-LAN-441	Prehistoric
Chatsworth	Old Santa Susana Stage Road	Historic - Aboriginal, Prehistoric
Chico	Mud Creek Canyon	Historic - Aboriginal, Prehistoric
Chico	Patrick Rancheria	Historic, Historic - Aboriginal
China Lake	Coso Rock Art District	Prehistoric
China Lake	Coso Rock District	Prehistoric
Clearlake	Borax Lake--Hodges Archaeological Site	Prehistoric
Clearlake Oaks	Patwin Indian Site	Historic - Aboriginal, Prehistoric
Coalinga	Birdwell Rock Petroglyph Site	Prehistoric
Costa Mesa	Fairview Indian Site	Historic, Historic - Aboriginal
Cottonwood	Reading Adobe Site	Historic - Aboriginal
Covelo	Town Creek Archaeological Site	Prehistoric
Crescent City	BROTHER JONATHAN (Shipwreck Site)	Shipwreck
Crescent City	Endert's Beach Archaeological Sites	Historic - Aboriginal
Crescent City	Point St. George Site	Historic - Aboriginal, Prehistoric
Crescent Mills	Ch'ichu'yam-bam	Historic - Aboriginal
Desert Center	Corn Springs	Prehistoric
Desert Center	Lederer, Gus, Site	Prehistoric
Desert Center	North Chuckwalla Mountain Quarry District	Prehistoric
Desert Center	North Chuckwalla Mountains Petroglyph District Ca-Riv 1383	Prehistoric
Devil's Garden Ranger District	Seven Mile Flat Site	Historic - Aboriginal, Prehistoric
Escondido	Felicita County Park Prehistoric Village Site	Prehistoric
Eureka	Gunther Island Site 67	Historic - Aboriginal, Prehistoric
Eureka	Tsahpek	Historic - Aboriginal, Prehistoric
Fontana	Fontana Pit and Groove Petroglyph Site	Prehistoric
Fort Dick	Yontocket Historic District	Historic, Historic - Aboriginal, Prehistoric
French Gulch	Tower House--Soo-Yeh-Choo-Pus	Historic, Prehistoric
French Lake	Meadow Lake Petroglyphs	Prehistoric
Gasquet	Mus-yeh-sait-neh Village and Cultural Landscape Property	Prehistoric
Gilroy Hot Springs	Coyote Creek Archaeological District	Prehistoric
Gold Lake	Lakes Basin Petroglyphs	Prehistoric
Gold Lake	Hawley Lake Petroglyphs	Historic, Historic - Aboriginal, Prehistoric

Closest City	Site Name	Type of Site
Goleta	Campbell No. 2 Archaeological Site	Prehistoric
Greeley Hill	Bower Cave	Historic, Prehistoric
Greenfield	Site Number 4 Mnt 85	Prehistoric
Grimes	Nowi Rancheria	Historic - Aboriginal, Prehistoric
Healdsburg	Dry Creek-Warm Springs Valleys Archaeological District	Historic, Historic - Aboriginal, Prehistoric
Hinkley	Black Canyon--Inscription Canyon--Black Mountain Rock Art District	Historic - Aboriginal, Prehistoric
Hoopa	De-No-To Cultural District	Historic - Aboriginal, Prehistoric
Irvine	Christ College Site	Prehistoric
Jacumba	Table Mountain District	Prehistoric
Jenner	Duncan's Landing Site	Historic, Prehistoric
Jenner	SS POMONA (Shipwreck)	Shipwreck
Johannesburg	Last Chance Canyon	Historic - Aboriginal, Prehistoric
Johannesburg	CA SBr 1008A, CA SBr 1008B, CA SBr 1008C	Prehistoric
Kettleman City	Witt Site	Prehistoric
King City	Cueva Pintada	Prehistoric
Klamath	O'Men Village Site	Historic - Aboriginal
La Jolla	Black, William, House--SDM-W-12 Locus A (CA-SDI-4669)	Prehistoric
Likely	Nelson Springs	Historic - Aboriginal, Prehistoric
Litchfield	Willow Creek Rim Archaeological District	Prehistoric
Little Lake	Coso Hot Springs	Historic - Aboriginal, Prehistoric
Little Lake	Fossil Falls Archaeological District	Prehistoric
Locke	Delta Meadows Site	Historic - Aboriginal, Prehistoric
Lompoc	SS YANKEE BLADE	Shipwreck
Long Barn	Quail Site	Historic - Aboriginal, Prehistoric
Long Beach	Puvunga Indian Village Sites	Historic - Aboriginal, Prehistoric
Long Beach	Puvunga Indian Village Sites (Boundary Increase)	Historic - Aboriginal, Prehistoric
Los Angeles	500 Varas Square--Government Reserve	Prehistoric
Los Banos	San Luis Gonzaga Archaeological District	Prehistoric
Lower Lake	Anderson Marsh Archaeological District	Prehistoric
Lower Lake	Cache Creek Archaeological District	Historic - Aboriginal, Prehistoric
Loyalton	Kyburz Flat Site	Prehistoric
Lucia	Kirk Creek Campground	Prehistoric
Malibu	Humaliwo	Historic, Historic - Aboriginal
Malibu	Saddle Rock Ranch Pictograph Site	Prehistoric
Marin City	Muir Beach Archaeological Site	Prehistoric
Marin City	Steamship TENNESSEE Remains	Shipwreck
Mariposa	El Portal Archaeological District	Historic - Aboriginal, Prehistoric
Mill Creek	Sulphur Creek Archaeological District	Historic - Aboriginal, Prehistoric

Closest City	Site Name	Type of Site
Millville	Cow Creek Petroglyphs	Prehistoric
Millville	Dersch-Taylor Petroglyphs	Prehistoric
Monterey	El Castillo	Historic - Aboriginal, Prehistoric
Morgan Hill	Poverty Flat Site	Prehistoric
Needles	Archaeological Site No. D-4	Prehistoric
Needles	Piute Pass Archaeological District	Historic - Aboriginal, Prehistoric, Military
Needles	Topock Maze Archaeological Site	Prehistoric
Nevada City	Red Dog Townsite	Historic
New Cuyama	Eastern Sierra Madre Ridge Archaeological District	Historic - Aboriginal, Prehistoric, Military
Newberry Springs	Newberry Cave Site	Prehistoric
Novato	Rancho Olompali	Historic, Historic - Aboriginal
Ocotillo	Spoke Wheel Rock Alignment	Prehistoric
Orangevale	Indian Stone Corral	Historic - Aboriginal, Prehistoric
Orick	Bald Hills Archaeological District	Historic - Aboriginal, Prehistoric
Orick	Bald Hills Archaeological District Extension (Boundary Increase)	Prehistoric
Oroville	Lee, Fong, Company	Historic
Oxnard	Calleguas Creek Site	Prehistoric
Palm Springs	Andreas Canyon	Historic, Historic - Aboriginal, Prehistoric
Palm Springs	Tahquitz Canyon	Historic - Aboriginal, Prehistoric
Paradise	Forks of Butte	Historic, Historic - Aboriginal
Parker	Archaeological Site No. E-21	Prehistoric
Perris	Buttercup Farms Pictograph	Prehistoric
Pine Grove	Point Cabrillo Site	Prehistoric
Pine Valley	Bear Valley Archaeological Site	Prehistoric
Plaster City	Yuha Basin Discontiguous District	Prehistoric
Point Sal Highlands	Point Sal Ataje	Prehistoric
Port Hueneme	Anacapa Island Archaeological District	Historic - Aboriginal, Prehistoric
Princeton	Archaeological Site SMA-151	Prehistoric
Red Mountain	Squaw Spring Archaeological District	Historic - Aboriginal, Prehistoric, Military
Red Mountains	Blackwater Well	Historic - Aboriginal, Prehistoric
Redding	Benton Tract Site	Historic, Prehistoric
Redding	Olsen Petroglyphs	Prehistoric
Redding	Squaw Creek Archaeological Site	Prehistoric
Redding	Swasey Discontiguous Archaeological District	Prehistoric
Redwood National Park	Old Requa	Historic - Aboriginal, Prehistoric
Roseville	Strap Ravine Nisenan Maidu Indian Site	Historic - Aboriginal, Prehistoric
Sacramento	Joe Mound	Historic, Historic - Aboriginal, Prehistoric
Sacramento	Woodlake Site	Prehistoric

Closest City	Site Name	Type of Site
Salton City	Southwest Lake Cahuilla Recessional Shoreline Archaeological District	Prehistoric
San Bernardino	Crowder Canyon Archaeological District	Prehistoric
San Diego	Cuyamaca Village	Historic - Aboriginal, Prehistoric, Military
San Diego	Ruiz-Alvarado Ranch Site	Historic
San Diego	Sorrento Valley Site	Prehistoric
San Francisco	GRIFFING'S, FREDERICK, (ship)	Shipwreck
San Francisco	KING PHILIP (ship) and REPORTER (schooner) Shipwreck Site	Shipwreck
San Francisco	Lydia, The	Shipwreck
San Francisco	Point Lobos Archaeological Sites	Prehistoric
San Francisco	SS RIO DE JANEIRO Shipwreck	Shipwreck
San Luis Obispo	Port San Luis Site	Historic - Aboriginal, Prehistoric, Military
San Luis Obispo	Rancho Canada de los Osos y Pecho y Islay	Historic - Aboriginal, Prehistoric, Military
San Rafael	Miller Creek School Indian Mound	Prehistoric
Santa Barbara	Hammond's Estate Site	Prehistoric
Santa Barbara	Painted Cave	Prehistoric
Santa Barbara	San Marcos Rancho	Historic - Aboriginal
Santa Barbara	San Miguel Island Archaeological District	Historic, Historic - Aboriginal, Prehistoric, Military
Santa Barbara	Santa Barbara Island Archaeological District	Historic, Historic - Aboriginal, Prehistoric, Military
Santa Barbara	Santa Cruz Island Archaeological District	Historic, Historic - Aboriginal, Prehistoric
Santa Cruz	Brown, Allan, Site	Prehistoric
Santa Cruz	Sand Hill Bluff Site	Prehistoric
Santa Susana	Burro Flats Painted Cave	Prehistoric
Silver Lake	Archaeological Site CA SBR 3186	Prehistoric
Soledad	Chalone Creek Archaeological Sites	Prehistoric
South Lake	Long Canyon Village Site	Historic - Aboriginal, Prehistoric
Stewarts Point	Salt Point State Park Archaeological District	Historic, Historic - Aboriginal, Prehistoric
Strawberry	Chinaman Mortar Site	Historic - Aboriginal, Prehistoric
Susanville	Bruff's Rock Petroglyph Site	Historic - Aboriginal, Prehistoric
Temecula	Murrieta Creek Archaeological Area	Historic - Aboriginal, Prehistoric
Three Rivers	Groenfeldt Site	Historic - Aboriginal, Prehistoric
Three Rivers	Hospital Rock	Historic - Aboriginal, Prehistoric
Trona	Reilly	Historic
Truckee	Sardine Valley Archaeological District	Prehistoric
Tule Lake	Fern Cave Archaeological Site	Historic - Aboriginal, Prehistoric
Tulelake	Lava Beds National Monument Archaeological District	Historic - Aboriginal, Prehistoric
Tulelake	Petroglyph Point Archaeological Site	Historic - Aboriginal, Prehistoric
Twentynine Palms	Foxtrot Petroglyph Site	Prehistoric

Closest City	Site Name	Type of Site
Valerie	Coachella Valley Fish Traps	Prehistoric
Ventura	San Miguel Chapel Site	Historic
Verdi	Stampede Site	Prehistoric
Volcano	Indian Grinding Rock	Prehistoric
Watsonville	Watsonville-Lee Road Site	Historic - Aboriginal
Wheatland	Johnson Ranch and Burtis Hotel Sites	Historic
Winterhaven	Winterhaven Anthropomorph and Bowknot, L-9	Prehistoric
Yermo	Calico Mountains Archaeological District	Prehistoric
Yosemite Village	Yosemite Valley Archaeological District	Historic - Aboriginal, Prehistoric
Yuma	Stonehead (L-7)	Prehistoric
Yuma	Winterhaven Anthropomorph (L-8)	Prehistoric

Source: (NPS, 2015q)

4.1.11.7 Historic Context

As interest in California grew during the late 18th century, Spain expanded its colonization efforts in an attempt to maintain control of the region. As a part of this, "twenty-one missions, built with Indian labor, were founded by the Franciscans south to north, from San Diego de Alcalá in 1769 to San Francisco Solano in Sonoma in 1821;" in addition to the missions, presidios were "established at San Diego (1769), Monterey (1770), San Francisco (1776), and Santa Barbara (1782)" (California State Parks: Office of Historic Preservation, 2013). Additionally, following Mexico's independence from Spain in 1821, the Mexican Army established a barracks—sometimes referred to as a "presidio"—in Sonoma in 1834. The barracks was completed in 1841 (California State Parks, 2011).

During the early 19th century, the west coast shipping industry began to grow relating to the whaling industry and trade with eastern countries like China and Japan. Westward migration began to increase during the 1840s, expanding further following the Mexican-American War (1846-1847), and especially after the accidental discovery of gold in late January 1848, which occurred less than two weeks before Mexico ceded California and other western territory to the United States. The logging industry benefited from the gold rush as well. However, because of its remote location, "until the transcontinental railroad was completed in 1869, California remained relatively isolated, developing an economy and culture mostly independent of the national framework" (California State Parks: Office of Historic Preservation, 2013).

In addition to mining activities, California became involved in agriculture during the second half of the 19th century. While California grew to become second in the nation in the production of wheat by 1889, "the production of fruits, nuts, and vegetables was increasing, and by 1905 that production exceeded the production of wheat as the major crops being grown in California" (California State Parks: Office of Historic Preservation, 2013). Wineries were established in the Sonoma Valley in 1857 and in the Napa Valley region starting in 1859, eventually becoming an important part of the state's cultural and economic history.

In the late 19th century, agriculture began to put a significant strain on the state's water supplies, and as a result, numerous state and federally funded irrigation projects were built in the early 20th century (California State Parks: Office of Historic Preservation, 2013).

Because the San Andreas and other major faults run through more than three-quarters of the length of the state, California is subject to frequent earthquakes. In 1906, San Francisco was largely destroyed by a major earthquake and a related ensuing fire and other major quakes have followed.

In 1907, the first major commercial film was completed in California, outside of Los Angeles, marking a seminal moment for the movie industry, which would soon become synonymous with the state (Robinson Library, 2014). During World War II (WWII), the threat of a Japanese attack on the Pacific coast provided a justification for increased defense spending, leading to a buildup of military bases, many of which remain today. Existing military bases include Fort Ord, Hunter Liggett Military Reservation, the Desert Training Center in the Mojave Desert, major Navy, and Marine Corps bases in San Francisco, and Army Air Force bases like McClellan, Mather, and Travis. Also during WWII, the U.S. government established internment camps for Japanese-American citizens, with the former Manzanar War Relocation Center, now Manzanar National Historic Site, being an example (NPS, 2016g). Following WWII, California experienced considerable growth, with large suburban developments occurring around major cities, as well as an accompanying growth in the public sector relating to the expansion of government (California State Parks: Office of Historic Preservation, 2013).

California has 2,672 NRHP listed sites, as well as 144 NHLs (NPS, 2014e). California does not contain a National Heritage Area (NPS, 2015r). Figure 4.1.11-3 shows the location of NRHP sites within California.[161]

[161] Section 4.1.8.4 provides a more in-depth discussion of additional historic resources as they relate to recreational resources.

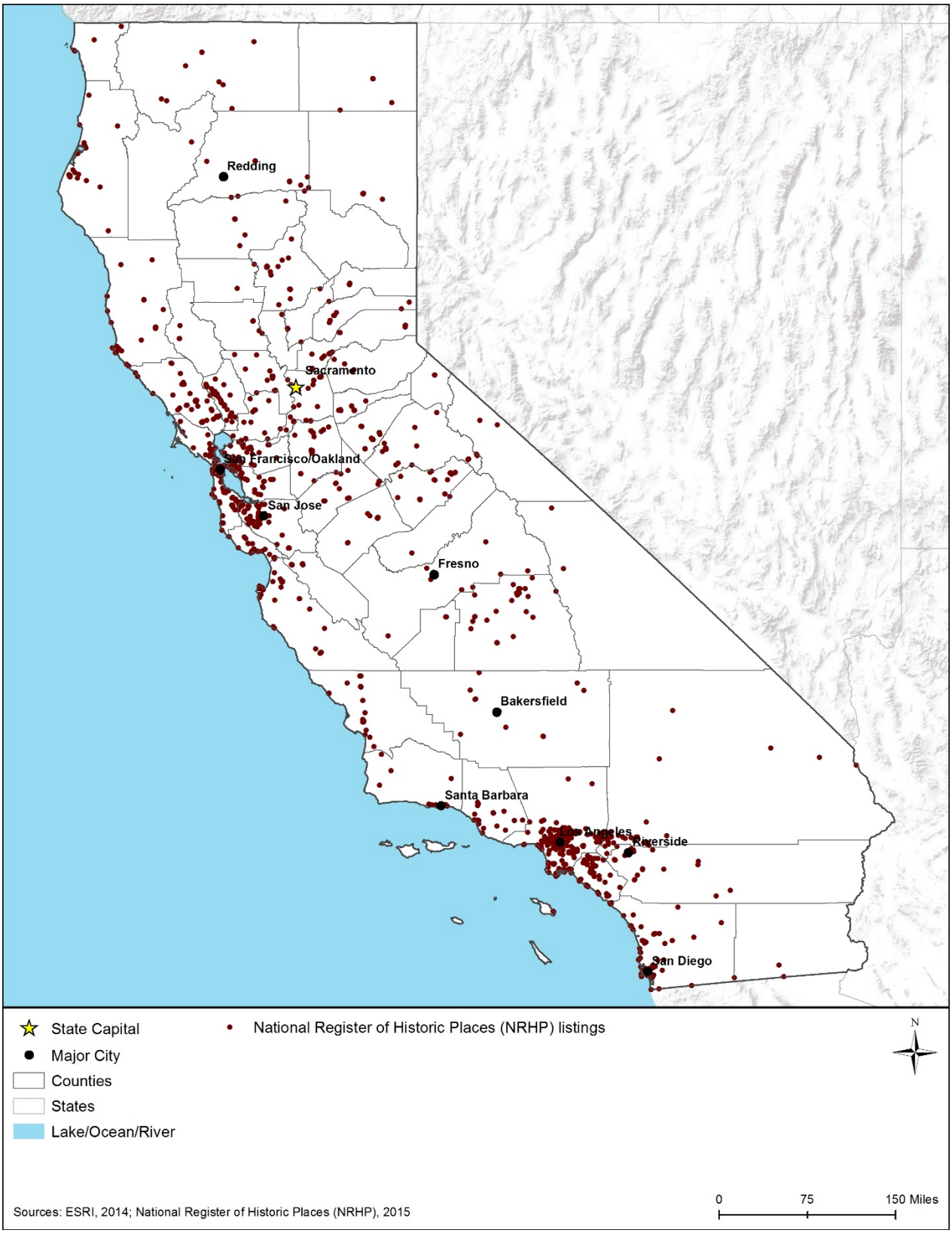


Figure 4.1.11-3: National Register of Historic Places (NRHP) Sites in California

4.1.11.8 Architectural Context

Early European structures built during the periods of Spanish and Mexican control were constructed of adobe, fired clay brick, and stone with wood roof structures and were built from San Diego in the south to areas north of San Francisco Bay. Other early European structures in northern California, such as the Russian built Fort Ross (1812), near Healdsburg, CA, were often built of redwood, which was abundant in the northern portion of the state. The first two-story, non-Spanish structure built in California is believed to be the home of "Thomas Larkin, the United States' first and only consul to Alta California during the Mexican period," which was built in 1835 in Monterey (California State Parks: Office of Historic Preservation, 2013). The style of Larkin's house came to be known as Spanish or Monterey Colonial. The popularity of the style was short-lived, "and by 1850 the American frame house was the vernacular architecture of the settlements in California dominated by immigrants from the eastern United States" (California State Parks: Office of Historic Preservation, 2013).

During the second half of the 19th century, houses in California were primarily balloon-framed, built of milled lumber, and followed styles popularized by architectural pattern books. "The availability of redwood likely gave San Francisco in the late nineteenth century a larger proportion of wood frame residential buildings than any other city in the nation" (California State Parks: Office of Historic Preservation, 2013). Styles that were popular during the second half of the 19th century include Gothic Revival, Italianate, Second Empire, Queen Anne, Stick, Shingle, and others (McAlester, 2013).

During the early 20th century, the Arts and Crafts movement began to grow in popularity. In California, this resulted in the development of the Craftsman style, often applied to bungalow house types. The bungalow, which developed primarily in southern California, was designed to resemble homes that were previously built of adobe, but using redwood instead. While many bungalows were quite ornate, more "modest bungalows were popular and practical, well-suited to the southern California climate. The arrangement of rooms around a central courtyard created an informal living space and blurred the distinction between indoors and out" (California State Parks: Office of Historic Preservation, 2013).

During the 1930s, the construction of buildings using adobe bricks experienced a revival, which continued to evolve, and can be traced to ranch house development. After the development of the style, "the ranch house…met the needs of modest and low cost housing for millions of families across the country" (California State Parks: Office of Historic Preservation, 2013). In addition to the development of different styles, architecture progressed with the introduction of flat roofs, structural concrete, and simple windows that lacked ornamentation (California State Parks: Office of Historic Preservation, 2013).

Additional types of historic resources present in California include institutional and public buildings dating from the early part of the 20th century, such as the Carnegie libraries, which were built from approximately 1899 to 1921 (National Register of Historic Places, 1990). Light stations are also common along California's expansive coastline. These were built largely during the second half of the 19th and the first half of the 20th centuries (National Register of Historic Places, 1991). Government buildings are common as well and their construction corresponds

with the growth of government. Post offices are a great example of these, many of which were built during the years of the Great Depression through New Deal work relief programs (National Register of Historic Places, 1985). Military installations and related support installations that were either constructed or expanded during WWII are common as well. The Marinship Corporation's shipbuilding facility in Sausalito is an example of a collection of resources associated with this history that are still present on the landscape (NPS, 2015s).

Figure 4.1.11-4: Representative Architectural Styles of California

- Top Left – "Painted Ladies" Victorian Houses (San Francisco, CA) – (Highsmith, Carol M., 2012a)
- Top Right – Mission San Antonio de Pádua (Jolon, CA) – (Photochrom Company, 1898)
- Bottom Left – California Bungalow (San Jose, CA) – (Historic American Buildings Survey, 1933a)
- Bottom Middle – Sacramento City Hall (Sacramento, CA) – (Historic American Buildings Survey, 1933b)
- Bottom Right – Golden Gate Bridge (San Francisco, CA) – (Highsmith, Carol M., 2012b)

4.1.12 Air Quality

4.1.12.1 Definition of the Resource

Air quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography[162] of the area, and the prevailing weather and climate conditions. The levels of pollutants and pollutant concentrations in the atmosphere are typically expressed in units of parts per million (ppm)[163] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[164] This section discusses the existing air quality in California. The USEPA designates areas within the U.S. as attainment,[165] nonattainment,[166] maintenance,[167] or unclassifiable[168] depending on the concentration of air pollution relative to ambient air quality standards. Information is presented regarding national and state ambient air quality standards and nonattainment areas that would be potentially more sensitive to impacts from implementation of the Proposed Action or alternatives.

The California Air Resources Board (CARB) oversees permitting completed by two air districts the regional air pollution control districts (APCD) and the air quality management districts (AQMD) (Reitze, 2001). There are 35 total local APCDs and AQMDs (air districts), as presented in Table 4.1.12-1 and Figure 4.1.12-1. Each air regulatory authority has different air regulations and state implementation plans (SIP) as required. The specific regulatory considerations for each of the 35 APCDs and AQMDs are presented in alphabetic order in Sections 4.1.12.3 to 4.1.12.37. See Table 4.1.12-1 for details about these sections. These sections are then followed by a description of the statewide ambient air quality standards.

Table 4.1.12-1: California Air Districts

District	Area Covered	Section
Amador County APCD	All of Amador County	4.1.12.3
Antelope Valley AQMD	Northeast portion of Los Angeles County	4.1.12.4
Bay Area AQMD	Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, western portion of Solano, southern portion of Sonoma Counties	4.1.12.5
Butte County AQMD	All of Butte County	4.1.12.6
Calaveras County APCD	All of Calaveras County	4.1.12.7
Colusa County APCD	All of Colusa County	4.1.12.8
Eastern Kern APCD	Eastern portion of Kern County	4.1.12.9
EL Dorado County AQMD	All of El Dorado County	4.1.12.10

[162] Topography: The unique features and shapes of the land (e.g., valleys and mountains).

[163] Equivalent to 1 milligram per liter (mg/L).

[164] Averaging Time: "The period over which data are averaged and used to verify proper operation of the pollution control approach or compliance with the emissions limitation or standard," (USEPA, 2015y).

[165] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015z).

[166] Nonattainment areas: Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015z).

[167] Maintenance areas: An area that was previously nonattainment, but has met the national primary or secondary ambient air quality standards for the pollutant, and has been designated as attainment (USEPA, 2015z).

[168] Unclassifiable areas: Any area that cannot be classified on the basis of available information as meeting the national primary or secondary air quality standard for a pollutant (USEPA, 2015z).

District	Area Covered	Section
Feather River AQMD	All of Sutter and Yuba Counties	4.1.12.11
Glenn County APCD	All of Glenn County	4.1.12.12
Great Basin Unified APCD	All of Alpine, Inyo, and Mono Counties	4.1.12.13
Imperial County APCD	All of Imperial County	4.1.12.14
Lake County AQMD	All of Lake County	4.1.12.15
Lassen County APCD	All of Lassen County	4.1.12.16
Mariposa County APCD	All of Mariposa County	4.1.12.17
Mendocino County AQMD	All of Mendocino County	4.1.12.18
Modoc County APCD	All of Modoc County	4.1.12.19
Mojave Desert AQMD	Northern portion of San Bernardino County, eastern portion of Riverside County	4.1.12.20
Monterey Bay Unified APCD	All of Monterey, San Benito, Santa Cruz Counties	4.1.12.21
North Coast Unified AQMD	All of Del Norte, Humboldt, Trinity Counties	4.1.12.22
Northern Sierra AQMD	All of Nevada, Plumas, Sierra Counties	4.1.12.23
Northern Sonoma County APCD	Northern portion of Sonoma County	4.1.12.24
Placer County APCD	All of Placer County	4.1.12.25
Sacramento Metro AQMD	All of Sacramento County	4.1.12.26
San Diego County APCD	All of San Diego County	4.1.12.27
San Joaquin Valley APCD	All of Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare, and Valley air basin portions of Kern Counties	4.1.12.28
San Luis Obispo County APCD	All of San Luis Obispo County	4.1.12.29
Santa Barbara County APCD	All of Santa Barbara County	4.1.12.30
Shasta County AQMD	All of Shasta County	4.1.12.31
Siskiyou County APCD	All of Siskiyou County	4.1.12.32
South Coast AQMD	Los Angeles County except for Antelope Valley AQMD, Orange County, western portion of San Bernardino and western portion of Riverside Counties	4.1.12.33
Tehama County APCD	All of Tehama County	4.1.12.34
Tuolumne County APCD	All of Tuolumne County	4.1.12.35
Ventura County APCD	All of Ventura County	4.1.12.36
Yolo-Solano AQMD	All of Yolo and eastern portion of Solano Counties	4.1.12.37

Figure 4.1.12-1: AQMDs and APCDs in California

4.1.12.2 Specific Regulatory Considerations

National and State Ambient Air Quality Standards

The Clean Air Act (CAA) establishes National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: Carbon monoxide (CO), lead, oxides of nitrogen (NO_X), particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), and oxides of sulfur (SO_2). The NAAQS establish various standards, either primary[169] or secondary,[170] for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) were developed to prevent the acute health effects from short-term exposure at high concentrations. Longer averaging periods (e.g., 3 months or annual) are intended to prevent chronic health effects from long-term exposure. A description of the NAAQS is presented in Appendix E. (USEPA, 2016b)

In addition to the NAAQS, there are standards for hazardous air pollutants (HAP), which are those typically associated with specific industrial processes such as chromium electroplating (hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated solvents) (USEPA, 2011a). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). The USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health (USEPA, 2016c).

In conjunction with the federal NAAQS, California maintains its own air quality standards, the California Ambient Air Quality Standards (CAAQS). Table 4.1.12-2 presents an overview of the CAAQS as defined by CARB.

Table 4.1.12-2: California Ambient Air Quality Standards (CAAQS)

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		µg/m³	ppm	µg/m³	ppm	
O_3	1 Hour	180	0.09	-	-	
	8 Hour	137	0.07	-	-	
PM_{10}	24 Hour	50	-	-	-	
	Annual	20	-	-	-	Annual arithmetic mean
$PM_{2.5}$	Annual	12	-	-	-	Annual arithmetic mean
CO	1 Hour	23,000	20	-	-	
	8 Hour	10,000	9	-	-	
	8 Hour (Lake Tahoe)	7,000	6	-	-	
NO_2	1 Hour	339	0.18	-	-	
	Annual	57	0.03	-	-	Annual arithmetic mean

[169] Primary standard: The primary standard is set to provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly (USEPA, 2014a).
[170] Secondary standards: The secondary standard is set to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USEPA, 2014a).

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		µg/m³	ppm	µg/m³	ppm	
SO_2	1 Hour	655	0.25	-	-	
	24 Hour	105	0.04	-	-	
Lead	30 Day Average	1.5	-	-	-	
Visibility Reducing Particles	8 Hour	See Notes	-	-	-	In 1989, the CARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.[171]
Sulfates	24 Hour	25	-	-	-	24-hour averaging period
Hydrogen Sulfide	1 Hour	42	0.03	-	-	One-hour average
Vinyl Chloride	24 Hour	26	0.01	-	-	24-hour averaging period

Source: (CARB, 2015a)

Title V Operating Permits/State Operating Permits

California air districts have authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR Part 70. The Title V program refers to Title V of the CAA that governs permitting requirements for major industrial air pollution sources and consolidates all CAA requirements for the facility into one permit (USEPA, 2015k). The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (FedCenter.gov, 2016) (USEPA, 2015l). The CARB does not issue Title V permits; however, each APCD and AQMD are authorize to regulate and permit all air emissions sources. California requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 4.1.12-3). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

[171] "The State standard for visibility reducing particles (VRP) for all areas but the Lake Tahoe Air Basin is an 8-hour average expressed as an extinction coefficient of 0.23 per kilometer due to particles when relative humidity is less than 70 percent (this is nominally equal to a visibility of 10 miles or more). The State VRP standard for the Lake Tahoe Air Basin only is an 8-hour average extinction coefficient of 0.07 per kilometer due to particles when relative humidity is less than 70 percent (this is nominally equal to a visibility of 30 miles or more). The VRP standard is not to be exceeded." (CARB, 2016d)

Table 4.1.12-3: Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Criteria Pollutant[172]	100
Single HAP	10
Total/Cumulative HAPs	25

Source: (USEPA, 2014b)

Exempt Activities

CARB does not issue air permits, therefore, there are no state mandated exempt activities from air permitting. However, each APCD and AQMD may issue Permits to Operate (PTO) to any source or activity that emits air pollutants. (CARB, 2010a)

Temporary Emissions Sources Permits

CARB has a Portable[173] Equipment Registration Program (PERP), which "is a voluntary statewide program to register portable equipment such as air compressors, generators, concrete pumps, tub grinders, wood chippers, water pumps, drill rigs, pile drivers, rock drills, abrasive blasters, aggregate screening and crushing plants, concrete batch plants, and welders" (CARB, 2015b). CARB created PERP as a way to register portable equipment that operate throughout the state without obtaining permits from each of the 35 APCD and AQMD (CARB, 2015b).

State Preconstruction Permits

CARB does not issue construction permits; however, any proposed construction and/or modification of an operation or equipment that may emit pollutants from a stationary source must obtain an Authority to Construct (ATC) from the county or regional APCD or AQMD. Each air district is responsible for issuing permits and monitoring sources of air pollutants to "ensure compliance with national, state, and local emission standards and to ensure that emissions from such sources will not interfere with the attainment and maintenance of ambient air quality standards adopted by the CARB and the U.S. Environmental Protection Agency" (CARB, 2010b).

Fugitive Dust

CARB does not issue fugitive dust permits; however, any proposed construction or activity that could produce fugitive dust might have requirements from the county or regional APCD or AQMD. Each air district is responsible for monitoring and issuing any permits pertaining to fugitive dust; however, not all county or regional APCD or AQMDs will have fugitive dust requirements and regulations. (CARB, 2016b)

The CARB does prohibit specific discharges that result in fugitive dust under the State Nuisance Law, Section 41700 of the Health& Safety Code (H&SC). This section states that "no person

[172] Sources in nonattainment areas will have lower thresholds for some criteria pollutants depending on the classification of the nonattainment area.

[173] Portable is defined under Section 2452(CC) of the PERP regulations as "a piece of equipment is considered portable if it does not reside at the same location longer than 12 consecutive months" (SFBRWQCB, 2015).

shall discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause, injury or damage to business or property" (California Health and Safety Code, 1975).

General Conformity

Established under Section 176(c)(4) of the CAA, "the General Conformity Rule ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality" outlined in the SIP (USEPA, 2013a). An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and (e), federal actions "in response to emergencies which are typically commenced on the order of hours or days after the emergency" and actions "which are part of part of a continuing response to emergency or disaster" that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (GPO, 2010).

The estimated pollutant emissions are compared to *de minimis*[174] levels. These tons per year (TPY) values are the minimum thresholds for which a conformity determination must be performed (see Table 4.1.12-4). No California counties lie in the Ozone Transport Region (OTR).[175]

Table 4.1.12-4: *De Minimis* Levels

Pollutant	Area Type	TPY
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
Ozone (NO_X)	Maintenance	100
CO, SO_2, NO_2	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ (Direct Emissions) (SO_2) (NO_X (unless determined not to be a significant precursor)) (VOC or ammonia (if determined to be significant precursors))	All Nonattainment and Maintenance	100
Lead	All Nonattainment and Maintenance	25

Source: (GPO, 2010)

[174] de minimis: USEPA states that "40 CFR 93 § 153 defines de minimis levels, that is, the minimum threshold for which a conformity determination must be performed, for various criteria pollutants in various areas." (USEPA, 2016e)

[175] Ozone Transport Region (OTR): "The CAA sets out specific requirements for a group of northeast states that make up the Ozone Transport Region (OTR). States in this region are required to submit a SIP and install a certain level of controls for the pollutants that form ozone, even if they meet the ozone standards." (USEPA, 2016f)

If an action does not result in an emissions increase above the *de minimis* levels in Table 4.1.12-4, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 4.1.12-4, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity,[176] the agency would have to fulfill one or more of the following:

- Show any emissions increase is specifically identified and accounted for in the respective state's SIP;
- Receive acknowledgement from the state that any increase in emissions would not exceed the SIP emission budget;
- Receive acknowledgement from the state to revise the SIP and include emissions from the action;
- Show the emissions would be fully offset by implementing reductions from another source in the same area; and
- Conduct air quality modeling that demonstrates the emissions would not cause or contribute to new violations of the NAAQS, or increase the frequency or severity of any existing violations of the NAAQS (USEPA, 2010)

State Implementation Plan Requirements

The California SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. California's SIP is a conglomeration of separate actions taken for each of the pollutants. California's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on California's website at https://www.arb.ca.gov/planning/sip/sip.htm.

4.1.12.3 Specific Regulatory Considerations for Amador Air Pollution Control District (Amador APCD)

National and State Ambient Air Quality Standards

The Amador Air Pollution Control District (Amador APCD) does not maintain its own ambient air quality standards. Instead, Amador APCD defers to the CARB which, as previously noted, adopted the federal NAAQS as well as promulgated a set of state Ambient Air Quality Standards (AAQS) (Amador APCD, 2001). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Amador APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Amador APCD Rule 500 (Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments Of 1990)

[176] Conformity: Compliance with the State Implementation Plan.

describes the applicability of Title V operating permits. Amador APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Amador County APCD major source thresholds (see Table 4.1.12-5) (Amador APCD, 2001) The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2013b)

Table 4.1.12-5: Amador County APCD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as serious	50
VOC or NO_X for a federal nonattainment area classified as severe	25
VOC or NO_X for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Amador APCD, 2001)

Exempt Activities

According to Amador APCD Rules 402 (Exemptions to Rule 401 [Permit Required]) and Rule 502 (Exemptions to Rule 501 [Permit Required]) the Amador APCD may exempt the following equipment from obtaining an ATC or PTO:

- "…Brazing, soldering welding equipment.
- Steam generators, steam superheaters, water boilers, water heaters, and closed heat transfer systems that have a maximum heat input rate of less than 50,000,000 British Thermal Units (BTU) per hour gross, and are fired exclusively with one of the following: 1. Natural gas; 2. Liquefied petroleum gas; 3. A combination of natural gas and liquefied petroleum gas.
- …Self-propelled mobile construction equipment other than pavement burners.
- …Repairs or maintenance not involving structural changes to any equipment for which a Permit to Operate has been granted.
- Other sources emitting less than 1 ton per year of any criteria pollutant or precursor which may be specified by the Air Pollution Control Officer" (Amador APCD, 2009).

Temporary Emissions Sources Permits

Amador APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed. (CARB, 2015b)

Preconstruction Permits

Amador APCD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of

Amador APCD Rules 402 (Exemptions to Rule 401 [Permit Required]) and Rule 502 (Exemptions to Rule 501 [Permit Required]), which exempts multiple sources from an ATC and PTO. The Amador APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions. (Amador APCD, 2009)

Fugitive Dust Emissions

Amador APCD Rule 218 (Fugitive Dust Emissions) indicates that "no person may cause, allow or permit fugitive dust[177] emissions without first implementing good housekeeping and/or work practices that reduce and control the emissions to the atmosphere below 20% opacity" (Amador APCD, 2000). The Fugitive Dust Emissions rule has specific good housekeeping practices to help with this requirement including, but not limited to, watering or using other approved dust control chemicals to keep dust down, paving dirt roads, and using wind brakes.

General Conformity

The Amador APCD follows the federal and state General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal and state General Conformity regulations.

State Implementation Plan Requirements

The Amador APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Amador APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Amador APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website: https://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Amador+County+APCD-Agency-Wide+Provisions.

4.1.12.4 Specific Regulatory Considerations for Antelope Valley Air Quality Management District (Antelope Valley AQMD)

National and State Ambient Air Quality Standards

The Antelope Valley Air Quality Management District (Antelope Valley AQMD) does not maintain its own ambient air quality standards. Instead, Antelope Valley AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Antelope Valley AQMD, 2005). See Section 4.1.12.2 for a discussion of California's AAQS.

[177] Fugitive dust is defined in "Rule 102 as solid particulate matter that becomes air-borne, other than that emitted from an exhaust stack, as a direct result of operation of a facility. Fugitive dust for the purposes of this rule is also defined as the particulate matter entrained into the air which is caused from man-made and natural activities which is emitted into the air without first passing through a stack or duct designed to control flow, including, but not limited to, emissions caused by movement of soil, vehicles, equipment, and windblown dust," (Amador APCD, 2000).

Title V Operating Permits/State Operating Permits

Antelope Valley AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Antelope Valley AQMD Regulation XXX (Title V Permits) describes the applicability of Title V operating permits. Antelope Valley AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Antelope Valley AQMD major source thresholds (see Table 4.1.12-6) (Antelope Valley AQMD, 2011) The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule permit (USEPA, 2013b).

Table 4.1.12-6: Antelope Valley AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant other than those indicated in subparts (b) and (c)	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X	25

Source: (Antelope Valley AQMD, 2005)

Exempt Activities

Antelope Valley AQMD does not explicitly exempt any source from obtaining a permit. All activities should review applicable stationary source requirements, or contact the Antelope Valley AQMD for additional assistance (Antelope Valley AQMD, 1997).

Temporary Emissions Sources Permits

Antelope Valley AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed. (Antelope Valley AQMD, 1997) (Antelope Valley AQMD, 2011)

Preconstruction Permits

Antelope Valley AQMD Rule 201 (Permit to Construct) requires a Permit to Construct (PTC) prior to construction, modification, and installation of any air emissions producing equipment. (Antelope Valley AQMD, 1997).

Fugitive Dust

Antelope Valley AQMD Rule 403 (Fugitive Dust) details requirements for specific activities that can contribute to fugitive dust including operations, storage piles, disturbed areas and track-out operations. The fugitive dust rule includes good housekeeping practices to help meet requirements including, but not limited to, watering or using other approved dust control chemicals, paving dirt roads, and using wind brakes (Antelope Valley AQMD, 2010). If the construction activities will include five acres or more of Disturbed Surface Area for non-residential development, a Dust Control Plan (DCP) is required prior to the start of construction (Antelope Valley AQMD, 2010).

General Conformity

The Antelope Valley AQMD follows the federal General Conformity regulations and does not maintain their own (Antelope Valley AQMD, 1994). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Antelope Valley AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Antelope Valley AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Antelope Valley AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Antelope+Valley+APCD-Agency-Wide+Provisions.

4.1.12.5 Specific Regulatory Considerations for Bay Area Air Quality Management District (Bay Area AQMD)

National and State Ambient Air Quality Standards

The Bay Area Air Quality Management District (Bay Area AQMD) does not maintain any ambient air quality standards. Instead, Bay Area AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Bay Area AQMD, 1993). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Bay Area AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Bay Area AQMD Regulation 2 (Permits) Rule 6 (Major Facility Review) describes the applicability of Title V operating permits (Bay Area AQMD, 1993). Bay Area AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Bay Area AQMD major source thresholds (see Table 4.1.12-7). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-7: Bay Area AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant[a]	100
Single Hazardous Air Pollutant (HAP)	10
Total/Cumulative HAPs	25

Source: (Bay Area AQMD, 1993)

[a] Regulated Pollutants are defined as NOx, VOC, and any pollutant for which a NAAQ has been promulgated; Class 1 or Class 2 ozone depleting substance subject to a standard promulgated under Title VI of the CAA; pollutants subject to any standard under Section 111 of the CAA; any pollutant subject to any standard or requirement promulgated under Section 112(g), (i), and (r) of the CAA; and Greenhouse gasses (GHG) where the PTE of 100,000 tons per year or more of CO_2e.[178] (Bay Area AQMD, 1993)

Exempt Activities

Bay Area AQMD exempts portable engines registered with PERP and non-road engines from obtaining a Title V Permit under Regulation 2 (Permits) Rule 6 (Major Facility Review). (Bay Area AQMD, 1993)

The Bay Area AQMD also exempts the following from obtaining a PTO as per Regulation 2 (Permits) Rule 1-114 (Exemption, Combustion Equipment):

- "Boilers, Heaters, Steam Generators, Duct Burners, and Similar Combustion Equipment:
  - Any of the above equipment with less than 1 million BTU per hour rated heat input.
  - Any of the above equipment with less than 10 million BTU per hour rated heat input if fired exclusively with natural gas (including compressed natural gas), liquefied petroleum gas (e.g., propane, butane, isobutane, propylene, butylenes, and their mixtures), or any combination thereof.
- Internal Combustion Engines and Gas Turbines:
  - Internal combustion (IC) engines and gas turbines with a maximum output rating less than or equal to 50 hp…
  - …Portable internal combustion engines which are at a location for less than 72 consecutive hours.
  - Any engine mounted on, within, or incorporated into any vehicle, train, ship, boat, or barge used to provide propulsion for the vehicle, train, ship, boat, or barge. Facilities which include cargo loading or unloading from cargo carriers other than motor vehicles shall include the cargo carriers as part of the source which receives or loads the cargo.
  - Any engine mounted on, within, or incorporated into any vehicle, train, ship, boat, or barge used to provide propulsion for the vehicle, train, ship, boat, or barge and which is also used to supply mechanical or electrical power to ancillary equipment (e.g., crane, drill, winch, etc.) which is affixed to or is a part of the vehicle, train, ship, boat, or barge. Facilities which include cargo loading or unloading from cargo carriers other than motor vehicles shall include the cargo carriers as part of the source which receives or loads the cargo" (Bay Area AQMD, 2012).

Temporary Emissions Sources Permits

The state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If f the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed. In addition to the CARB PERP, the Bay Area AQMD allows for temporary PTO as per

[178] CO_2e refers to Carbon Dioxide Equivalent, "A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as million metric tons of carbon dioxide equivalents ($MMTCO_2e$). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. $MMTCO_{2e}$ = (million metric tons of a gas) * (GWP of the gas)" (USEPA, 2015aa).

Regulation 2 (Permits) Rule 1-302 (PTO). "A temporary permit may be obtained to allow an operator to test equipment, processes, or new formulations. A temporary permit may also be obtained for a temporary source which replaces critical equipment during scheduled maintenance" (Bay Area AQMD, 2012). The Bay Area AQMD may issue a non-renewable temporary PTO (3 months long) for temporary operations at sources were equipment testing is occurring, a temporary replacement of an existing source where the replacement is identical or the purpose of the source is identical, or the operation will comply with all Bay Area AQMD regulations. (Bay Area AQMD, 2012).

Preconstruction Permits

Bay Area AQMD Regulation 2 (Permits) Rule 1-302 (Authority to Construct [ATC]) requires an ATC be obtained for any air emission producing article, machine, equipment, or other component (used to reduce or control the emission of air contaminants) that is built, installed, modified, or replaced after July, 1972 (Bay Area AQMD, 2012).

Fugitive Dust Emissions

Bay Area AQMD does not have specific Fugitive Dust Emission Regulations (Bay Area AQMD, 2015); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

General Conformity

The Bay Area AQMD follows the federal General Conformity regulations and does not maintain their own (Bay Area AQMD, 2012). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Bay Area AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Bay Area AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Bay Area AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Bay+Area+Air+Quality+Management+District-Agency-Wide+Provisions.

4.1.12.6 Specific Regulatory Considerations for Butte Air Quality Management District (Butte AQMD)

National and State Ambient Air Quality Standards

The Butte Air Quality Management District (Butte AQMD) does not maintain its own ambient air quality standards. Instead, Butte AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AA year (Butte AQMD, 2014a). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Butte AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Butte AQMD Regulation XI (Federal Clean Air Act Requirements) Rule 1101 (Title V – Federal Operating Permits) describes the applicability of Title V operating permits (Butte AQMD, 2013). Butte AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Butte County AQMD major source thresholds (see Table 4.1.12-8). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-8: Butte County AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as serious	50
VOC or NO_X for a federal nonattainment area classified as severe	25
VOC or NO_X for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70
GHG	100
CO_2e	100,000

Source: (Butte AQMD, 2014b)

Exempt Activities

Butte AQMD Regulation IV (Permits) Rule 401 (Permit Exemptions) exempts the following source categories from an ATC and a PTO:

- Combustion and Heat Transfer Sources:
- "…Steam generators, water boilers or water heaters fired exclusively by natural gas, liquefied petroleum gas (LPG) or a combination thereof, having a maximum fuel input heating value of less than one (1) million British thermal units (MMBtu) per hour or thirty (30) boiler horsepower (HP).
- Equipment used for space heating, other than boilers.
- Internal Combustion Engines:
    - Any reciprocating internal combustion engine with a brake horsepower rating of less than fifty (50).
    - Internal combustion engines used exclusively for purposes of educating students in the operation, maintenance, repair, and rebuilding of such engines.
    - Any natural gas, propane, or LPG fueled engine rated at 250 brake horsepower or less and operating less than 200 hours per calendar year for non-emergency purposes.
    - Fuel cells or microturbines used in power and/or heat generating equipment that meet the following emission standards: NOx 0.07 lb/Megawatthour (MW-hr), CO 0.10 lb/MW-hr, and VOCs 0.02 lb/MW-hr…

- …Portable Handheld Equipment: Handheld equipment used for buffing, polishing, carving, cutting, drilling, machining, routing, sanding, sawing, surface grinding, or turning of metal, wood, plastic, or similar material…
- … Maintenance: Routine repairs or routine maintenance not involving structural changes to an emissions unit to which a permit has been granted or is not required by this Rule. Routine maintenance is intended to include replacement of wearable parts such as spark plugs, seals, belts, etc…
- … Motor vehicles which are devices by which any person or property may be propelled, moved, or drawn upon a highway or used exclusively on stationary rails or tracks, but not including any article, machine, equipment or other contrivance mounted on such vehicle that would otherwise require a permit under the provisions of these Rules and Regulations…
- … Portable Equipment: Any portable equipment that is registered in accordance with Rule 440-Portable Equipment Registration of these Rules and Regulations or with the Statewide Portable Equipment Registration Program [PERP]. This exemption does not apply to any equipment while in use for screening of soils in contaminated soil remediation projects…
- … Low Emitting Sources: As determined by the APCO, other low emitting sources with an uncontrolled emissions rate of each air contaminant of:
  - CO at less than the 500 pounds per day; and
  - Particulate matter (PM10 or PM2.5), NOx, VOCs, or SOx at:
  - Less than or equal to two (2) pounds per day or, 4.18.2.2 If greater than two (2) pounds per day, is less than or equal to 75 pounds per year" (Butte AQMD, 2014a).

Butte AQMD Regulation IV (Permits) Rule 401 (Permit Exemptions) also conditionally exempts specific sources. The following source categories need to submit a request for an exemption for the following equipment: identical replacement of any air emission equipment when a PTO has been granted and other low emitting sources with uncontrolled emission rates of less than 500 pounds per year. (Butte AQMD, 2014a)

Temporary Emissions Sources Permits

Butte AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Butte AQMD requires stationary sources that are building, altering, or replacing any source of air to obtain an ATC prior to constructing, unless they meet the exemptions of Regulation IV (Permits) Rule 401 (Permit Exemptions), which exempts multiple sources from an ATC and PTO. The Butte AQMD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions. (Butte AQMD, 2014a)

Fugitive Dust Emissions

Butte AQMD Regulation II (Prohibitions) Rule 205 (Fugitive Dust Emissions) details regulations to "reduce ambient concentrations and limit fugitive emissions of fine particulate matter (PM_{10})" (Butte AQMD, 2010). This rule applies to "outdoor fugitive dust sources including construction activities, carryout and trackout, inactive disturbed land or open areas, unpaved parking lots/staging areas and private unpaved roads, weed abatement, and windblown dust as set forth in the following definitions, requirements, and exemptions" (Butte AQMD, 2010).

Activities should not cause fugitive dust emissions that remain visible beyond the property line and should not exceeds 20 percent opacity for longer than three minutes in any one hour (if the dust emission is the result of vehicle traffic). Best management practices should be implemented in order to adhere to this regulation including, but not limited to, watering or using other approved dust control chemicals to keep dust down, paving dirt roads, and using wind brakes. (Butte AQMD, 2010)

General Conformity

The Butte AQMD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Butte AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Butte AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Butte AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website*:*
http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Butte+County+APCD-Agency-Wide+Provisions.

4.1.12.7 Specific Regulatory Considerations for Calaveras County Air Pollution Control District (Calaveras County APCD)

National and State Ambient Air Quality Standards

The Calaveras County Air Pollution Control District (Calaveras County APCD) does not maintain its own ambient air quality standards. Instead, Calaveras County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Calaveras County APCD, 1997a). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Calaveras County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Calaveras County APCD Regulation X (Additional

Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments Of 1990) describes the applicability of Title V operating permits (Calaveras County APCD, 1997c). Calaveras County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the federal major source thresholds[179] (see Table 4.1.12-3). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

According to Calaveras County APCD Rules 402 (Exemptions to Rule 401 [Permit Required]) and Rule 502 (Exemptions to Rule 501 [Permit Required]) the Calaveras County APCD may exempt the following equipment and activities from an ATC and a PTO:

- "Vehicles as defined by the Vehicle Code of the State of California…
- "…Piston type internal combustion engines used on other than vehicles for transporting passengers or freight, and fired with natural gas or liquified petroleum gas, or those having 1,000 cubic inches cylinder displacement or less and fired with diesel oil or gasoline…
- …Brazing, soldering, or welding equipment.
- Steam generators, steam superheaters, water boilers, water heaters, and closed heat transfer systems that have a maximum heat input rate of less than 50,000,000 British Thermal Units (BTU) per hour gross, and are fired exclusively with one of the following: Natural gas; Liquified petroleum gas; a combination of natural gas and liquified petroleum gas.
- Self-propelled mobile construction equipment other than pavement burners…
- …Repairs or maintenance not involving structural changes to any equipment for which a Permit to Operate has been granted.
- Other sources emitting less than 1 ton per year of any criteria pollutant or precursor which may be specified by the Air Pollution Control Officer [Calaveras County APCD]" (Calaveras County APCD, 1997b).

Temporary Emissions Sources Permits

Calaveras County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits (Calaveras County APCD, 1997b). If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

[179] The Calaveras County APCD refers to regulated air pollutants that exceed 100 TPY and not just criteria pollutants that exceed 100 TPY. Regulated air pollutants are any pollutants which are emitted into the ambient air and are pollutants for which the USEPA has adopted an emissions limit (California Technology Agency, 2011).

Preconstruction Permits

Calaveras County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions from Calaveras County APCD Rules 402 (Exemptions to Rule 401 [Permit Required]) and Rule 502 (Exemptions to Rule 501 [Permit Required]), which exempts multiple sources from an ATC and PTO (Calaveras County APCD, 1997b) (Calaveras County APCD, 1997d). The Calaveras County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Calaveras County APCD does not have specific Fugitive Dust Emission Regulations (CARB, 2009a); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

General Conformity

The Calaveras County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Calaveras County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Calaveras County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Calaveras County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website: http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Calaveras+County+APCD-Agency-Wide+Provisions.

4.1.12.8 Specific Regulatory Considerations for Colusa County Air Quality Management District (Colusa County APCD)

National and State Ambient Air Quality Standards

The Colusa County Air Pollution Control District (Colusa County APCD) does not maintain any ambient air quality standards. Instead, Colusa County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Colusa County APCD, 2008). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Colusa County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Colusa County APCD Regulation III (Permits) Rule 3.17 (Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990) describes the applicability of Title V operating permits. Colusa County APCD regulations

requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the federal major source thresholds[180] (see Table 4.1.12-3) (Colusa County APCD, 2001). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

Colusa County APCD Regulation III (Permits) Rule 3.3 (Exemptions) exempts the following source categories and equipment from an ATC and a PTO. An ATC or PTO is required for:

- "Vehicles as defined by the Vehicle Code of the State of California, but not including any article, machine, equipment, or other contrivance mounted on such vehicle that would otherwise require a permit under the provisions of these regulations and rules…
- …Brazing, soldering, or welding equipment…
- …Self-propelled mobile construction equipment other than pavements burners.
- Other sources of minor significance specified by the Air Pollution Control Officer [Colusa APCD]… " (Colusa County APCD, 1989).

Temporary Emissions Sources Permits

Colusa County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Colusa County APCD requires stationary sources that are building, modifying, or replacing any source of air contaminants (equipment or parts) to obtain an ATC prior to constructing, unless they meet the exemptions from the Colusa County APCD Regulation III (Permits) Rule 3.3 (Exemptions), which exempts multiple sources from an ATC and PTO. The Colusa County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions. (Colusa County APCD, 1989)

Fugitive Dust Emissions

Colusa County APCD does not have specific Fugitive Dust Emission Regulations (CARB, 2008a); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

[180] The Colusa County APCD refers to regulated air pollutants that exceed 100 TPY and not just criteria pollutants that exceed 100 TPY. Regulated air pollutants are any pollutants which are emitted into the ambient air and are pollutants for which the USEPA has adopted an emissions limit (Colusa County APCD, 2001).

General Conformity

The Colusa County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Colusa County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Colusa County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Colusa County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Colusa+County+APCD-Agency-Wide+Provisions.

4.1.12.9 Specific Regulatory Considerations for Eastern Kern Air Pollution Control District (Eastern Kern APCD)

National and State Ambient Air Quality Standards

The Eastern Kern Air Pollution Control District (Eastern Kern APCD) does not maintain its own ambient air quality standards. Instead, Eastern Kern APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Eastern Kern APCD, 2011). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Eastern Kern APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Eastern Kern APCD Regulation II (Permits) Rule 201.1 (Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990) describes the applicability of Title V operating permits. Eastern Kern APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Eastern Kern APCD major source thresholds (see Table 4.1.12-9) (Eastern Kern APCD, 2012). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-9: Eastern Kern APCD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC NO_X	50
GHG	100

Source: (Eastern Kern APCD, 2012)

Exempt Activities

Eastern Kern APCD Regulation II (Permits) Rule 202 (Exemptions) exempts the following source categories and equipment from an ATC and a PTO, unless a written permit is requested by the owner. An ATC or PTO shall not be required for:

- "…Any Vehicle as defined in Rule 102, but not including any source operation mounted on such vehicle that would otherwise require a permit under provisions of the District Rules and Regulations (CH & SC, Section 42310 (a)(1))…
- …Combustion Equipment:
  - Steam generators, steam superheaters, water boilers, water heaters, steam cleaners, and closed heat transfer systems with a total burner(s) maximum input heat rating of less than 5,000,000 Btu per hour (gross) and equipped to be fired exclusively with natural gas, liquefied petroleum gas, or any combination thereof, provided the fuel contains no more than 5 percent by weight hydrocarbons heavier than butane (as determined by test method American Society for Testing And Materials (ASTM) E-260-73) and no more than 0.30 grains of total sulfur per 100 standard cubic feet of gas (as determined by test method ASTM D-1072-80);
  - Piston-type internal combustion engines with a manufacturer's maximum continuous rating of 50 brake horsepower (bhp) or less; and 3. Gas turbine engines with a maximum heat input rating of 3,000,000 Btu per hour or less at Standard Conditions as defined in Rule 102, Definitions ; and
  - Natural gas or liquefied petroleum gas fired equipment used exclusively for space heating, except boilers…
- …Cooling Towers: Except as required by Rule 429.1, water cooling towers with a circulation rate of less than 1,000 gallons/minute and not used for cooling liquids containing volatile organic compounds such as process water, water from barometric jets, or water from barometric condensers…
- …Miscellaneous:
  - Brazing, soldering, or welding equipment. This exemption applies to conventional brazing, soldering, or welding operations only; any internal combustion engine or other equipment associated with these source operations that would otherwise require permits is not exempt;
  - Equipment used exclusively to compress or hold dry natural gas; any engine or other equipment associated with such source operation otherwise requiring permits is not exempt;
  - Unvented (except for emergency pressure relief) pressure vessels associated with a source operation exempt from permit; and
  - Comfort air conditioning or comfort ventilating systems not designed to remove air contaminants generated by or released from a source operation.
- Low Emitting Unit: A source operation that meets the emission limits specified in either Subsection 1 or 2 of this section and complies with Section IV, Recordkeeping of this rule.

- A source operation with a potential to emit any uncontrolled affected pollutant at a rate of less than or equal to 2 pounds in any 24-hour period.
- A source operation with a potential to emit uncontrolled Oxides of Nitrogen (NOx) or Volatile Organic Compounds (VOCs) at a rate of less than or equal to10 pounds in any 24-hour period and less than or equal to 180 pounds in any calendar year." (Eastern Kern, 2011)

Temporary Emissions Sources Permits

Eastern Kern APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Eastern Kern APCD requires an ATC prior to construction, modification, and installation of any air emissions producing equipment unless they meet the exemptions of Eastern Kern APCD Regulation II (Permits) Rule 202 (Exemptions). Regulation II (Permits) Rule 202 (Exemptions) exempts multiple sources from an ATC and a PTO. The Eastern Kern APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust

Eastern Kern APCD Regulation II (Permits) Rule 402 (Fugitive Dust) applies to outdoor activities including, but not limited to, construction (including land clearing and access roads), demolition, and excavation. The Fugitive Dust Emissions rule has specific good housekeeping practices to help with this requirement including, but not limited to, watering or using other approved dust control chemicals to keep dust down, paving dirt roads, using wind brakes, and phasing construction activities. (Eastern Kern APCD, 2015)

General Conformity

The Eastern Kern APCD follows the federal General Conformity regulations and does not maintain their own (Eastern Kern APCD, 1994). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Eastern Kern APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Eastern Kern APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Eastern Kern APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on Eastern Kern's website at http://www.kernair.org/Documents/Rules/Rules March 2014/EPA TSD for 432 5-4-15.pdf.

4.1.12.10 Specific Regulatory Considerations for El Dorado Air Quality Management District (El Dorado AQMD)

National and State Ambient Air Quality Standards

The El Dorado Air Quality Management District (El Dorado AQMD) does not maintain its own ambient air quality standards. Instead, El Dorado AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (El Dorado AQMD, 2000). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

El Dorado AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. El Dorado AQMD Regulation V (Permit to Operate Regulations) Rule 522 (Title V – Federal Operating Permit Program) describes the applicability of Title V operating permits. El Dorado AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the El Dorado AQMD major source thresholds (see Table 4.1.12-10) (El Dorado AQMD, 2001). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-10: El Dorado County AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as serious	50
VOC or NO_X for a federal nonattainment area classified as severe	25
VOC or NO_X for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (El Dorado AQMD, 2001)

Exempt Activities

El Dorado AQMD Rule 501 (General Permit Requirements) exempts the following source categories and equipment from an ATC and a PTO, unless a written permit is requested by the owner. An ATC or PTO are not required for:

- "…Vehicles used to transport passengers or freight, but not including any article, machine, equipment or other contrivance mounted on such a vehicle that would otherwise require a permit under the provisions of these rules and regulations…
- …Combustion and Heat Transfer Equipment:
  - Internal combustion engines with a manufacturer's maximum continuous rating of 50 brake horsepower or less or gas turbine engines with a maximum heat input rate of 3,000,000 British Thermal Units (Btu) per hour or less at ISO standard day conditions (288 degrees Kelvin, 60 percent relative humidity, and 101.3 kilopascals pressure). The

ratings of all engines or turbines used in the same process will be accumulated to determine whether this exemption applies.

- Any combustion equipment that has a maximum heat input of less than 1,000,000 Btu per hour (gross) and is equipped to be fired exclusively with purchased quality natural gas, liquefied petroleum gas or any combination thereof. The ratings of all combustion equipment used in the same process will be accumulated to determine whether this exemption applies…

- …Repairs and Maintenance: Repairs or maintenance not involving changes to any equipment for which a permit has been granted under Section 501.3 A [ATC], of this rule.
- Other Equipment: Unless subject to the requirements of Rule 522 Title V - Federal Operating Permit Program, other equipment authorized for exemption by the Air Pollution Control Officer and which would emit less than 2 pounds in any 24 hour period of any pollutants without the benefit of air pollution control devices" (El Dorado AQMD, 2006).

Temporary Emissions Sources Permits

El Dorado AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2 , Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

El Dorado AQMD Regulation V Rule 501 (General Permit Requirements) requires an ATC prior to construction, modification, and installation of any air emissions producing equipment unless they meet the exemptions of Regulation V Rule 501 (General Permit Requirements), which exempts multiple sources from an ATC and PTO. The El Dorado AQMD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

El Dorado AQMD Regulation II (Prohibitions) Rule 223 (Fugitive Dust – General Requirements) details regulations to "reduce the amount of particulate matter entrained in the ambient air as a result of anthropogenic (man-made) fugitive dust sources by requiring actions to prevent, reduce or mitigate fugitive dust emissions" (El Dorado AQMD, 2005a). This rule applies to specific outdoor fugitive dust sources.

El Dorado AQMD Regulation II (Prohibitions) Rule 223.1 (Fugitive Dust - Construction, Bulk Material Handling, Blasting, Other Earthmoving Activities and Carryout and Trackout Prevention) also details regulations to "limit fugitive dust emissions from construction, and construction related activities" (El Dorado AQMD, 2005b). This rule applies to "any construction or construction related activities, including, but not limited to, land clearing, grubbing, scraping, travel on site, and travel on access roads. This rule also applies to all sites

that are subject to this rule where carryout or trackout has occurred or may occur on paved public roads or the paved shoulders of a paved public road" (El Dorado AQMD, 2005b).

General Conformity

The El Dorado AQMD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The El Dorado AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. El Dorado AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. El Dorado AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=El+Dorado+County+APCD-Agency-Wide+Provisions.

4.1.12.11 Specific Regulatory Considerations for Feather River Air Quality Management District (Feather River AQMD)

National and State Ambient Air Quality Standards

The Feather River Air Quality Management District (Feather River AQMD) does not maintain any ambient air quality standards. Instead, Feather River AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Feather River AQMD, 2001). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Feather River AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Feather River AQMD Regulation X (New Source Review) Rule 10.3 (Federal Operating Permits) describes the applicability of Title V operating permits. Feather River AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Feather River AQMD major source thresholds (see Table 4.1.12-11) (Feather River AQMD, 2001). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-11: Feather River AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as serious	50
VOC or NO_X for a federal nonattainment area classified as severe	25
VOC or NO_X for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Feather River AQMD, 2001)

Exempt Activities

Feather River AQMD Regulation IV (Stationary Emission Sources Permit System and Registration) Rule 4.3 (Exemptions from Permit) exempts the following source categories from an ATC and a PTO:

- "…Vehicles as defined by the Vehicle Code of the State of California, but not including any article, machine, equipment, or other contrivance mounted on such vehicle that would otherwise require a permit under the provisions of these Rules and Regulations…
- …Self-propelled mobile construction equipment other than pavement burners.
- The APCO may exempt any process, article, machine, equipment or other contrivance with uncontrolled emissions which never exceed 2 pounds in any 24 hour period…" (Feather River AQMD, 2007).

Temporary Emissions Sources Permits

Feather River AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Feather River AQMD requires stationary sources that are building, altering, or replacing any source of air contaminants (which increase or decrease air contaminants) to obtain an ATC prior to constructing, unless they meet the exemptions of Regulation IV (Stationary Emission Sources Permit System and Registration) Rule 4.3 (Exemptions from Permit), which exempts multiple sources from an ATC and PTO. The Feather River AQMD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Feather River AQMD Regulation II (Prohibitions – Stationary Emission Sources) Rule 3.16 (Fugitive Dust Emissions) details regulations to "take every reasonable precaution not to cause or allow the emissions of fugitive dust from being airborne beyond the property line from which

the emission originates, from any construction, handling or storage activity, or any wrecking, excavation, grading, clearing of land or solid waste disposal operation. Reasonable precautions include, but are not limited to:

- Use, where possible, of water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, construction of roadways, or the clearing of land;
- Application of asphalt, oil, water, or suitable chemical on dirt roads, material stockpiles, and other surfaces which can give rise to airborne dusts…" (Feather River AQMD, 1994a).

General Conformity

The Feather River AQMD follows the federal General Conformity regulations and does not maintain their own (Feather River AQMD, 1994b). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Feather River AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Feather River AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Feather River AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Feather+River+AQMD-Agency-Wide+Provisions.

4.1.12.12 Specific Regulatory Considerations for Glenn County Air Pollution Control District (Glenn County APCD)

National and State Ambient Air Quality Standards

The Glenn County Air Pollution Control District (Glenn County APCD) does not maintain any ambient air quality standards. Instead, Glenn County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Glenn County APCD, 2001). See Table 4.1.12-2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Glenn County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Glenn County APCD Article VIII (Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990) describes the applicability of Title V operating permits. Glenn County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the federal major source thresholds[181] (see Table 4.1.12-

[181] Glenn County APCD refers to regulated air pollutants that exceed 100 TPY and not just criteria pollutants that exceed 100 TPY. Regulated air pollutants are any pollutants which are emitted into the ambient air and are pollutants for which the USEPA has adopted an emissions limit (Glenn County APCD, 2001).

3) (Glenn County APCD, 2001). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

Glenn County APCD Article III (Construction Authorization and Registration) Section 57 (Exemptions) exempts the following source categories and equipment from an ATC and a PTO. An ATC or PTO is not required for:

- The following equipment:
  - …Brazing, soldering, or welding equipment…
- …Steam heated by natural gas or LPG, or both.
- Self-propelled mobile construction equipment other than pavement burners.
- Containers, reservoirs or tanks used exclusively for:
  - Storage of liquefied gases.
  - The storage of fuel oils with a gravity of 40 degrees AP1 or lower.
  - The storage of lubricating oils.
  - The storage of gasoline having a capacity of less than 250 gallons.
- Structural changes which cannot change the quality, nature, or quantity of air contaminant emissions.
- Identical replacements in whole or in part of any article, machine, equipment or other contrivance.
- Repairs or maintenance not involving structural changes to any article, machine, equipment or other contrivance.
- Other sources of minor significance specified by the Air Pollution Control Officer [Glenn County APCD]" (Glenn County APCD, 1999).

Temporary Emissions Sources Permits

Glenn County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Glenn County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants (which increase or decrease air contaminants) to obtain an ATC prior to constructing, unless they meet the exemptions of Article III (Construction Authorization and Registration) Section 57 (Exemptions), which exempts multiple sources from an ATC and PTO. The Glenn County APCD exemptions section above details some of the exemptions that are most

directly relevant to FirstNet actions, not all of the possible exemptions. (Glenn County APCD, 1999)

General Conformity

The Glenn County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

Fugitive Dust Emissions

Glenn County APCD does not have specific Fugitive Dust Emission Regulations (CARB, 2013a); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

State Implementation Plan Requirements

The Glenn County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Glenn County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Glenn County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Glenn+County+APCD-Agency-Wide+Provisions.

4.1.12.13 Specific Regulatory Considerations for Great Basin Unified Air Pollution Control District (Great Basin Unified APCD)

National and State Ambient Air Quality Standards

The Great Basin Unified Air Pollution Control District (Great Basin Unified APCD) does not maintain its own ambient air quality standards. Instead, Great Basin Unified APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Glenn County APCD, 2001). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Great Basin Unified APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Great Basin Unified APCD Regulation II (Permits) Rule 217 (Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990) describes the applicability of Title V operating permits (Great Basin Unified APCD, 2016). Great Basin Unified APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Great Basin Unified APCD major source thresholds (see Table 4.1.12-12). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-12: Great Basin Unified APCD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Great Basin Unified APCD, 2012)

Exempt Activities

Great Basin Unified APCD Regulation II (Permits) Rule 201 (Exemptions) exempts the following source categories and equipment from an ATC and a PTO, unless a written permit is requested by the owner. An ATC or PTO shall not be required for:

- …The following equipment:
  - ….Piston type internal combustion engines except for diesel engines greater than 50 brake horsepower that are subject to emission control requirements pursuant to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines (Title 17, California Code of Regulations, Section 93115)…
- The following equipment or any exhaust system or collector serving exclusively such equipment:
  - Blast cleaning equipment using a suspension of abrasive in water…
  - …Equipment used for inspection of metal products…
  - …Brazing, soldering, or welding equipment…
- …Steam generators, steam superheaters, water boilers, water heaters, and closed heat transfer systems that have a maximum heat input rate of less than 15 million British Thermal Units (BTU) per hour (gross), and are fired exclusively with natural gas or liquefied petroleum gas or any combination thereof….
- …Structural changes which cannot change the quality, nature, or quantity of air contaminant emissions.
- Repairs or maintenance not involving structural changes to any equipment for which a permit has been granted.
- Identical replacements in whole or in part of any article, machine, equipment or other contrivance where a permit to operate has previously been granted for such equipment under Rule 200 [Permits Required]; however, this exception shall not be applicable to equipment or air pollution control equipment with respect to the loading of gasoline into stationary tanks (Rule 419)" (Great Basin Unified APCD, 2012).

Temporary Emissions Sources Permits

Great Basin Unified APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment

does not meet the definition of portable, the stationary source permitting requirements must be followed. (Great Basin Unified APCD, 2012)

Preconstruction Permits

Great Basin Unified APCD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of Regulation II (Permits) Rule 201 (Exemptions), which exempts multiple sources from an ATC and PTO. The Great Basin Unified APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust

Great Basin Unified APCD Regulation IV (Prohibitions) Rule 401 (Fugitive Dust) requires that "a person shall take reasonable precautions to prevent visible particulate matter from being airborne, under normal wind conditions, beyond the property from which the emission originates" (Great Basin Unified APCD, 2012). Some precautions include, but are not limited to, watering or using other approved dust control chemicals to keep dust down, paving dirt roads, and remove dirt from roadways (Great Basin Unified APCD, 2012).

General Conformity

The Great Basin Unified APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Great Basin Unified APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Great Basin Unified APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Great Basin Unified APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website: http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Great+Basin+APCD-Agency-Wide+Provisions.

4.1.12.14 Specific Regulatory Considerations for Imperial County Air Pollution Control District (Imperial County APCD)

National and State Ambient Air Quality Standards

The Imperial County Air Pollution Control District (Imperial County APCD) does not maintain its own ambient air quality standards. Instead, the Imperial County APCD defers to the CARB, which adopted the federal NAAQS as well as promulgated a set of state AAQS, see Section 4.1.12.2 for a discussion of California's AAQS (Imperial County APCD, 2016).

Title V Operating Permits/State Operating Permits

Imperial County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Imperial County APCD Regulation IX (Title V) describes the applicability of Title V operating permits. Imperial County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Imperial County APCD major source thresholds (see Table 4.1.12-13) (Imperial County APCD, 2016). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-13: Imperial County APCD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant, excluding greenhouse gases	100
Single HAP	10
Total/Cumulative HAPs	25
PM_{10}	70
GHG's that are subject to regulation as defined in 40 CFR 70.2 (State Operating Permit Programs, Definitions), provided that the mass emissions of all GHGs emitted, without consideration of global warming potential (GWP), are equal to or greater than 100 tons per year	100

Source: (Imperial County APCD, 2016)

Exempt Activities

According to Imperial County APCD Regulation II (Permits) Rule 202 (Exemptions) exempts the following equipment and processes from an ATC and a PTO. An ATC or PTO shall not be required for:

- …Combustion and Heat Transfer Equipment:
  - Internal Combustion Engines and Gas Turbines: Piston type internal combustion engines with a manufacturer's maximum continuous rating of 50 brake horsepower (bhp) or less or gas turbine engines with a maximum heat input rate of 3 million British thermal units (Btu) per hour or less at ISO Standard Day Conditions. The ratings of all engines or turbines used within a Stationary Source will be accumulated to determine whether this exemption applies.
  - Steam generator, steam superheaters, water boilers, water heaters, steam cleaners, and closed indirect heat transfer systems which have a maximum input heat rating of 5,000,000 Btu per hour (gross) or less and are equipped to be fired exclusively with Public Utilities Commission regulated natural gas, liquefied petroleum gas or any combination thereof.
  - Portable equipment holding a valid registration under the Statewide Portable Equipment Registration Program [PERP]…
- …Motor Vehicles as defined by the Vehicle Code of the State of California but not including any article, machine, Equipment, or other contrivance mounted on such vehicle that would otherwise require a permit under the provisions of these rules and regulations…

- …Repairs or Maintenance: Routine repairs or maintenance not involving structural changes to any Equipment for which a permit has been granted" (Imperial County APCD, 2016).

Temporary Emissions Sources Permits

Imperial County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed. (Imperial County APCD, 2016)

Preconstruction Permits

Imperial County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of Regulation II (Permits) Rule 202 (Exemptions), which exempts multiple sources from an ATC and a PTO. The Imperial County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Imperial County APCD Regulation VIII (Fugitive Dust Rules) Rule 801 (Construction and Earthmoving Activities) applies to "…any Construction and other Earthmoving Activities, including, but not limited to, land clearing, excavation related to construction, land leveling, grading, cut and fill grading, erection or demolition of any structure, cutting and filling, trenching, loading or unloading of bulk materials, demolishing, drilling, adding to or removing bulk of materials from open storage piles, weed abatement through disking, back filling, travel on-site and travel on access roads to and from the site" (Imperial County APCD, 2016). Imperial County APCD requires all persons who own or operate a construction site or who perform earth moving activities to comply with the 20 percent opacity rule and develop a dust control plan for non-residential sites that are 5 acres or more. Actions operators can take to minimize fugitive emissions include watering or using other approved dust control chemicals, paving dirt roads, and wind brakes (Imperial County APCD, 2016).

Imperial County APCD Regulation VII (Fugitive Dust) Rule 803 (Carry-Out and Track-Out) requires that during construction activities any dirt or material that is tracked onto paved public roads or the paved shoulders of public roads must clean or prevent materials from being tracked-out onto public surfaces (Imperial County APCD, 2016).

General Conformity

The Imperial County APCD follows the federal General Conformity regulations and does not maintain their own (Imperial County APCD, 1994). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Imperial County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Imperial County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Imperial County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on Imperial County APCD's website at https://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Imperial+County+APCD-Agency-Wide+Provisions.

4.1.12.15 Specific Regulatory Considerations for Lake County Air Quality Management District (Lake County AQMD)

National and State Ambient Air Quality Standards

The Lake County Air Quality Management District (Lake County AQMD) does not maintain its own ambient air quality standards. Instead, Lake County AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Lake County AQMD, 2006). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Lake County AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Lake County AQMD Chapter XII (Issuing Permits to Title V Sources) describes the applicability of Title V operating permits. Lake County AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 4.1.12-14) (Lake County AQMD, 2006). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-14: Lake County AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as serious	50
VOC or NO_X for a federal nonattainment area classified as severe	25
VOC or NO_X for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Lake County AQMD, 2006)

Exempt Activities

According to Lake County AQMD Chapter IV (Permits) Article IV (Permit Exemptions) the Lake County AQMD may exempt the following equipment from obtaining an ATC or PTO:

- "Any vehicle as defined in the Vehicle Code…

- …Repairs or maintenance not involving structural changes to any equipment for which a permit has been granted" (Lake County AQMD, 2006).

Temporary Emissions Sources Permits

Lake County AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Lake County AQMD requires stationary sources that are constructing, modifying or replacing any air contaminant equipment or sources obtain an ATC prior to constructing that source, unless the source meets the exemptions of Lake County AQMD Chapter IV (Permits) Article IV (Permit Exemptions), which exempts multiple sources from an ATC and PTO. The Lake County AQMD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Lake County AQMD does not have specific Fugitive Dust Emission Regulations (CARB, 2006); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

General Conformity

The Lake County AQMD follows the federal General Conformity regulations and does not maintain their own (Lake County AQMD, 2006). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Lake County AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Lake County AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Lake County AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website: http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Lake+County+AQMD-Agency-Wide+Provisions.

4.1.12.16 Specific Regulatory Considerations for Lassen County Air Pollution Control District (Lassen County APCD)

National and State Ambient Air Quality Standards

The Lassen County Air Pollution Control District (Lassen County APCD) does not maintain any ambient air quality standards. Instead, Lassen County APCD defers to the CARB which as

previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS. See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Lassen County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Lassen County APCD Regulation VII (Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990) describes the applicability of Title V operating permits. Lassen County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the federal major source thresholds[182] (see Table 4.1.12-3) (Lassen County APCD, 2001). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

Lassen County APCD Regulation II (Permits) Rule 2:1 (Sources Not Requiring Permits) exempts the following source categories and equipment from an ATC and a PTO. An ATC or PTO shall not be required for the following equipment:

- "Vehicles as defined by the Vehicle Code of the State of California but not including any article, machine, equipment, or other contrivance mounted on such vehicle that would otherwise require a permit under the provisions of these Rules and Regulations…
- …Refrigeration units except those used as, or in conjunction with, air pollution control equipment.
- Piston type internal combustion engines except for diesel engines greater than 50 brake horsepower or less, except those used to power stationary emission sources or air pollution control equipment…
- …Natural gas or liquefied petroleum gas fired equipment used exclusively for space heating other than boilers….
- …Brazing, soldering, or welding equipment…
- …Self-propelled mobile construction equipment other than pavement burners.
- Other sources of minor significance specified by the Air Pollution Control Officer [Lassen County APCD]…" (Lassen County APCD, 2011).

Temporary Emissions Sources Permits

Lassen County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide

[182] The Lassen County APCD refers to regulated air pollutants that exceed 100 TPY and not just criteria pollutants that exceed 100 TPY. Regulated air pollutants are any pollutants which are emitted into the ambient air and are pollutants for which the USEPA has adopted an emissions limit (Lassen County APCD, 2001).

use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Lassen County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of Regulation II (Permits) Rule 2:1 (Sources Not Requiring Permits), which exempts multiple sources from an ATC and PTO. The Lassen County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust

Lassen County APCD Regulation IV (Prohibitions) Rule 4:18 (Fugitive Dust) requires that "reasonable precautions shall be taken to prevent particulate matter from being airborne" (Lassen County APCD, 2014). The Fugitive Dust rule lists good housekeeping practices to help control particulate matter such as watering or using other approved dust control chemicals, paving dirt roads, and covering open bodied trucks. (Lassen County APCD, 2014)

General Conformity

The Lassen County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Lassen County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Lassen County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Lassen County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Lassen+County+APCD-Agency-Wide+Provisions.

4.1.12.17 Specific Regulatory Considerations for Mariposa County Air Pollution Control District (Mariposa County APCD)

National and State Ambient Air Quality Standards

The Mariposa County Air Pollution Control District (Mariposa County APCD) does not maintain its own ambient air quality standards (CARB, 2008b). Instead, Mariposa County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS. See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Mariposa County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Mariposa County APCD Regulation X (Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments Of 1990) describes the applicability of Title V operating permits (Mariposa County APCD, 2008a). Mariposa County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the federal major source thresholds[183] (see Table 4.1.12-3). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

According to Mariposa County APCD Regulation IV (Authorization to Construct Regulations) Rules 402 (Exemptions to Rule 401 [Permit Required]) and Regulation V (Permit to Operate Regulations) Rule 502 (Exemptions to Rule 501 [Permit Required]) the Mariposa County APCD exempts the following equipment from obtaining an ATC or PTO

- "Vehicles as defined by the Vehicle Code of the State of California.
- …Refrigeration units except those used as; or in conjunction with, air pollution control equipment.
- Piston type internal combustion engines used on other than vehicles for transporting passengers or freight, and fired with natural gas or liquefied petroleum gas, or those having 1,000 cubic inches cylinder displacement or less and fired with diesel oil or gasoline…
- Steam generators, steam superheaters, water boilers, water heaters, and closed heat transfer systems that have a maximum heat input rate of less than 50,000,000 British Thermal Units (BTU) per hour gross, and are fired exclusively with one of the following: 1. Natural gas; 2. Liquefied petroleum gas; 3. A combination of natural gas and liquefied petroleum gas.
- …Self-propelled mobile construction equipment other than pavement burners…
- …Repairs or maintenance not involving structural changes to any equipment for which a Permit to Operate has been granted.
- Other sources emitting less than 1 ton per year of any criteria pollutant or precursor which may be specified by the Air Pollution Control Officer." (Mariposa County APCD, 2008b)

Temporary Emissions Sources Permits

Mariposa County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

[183] Mariposa County APCD refers to regulated air pollutants that exceed 100 TPY and not just criteria pollutants that exceed 100 TPY. Regulated air pollutants are any pollutants which are emitted into the ambient air and are pollutants for which the USEPA has adopted an emissions limit (Mariposa County APCD, 2008c).

Preconstruction Permits

Mariposa County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions from APCD Regulation IV (Authorization to Construct Regulations) Rules 402 (Exemptions to Rule 401 [Permit Required]) and Regulation V (Permit to Operate Regulations) Rule 502 (Exemptions to Rule 501 [Permit Required]), which exempts multiple sources from an ATC and PTO. The Mariposa County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust

Mariposa County APCD does not have specific Fugitive Dust Emission Regulations (CARB, 2008b); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

General Conformity

The Mariposa County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Mariposa County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Mariposa County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Mariposa County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Mariposa+County+APCD-Agency-Wide+Provisions.

4.1.12.18 Specific Regulatory Considerations for Mendocino County Air Quality Management District (Mendocino County AQMD)

National and State Ambient Air Quality Standards

The Mendocino County Air Quality Management District (Mendocino County AQMD) does not maintain any ambient air quality standards. Instead, "the ambient air quality standards of the Mendocino County Air Quality Management District shall be those established by the California Air Resources Board and the U.S. Environmental Protection Agency" (Mendocino County AQMD, 2011). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Mendocino County AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Mendocino County AQMD Regulation 5 (Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act

Amendments of 1990) describes the applicability of Title V operating permits (Mendocino County AQMD, 2000a). Mendocino County AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Mendocino County AQMD major source thresholds (see Table 4.1.12-15). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-15: Mendocino County AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as serious	50
VOC or NO_X for a federal nonattainment area classified as severe	25
VOC or NO_X for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Mendocino County AQMD, 2000b)

Exempt Activities

Mendocino County AQMD Regulation I (Table of Contents) Chapter 2 (Permits) exempts the following source categories from an ATC and a PTO:

- "Any vehicle as defined in the Vehicle Code…
- …Mixing, blending, conveying, or other mechanical systems which do not, directly or indirectly, emit air contaminants.
- Gasoline and organic liquid storage tanks having a capacity of less than 250 gallons.
- Any article, machine, equipment or other contrivance that the Air Pollution Control Officer [Mendocino County AQMD] finds emits air contaminants below the significance level and he [Mendocino County AQMD] determines should be exempted…" (Mendocino County AQMD, 2006).

Temporary Emissions Sources Permits

Mendocino County AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Mendocino County AQMD requires stationary, portable, and indirect sources of air emission contaminants (both causing and reducing) to obtain an ATC prior to constructing, unless they meet the exemptions of Regulation I (Table of Contents) Chapter 2 (Permits), which exempts multiple sources from an ATC and PTO. The Mendocino County AQMD exemptions section

above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions. (Mendocino County AQMD, 2006)

Fugitive Dust Emissions

Mendocino County AQMD Rule 1-430 regulates Fugitive Dust emissions throughout the district. Rule 1-430 states:

"This Rule prohibits the handling, transportation, or open storage of materials, or the conduct of other activities in such a manner that allows or may allow unnecessary amounts of particulate matter to become airborne except under the following circumstances:

(a) Reasonable precautions shall be taken to prevent particulate matter from becoming airborne, including, but not limited to, the following provisions:

(1) Covering open bodied trucks when used for transporting materials likely to give rise to airborne dust.

(2) Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials.

(3) The screening of all open-outdoor sandblasting and similar operations.

(4) The use of water or chemicals for the control of dust during the demolition of existing buildings or structures.

(b) The following airborne dust control measures shall be required during all construction operations, the grading of roads, or the clearing of land

(1) All visibly dry disturbed soil road surfaces shall be watered to minimize fugitive dust emissions.

(2) All unpaved surfaces, unless otherwise treated with suitable chemicals or oils, shall have a posted speed limit of 10 miles per hour.

(3) Earth or other material that has been transported by trucking or earth moving equipment, erosion by water, or other means onto paved streets shall be promptly removed.

(4) Asphalt, oil, water or suitable chemicals shall be applied on materials stockpiles, and other surfaces that can give rise to airborne dusts.

(5) All earthmoving activities shall cease when sustained winds exceed 15 miles per hour.

(6) The operator shall take reasonable precautions to prevent the entry of unauthorized vehicles onto the site during non-work hours.

(7) The operator shall keep a daily log of activities to control fugitive dust.

(c) During recreational activities adequate dust control shall be maintained to prevent dust from migrating off the property where the activity is occurring." (CARB, 2013b)

General Conformity

The Mendocino County AQMD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Mendocino County AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Mendocino County AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Mendocino County AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Mendocino+AQMD-Agency-Wide+Provisions.

4.1.12.19 Specific Regulatory Considerations for Modoc County Air Pollution Control District (Modoc County APCD)

National and State Ambient Air Quality Standards

The Modoc County Air Pollution Control District (Modoc County APCD) does not maintain any ambient air quality standards. Instead, Modoc County APCD adopted the federal NAAQS as well as CARB's AAQS, see Section 4.1.12.2 for a discussion of California's AAQS. (Modoc County APCD, 2001)

Title V Operating Permits/State Operating Permits

Modoc County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Modoc County APCD Regulation II (Permit System) Rule 2.13 (Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990) describes the applicability of Title V operating permits (Modoc County APCD, 2001). Modoc County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the federal major source thresholds[184] (see Table 4.1.12-3). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

Modoc County APCD Regulation II (Permit System) Rule 2.2 (Exemptions) exempts the following source categories and equipment from an ATC and a PTO. An ATC or PTO shall not be required for the following equipment:

[184] Modoc County APCD refers to regulated air pollutants that exceed 100 TPY and not just criteria pollutants that exceed 100 TPY. Regulated air pollutants are any pollutants which are emitted into the ambient air and are pollutants for which the USEPA has adopted an emissions limit (Modoc County APCD, 2001).

- "Vehicles as defined by the Vehicle Code of the State of California, but not including any article, machine, equipment, or other contrivance mounted on such vehicle that would otherwise require a permit under the provisions of these Rules and Regulations…
- …Steam generators, water boilers, water heaters, or space heaters having an input heating value of less than 5 million BTU per hour and which are fired exclusively with one of the following: natural gas, liquefied petroleum gas, distillate fuel oil, any combination of items 1, 2, and 3,
- Containers, reservoirs, or tanks used exclusively for:
  - Storage of liquefied gases.
  - The storage of fuel used primarily for implements of husbandry.
  - The storage of lubricating oils.
  - The storage of gasoline and fuel oi1s and having a capacity of 20,000 gallons or less, provided that a permit shall be required for any bulk plant and for any retail service station subject to Rule 8.1.
- Repairs or maintenance not involving structural changes to any equipment for which a permit has been granted.
- Any article. Machine, equipment or other contrivance which emits air contaminants below the significance level and which the Control Officer [Modoc County APCD] determines should be exempted" (Modoc County APCD, 1989a).

Temporary Emissions Sources Permits

Modoc County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed. (Modoc County APCD, 1989b)

Preconstruction Permits

Modoc County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants, which may increase or reduce emissions, to obtain an ATC prior to constructing, unless they meet the exemptions of Regulation II (Permit System) Rule 2.2 (Exemptions), which exempts multiple sources from an ATC and PTO. The Modoc County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Modoc County APCD does not have specific Fugitive Dust Emission Regulations (CARB, 2009b); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

General Conformity

The Modoc County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Modoc County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Modoc County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Modoc County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Modoc+County+APCD-Agency-Wide+Provisions.

4.1.12.20 Specific Regulatory Considerations for Mojave Desert Air Quality Management District (Mojave Desert AQMD)

National and State Ambient Air Quality Standards

The Mojave Desert Air Quality Management District (Mojave Desert AQMD) does not maintain any ambient air quality standards. Instead, Mojave Desert AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Mojave Desert AQMD, 2005). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Mojave Desert AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Mojave Desert AQMD Regulation XII (Federal Operating Permits) describes the applicability of Title V operating permits (Mojave Desert AQMD, 2011). Mojave Desert AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Mojave Desert AQMD major source thresholds (see Table 4.1.12-16). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-16: Mojave Desert AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Air Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as severe-17 for O_3[a]	25

Source: (Mojave Desert AQMD, 2005)

[a] "For any Facility located in Zone A (Any area within the District which is designated Federal Severe-17 Non-attainment area for Ozone)" (Mojave Desert AQMD, 2005)

Rule 203 (Permit to Operate) requires that a person obtain a PTO prior to the use of any air emissions producing or reducing article, machine, or equipment (Mojave Desert AQMD, 1977a).

Exempt Activities

Mojave Desert AQMD does not explicitly exempt any source from obtaining a permit. (Mojave Desert AQMD, 1977a).

Temporary Emissions Sources Permits

Mojave Desert AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed (Mojave Desert AQMD, 1977b).

Preconstruction Permits

Under Rule 201 (Permit to Construct), the Mojave Desert AQMD requires that a person obtain a Permit to Construct (PTC) prior to building, installing, modifying or replacing any air emissions producing article, machine, equipment, or other component (used to reduce or control the emission of air contaminants) (Mojave Desert AQMD, 1977c).

Fugitive Dust

Mojave Desert AQMD Regulation IV (Prohibitions) Rule 403 (Fugitive Dust) details that "a person shall not cause or allow the emissions of fugitive dust from any transport, handling, construction or storage activity so that the presence of such dust remains visible in the atmosphere beyond the property line of the emission source" (Mojave Desert AQMD, 1977d).

General Conformity

The Mojave Desert AQMD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Mojave Desert AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Mojave Desert AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Mojave Desert AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Mojave+Desert+AQMD-Agency-Wide+Provisions.

4.1.12.21 Specific Regulatory Considerations for Monterey Bay Unified Air Pollution Control District (Monterey Bay Unified APCD)

National and State Ambient Air Quality Standards

The Monterey Bay Unified Air Pollution Control District (Monterey Bay Unified APCD) does not maintain any ambient air quality standards. Instead, Monterey Bay Unified APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Monterey Bay Unified APCD, 2010). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Monterey Bay Unified APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70 (Monterey Bay Unified APCD, 2010). Monterey Bay Unified APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Monterey Bay Unified APCD major source thresholds (see Table 4.1.12-17). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-17: Monterey Bay Unified AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
Carbon dioxide equivalent (CO_2e) GHG emissions	100,000
GHG (actual and potential to emit)	100

Source: (Monterey Bay Unified APCD, 2010)

Exempt Activities

Monterey Bay Unified APCD Regulation II (Permits) Rule 201 (Sources Not Requiring Permits) exempts the following source categories and equipment from an ATC and/or a PTO. An ATC or PTO shall not be required for:

- "…External Combustion Equipment
  - Any Steam generator, steam superheater, water boiler, water heater, or closed heat transfer system at a stationary source that has an aggregate heat input rate of less than: 2 million British Thermal Units (BTU) per hour (gross) when fired with natural gas or liquefied petroleum gas or any combination thereof and 250,000 BTU per hour (gross) when fired with any other fuel than that identified in Subsection 4.7.2.1…
- …Internal Combustion Engines
  - Any stationary piston-type internal combustion engine of less than 50 break horsepower (bhp).

  - Turbines – Any turbine at a stationary sources that as a heat input rate of less than 3 million BTU per hour (gross), and is fired exclusively with natural gas or liquefied petroleum gas or any combination thereof.

- Low Emitting Unit – Any other process not otherwise identified which has "emissions of less than 2 pounds per day of any affected pollutant…"
- "The following equipment or any exhaust system or collector serving exclusively such equipment…Brazing, soldering, or welding equipment…
- …Miscellaneous Equipment:…Earth-moving or grading equipment at construction sites…" (Monterey Bay Unified APCD, 2014).

Temporary Emissions Sources Permits

Monterey Bay Unified APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Monterey Bay Unified APCD Rule 200 (Permits Required) requires that a person obtain an ATC prior to building, installation, modification or replacement of any air emissions producing or reducing article, machine, equipment, or other component, unless exempt by Rule 201 (Sources Not Requiring Permits), which exempts multiple sources from an ATC and PTO. The Monterey Bay Unified APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Monterey Bay Unified APCD does not have specific Fugitive Dust Emission Regulations (CARB, 2015c); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

General Conformity

The Monterey Bay Unified APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Monterey Bay Unified APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Monterey Bay Unified APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Monterey Bay Unified APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at

http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Monterey+Bay+Unified+APCD-Agency-Wide+Provisions.

4.1.12.22 Specific Regulatory Considerations for North Coast Unified Air Quality Management District (North Coast Unified AQMD)

National and State Ambient Air Quality Standards

The North Coast Unified Air Quality Management District (North Coast Unified AQMD) does not maintain its own ambient air quality standards. Instead, North Coast Unified AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (North Coast Unified AQMD, 2015a). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

North Coast Unified AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. North Coast Unified AQMD Regulation V (Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990) describes the applicability of Title V operating permits (North Coast Unified AQMD, 2015a). North Coast Unified AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the North Coast Unified AQMD major source thresholds (see Table 4.1.12-18). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-18: North Coast Unified AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as serious	50
VOC or NO_X for a federal nonattainment area classified as severe	25
VOC or NO_X for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (North Coast Unified AQMD, 2015a)

Exempt Activities

North Coast Unified AQMD Regulation I (General Provisions) Rule 102 (Required Permits) exempts the following source categories and equipment from an ATC and/or a PTO. An ATC or PTO shall not be required for:

- "Vehicles as defined by the Vehicle Code of the State of California, but not including any article, machine, equipment, or other contrivance mounted on such vehicle that would otherwise require a permit under the provisions of these Rules and Regulations…

- … Steam generators, water boilers or water heaters fired exclusively by natural gas, liquefied petroleum gas or a combination thereof, having a maximum fuel input heating value of less than one million (1,000,000) British Thermal Units (BTU) per hour or thirty (30) horsepower…
- … Self-propelled mobile construction equipment other than pavement burners…" (North Coast Unified AQMD, 2015b).

Temporary Emissions Sources Permits

North Coast Unified AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

North Coast Unified AQMD Regulation I (General Provisions) Rule 102 (Required Permits) requires that a person obtain an ATC prior to "building, erecting, altering or replacing any article, machine, equipment or other contrivance or indirect source, the use of which may cause the issuance of air contaminants or the use of which may eliminate or reduce or control the issuance of air contaminants," unless they meet the exemptions (North Coast Unified AQMD, 2015b). The North Coast Unified AQMD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

North Coast Unified AQMD Reg. I, Rule 104 D pertains to Fugitive Dust Emissions. That rule states:

1) "No person shall allow handling, transporting, or open storage of materials in such a manner which allows or may allow unnecessary amounts of particulate matter to become airborne.

2) Reasonable precautions shall be taken to prevent particulate matter from becoming airborne, including, but not limited to, the following provisions:

a) Covering open bodied trucks when used for transporting materials likely to give rise to airborne dust.

b) Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials. Containment methods can be employed during sandblasting and other similar operations.

c) Conduct agricultural practices in such a manner as to minimize the creation of airborne dust.

d) The use of water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads or the clearing of land.

e) The application of asphalt, oil, water or suitable chemicals on dirt roads, materials stockpiles, and other surfaces which can give rise to airborne dusts.

f) The paving of roadways and their maintenance in a clean condition.

g) The prompt removal of earth or other track out material from paved streets onto which earth or other material has been transported by trucking or earth moving equipment, erosion by water, or other means." (CARB, 2015d)

General Conformity

The North Coast Unified AQMD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The North Coast Unified AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. North Coast Unified AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. North Coast Unified AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website: http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=North+Coast+Unified+AQMD-Agency-Wide+Provisions.

4.1.12.23 Specific Regulatory Considerations for Northern Sierra Air Quality Management District (Northern Sierra AQMD)

National and State Ambient Air Quality Standards

The Northern Sierra Air Quality Management District (Northern Sierra AQMD) does not maintain its own ambient air quality standards. Instead, Northern Sierra AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Northern Sierra AQMD, 2016). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Northern Sierra AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Northern Sierra AQMD Regulation V (Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990) describes the applicability of Title V operating permits (Northern Sierra AQMD, 2001). Northern Sierra AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Northern Sierra AQMD major source thresholds (see Table 4.1.12-19). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-19: Northern Sierra AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as serious	50
VOC or NO_X for a federal nonattainment area classified as severe	25
VOC or NO_X for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Northern Sierra AQMD, 2001)

Exempt Activities

According to the Northern Sierra AQMD Rules 402 (Exemptions to Rule 401 [Permit Required]) and Rule 502 (Exemptions to Rule 501 [Permit Required]) the Northern Sierra AQMD may exempt the following equipment from obtaining an ATC or PTO:

- "Any vehicles…
- … Any facility or source with a toxic prioritization score[185] less than 1 as determined by the District and that emits less than 1000 pounds per year of any criteria pollutant, precursor, or toxic air contaminant.
- Steam generators, steam superheaters, water boilers, water heaters, and closed heat transfer systems that have a maximum heat input rate of less than 3,000,000 British Thermal Units (BTU) per hour gross, and are fired exclusively with one of the following: (1) Natural gas; (2) Liquefied petroleum gas; (3) A combination of natural gas and liquefied petroleum gas.
- Other sources that have not been deemed a nuisance or potential nuisance by the APCO and emit less than 1000 pounds per year of any one criteria pollutant or precursor or emit less than 2000 pounds of any combination thereof as determined by the APCO" (Northern Sierra AQMD, 2005).

Temporary Emissions Sources Permits

Northern Sierra AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Northern Sierra AQMD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of AQMD Rules 402 (Exemptions to Rule 401 [Permit Required]) and Rule 502

[185] Toxic Prioritization Score is the health risk assessment score which has been "prioritized by the district in accordance with California Health and Safety Code Section 44360(a) using procedures that have undergone public review and that are consistent with the procedures presented in the California Air Pollution Control Officers Association (CAPCOA)," (California Health and Safety Code, 1975).

(Exemptions to Rule 501 [Permit Required]) (Northern Sierra AQMD, 2005), which exempts multiple sources from an ATC and PTO. The Northern Sierra AQMD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Northern Sierra AQMD Rule 226 (Dust Control) indicates that reasonable precautions must be taken to prevent dust emissions. "Reasonable precautions may include, but are not limited to, cessation of operations, cleanup, sweeping, sprinkling, compacting, enclosure, chemical or asphalt sealing, and use of wind screens or snow fences" (Northern Sierra AQMD, 1994).

General Conformity

The Northern Sierra AQMD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Northern Sierra AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Northern Sierra AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Northern Sierra AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Northern+Sierra+AQMD-Agency-Wide+Provisions.

4.1.12.24 Specific Regulatory Considerations for Northern Sonoma County Air Pollution Control District (Northern Sonoma County APCD)

National and State Ambient Air Quality Standards

The Northern Sonoma County Air Pollution Control District (Northern Sonoma County APCD) does not maintain its own ambient air quality standards. Instead, Northern Sonoma County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Northern Sierra AQMD, 2001). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Northern Sonoma County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Northern Sonoma County APCD Regulation V (Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments Of 1990) describes the applicability of Title V operating permits (Northern Sierra AQMD, 2001). Northern Sonoma County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the

Northern Sonoma APCD major source thresholds (see Table 4.1.12-20). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-20: Northern Sonoma APCD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X for a federal nonattainment area classified as serious	50
VOC or NO_X for a federal nonattainment area classified as severe	25
VOC or NO_X for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Northern Sonoma County APCD, 2011)

Exempt Activities

According to Northern Sonoma County APCD Rules 200 (Permit Requirements) the Northern Sonoma County APCD may exempt the following equipment from obtaining an ATC or PTO:

- "Any vehicle as defined in the Section 670 of the California Vehicle Code, as of November 14, 2014…
- …Mixing, blending, conveying, or other mechanical systems which do not, directly or indirectly, emit air contaminants.
- Gasoline and organic liquid storage tanks having a capacity of less than 250 gallons.
- Any article, machine, equipment or other contrivance which the Control Officer [Northern Sonoma County APCD] finds emits air contaminants in an amount that is less than 50 percent of the level specified in Rule 130(2) as significant [Rule 130 section (s2) Signification Emission Rates], is not subject to any federal regulation enforceable by the District or any NSPS or NESHAP, and which and s/he determines should be exempted" (Northern Sonoma County APCD, 1985a).

Temporary Emissions Sources Permits

Northern Sonoma County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Northern Sonoma County APCD requires stationary sources that are building, altering, or replacing any source of air to obtain an ATC prior to constructing, unless they meet the exemptions of APCD Rules 200 (Permit Requirements). The Northern Sonoma County APCD

exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Northern Sonoma County APCD Rule 430 (Fugitive Dust Emissions) indicates that reasonable precautions must be taken to prevent fugitive dust to becoming airborne. The Fugitive Dust Emissions rule has specific good housekeeping practices including, but not limited to, watering or using other approved dust control chemicals to keep dust down, covering open trucks, paving dirt roads, and removing soil and other materials from paved surfaces. (Northern Sonoma County APCD, 1985b)

General Conformity

The Northern Sonoma County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Northern Sonoma County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Northern Sonoma County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Northern Sonoma County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Northern+Sonoma+County+APCD-Agency-Wide+Provisions.

4.1.12.25 Specific Regulatory Considerations for Placer County Air Pollution Control District (Placer County APCD)

National and State Ambient Air Quality Standards

The Placer County Air Pollution Control District (Placer County APCD) does not maintain any ambient air quality standards. Instead, Placer County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Placer County APCD, 2010). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Placer County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Placer County APCD Rule 507 (Federal Operating Permit Program) describes the applicability of Title V operating permits. Placer County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Placer County APCD major source thresholds (see Table 4.1.12-21) (Placer County APCD, 2001). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-21: Placer County APCD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant, sulfur dioxide, carbon monoxide, and PM_{10}	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X	25

Source: (Placer County APCD, 2001)

Exempt Activities

According to Placer County APCD Rule 501 (General Permit Requirements) the Placer County APCD may exempt the following equipment from obtaining an ATC or PTO:

- "…Engines used to propel mobile equipment or a motor vehicle of any kind, but not including any article, machine, equipment or other contrivance mounted on such a vehicle that would otherwise require a permit under the provisions of these rules and regulations…
- …Internal combustion engines with a manufacturer's maximum continuous rating of 50 brake horsepower or less or gas turbine engines with a maximum heat input rate of 3,000,000 British Thermal Units (Btu) per hour or less at ISO standard day conditions (288 degrees Kelvin, 60 percent relative humidity, and 101.3 kilopascals pressure). The ratings of all engines or turbines used in the same process will be accumulated to determine whether this exemption applies.
- Any combustion equipment that has a maximum heat input of less than 1,000,000 Btu per hour (gross) and is equipped to be fired exclusively with natural gas, liquefied petroleum gas or any combination thereof. The ratings of all combustion equipment used in the same process will be accumulated to determine whether this exemption applies…
- …Repairs or maintenance not involving changes to any equipment for which a permit has been granted under Section 301[Authority to Construct] of this rule
- …Other equipment authorized for exemption by the Air Pollution Control Officer and which would emit less than 2 pounds in any 24 hour period of any pollutants without the benefit of air pollution control devices…." (Placer County APCD, 2010).

Temporary Emissions Sources Permits

Placer County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

Preconstruction Permits

Placer County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of APCD Rule 501 (General Permit Requirements), which exempts multiple sources

from an ATC and PTO. The Placer County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Placer County APCD Rule 218 (Fugitive Dust Emissions) applies to any man-made activity that generates fugitive dust. The fugitive dust emissions must not remain visible beyond a property or boundary line, be greater than 40 percent opacity around active operations, must not exceed 50 $\mu g/m^3$ over a 24 hour average, and must not track-out material or soil onto roadways. Standards to minimize fugitive dust include, but are not limited to, watering or using other approved dust control chemicals to keep dust down, paving dirt roads, using wind brakes, and cleaning material off paved roads (Placer County APCD, 2003).

General Conformity

The Placer County APCD follows the federal General Conformity regulations and does not maintain their own (Placer County APCD, 1994). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Placer County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Placer County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Placer County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Placer+County+APCD-Agency-Wide+Provisions.

4.1.12.26 Specific Regulatory Considerations for Sacramento Metropolitan Air Quality Management District (Sacramento Metropolitan AQMD)

National and State Ambient Air Quality Standards

The Sacramento Metropolitan Air Quality Management District (Sacramento Metropolitan AQMD) does not maintain its own ambient air quality standards. Instead, Sacramento Metropolitan AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Sacramento Metropolitan AQMD, 2011). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Sacramento Metropolitan AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Sacramento Metropolitan AQMD Rule 207 (Federal Operating Permit Program) describes the applicability of Title V operating permits (Sacramento Metropolitan AQMD, 2011). Sacramento Metropolitan AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit

pollutants in excess of the Sacramento Metropolitan AQMD's major source thresholds (see Table 4.1.12-22). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-22: Sacramento Metropolitan AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single Hazardous Air Pollutant (HAP)	10
Total/Cumulative HAPs	25
Green House Gas	100
Volatile Organic Compounds or Nitrogen Oxides	25

Source: (Sacramento Metropolitan AQMD, 2011)

Exempt Activities

The Sacramento Metropolitan AQMD exempts the following from obtaining an ATC or a PTO as per Regulation 201 (General Permit Requirements):

- "…Vehicles used to transport passengers or freight, but not including any article, machine, equipment, or other contrivance mounted on such vehicle that would otherwise require a permit under provisions of these rules and regulations. …
- … Internal combustion engines with a manufacturer's maximum continuous rating of 50 brake horsepower or less or gas turbine engines with a maximum heat input rate of 3,000,000 British Thermal Units (Btu) per hour or less at ISO standard day conditions (288 degrees Kelvin, 60 percent relative humidity, and 101.3 kilopascals pressure). The ratings of all engines or turbines used in the same process will be accumulated to determine whether this exemption applies.
- Any combustion equipment that has a maximum heat input of less than 1,000,000 Btu per hour (gross) and is equipped to be fired exclusively with natural gas, liquefied petroleum gas or any combination thereof. The ratings of all combustion equipment used in the same process will be accumulated to determine whether this exemption applies…
- …Repairs or maintenance not involving changes to any equipment for which a permit has been granted under Section 301[Authority to Construct] of this rule
- …Other equipment authorized for exemption by the Air Pollution Control Officer and which would emit less than 2 pounds in any 24 hour period of any pollutants without the benefit of air pollution control devices…." (Sacramento Metropolitan AQMD, 2006).

Temporary Emissions Sources Permits

Sacramento Metropolitan AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

Sacramento Metropolitan AQMD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of Sacramento Metropolitan AQMD Regulation 201 (General Permit Requirements). The Sacramento Metropolitan AQMD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust

Sacramento Metropolitan AQMD Rule 403 (Fugitive Dust) rules state that all reasonable precautions should be taken to not cause or allow fugitive dust emissions from being airborne beyond the property line where the activities (construction, excavating, or grading operations) occur. Reasonable Precautions to minimize fugitive dust include, but are not limited to, watering or use of other approved dust control chemicals to keep dust down and application of asphalt on road surfaces. (Sacramento Metropolitan AQMD, 1977)

General Conformity

The Sacramento Metropolitan AQMD follows the federal General Conformity regulations and does not maintain their own (Sacramento Metropolitan AQMD, 1994). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Sacramento Metropolitan AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Sacramento Metropolitan AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Sacramento Metropolitan AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Sacramento+Metropolitan+AQMD-Agency-Wide+Provisions.

4.1.12.27 Specific Regulatory Considerations for San Diego Metropolitan Air Pollution Control District (San Diego County APCD)

National and State Ambient Air Quality Standards

The San Diego Metropolitan Air Pollution Control District (San Diego County APCD) does not maintain its own ambient air quality standards. Instead, San Diego County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (San Diego County APCD, 2001). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

San Diego County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. San Diego County APCD Regulation XIV (Title V Operating Permits) describes the applicability of Title V operating permits (San Diego County APCD, 2001). San Diego County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the San Diego County APCD's major source thresholds (see Table 4.1.12-23) (San Diego County APCD, 1999). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-23: San Diego County APCD Major Air Pollutant Source Thresholds

Pollutant	TPY
PM_{10},SO_x, CO, and Pb	100
NO_x and VOC	50

Source: (San Diego County APCD, 1999)

Exempt Activities

The San Diego County APCD exempts the following from obtaining an Authority to Construct and a PTO as per Regulation II (Permit Requirements) Rule 11 (Exemptions from Rule 10 Permit Requirements):

- "Mobile Sources - Any engine mounted on, within, or incorporated into any vehicle, train, ship, boat, or barge, that is used primarily to provide propulsion, but which may also supply heat, mechanical, hydraulic, or electrical power to that same vehicle, train, ship, boat, or barge. This exemption does not apply to equipment located onboard floating dry docks or equipment used for dredging operations…
- …Combustion and Heat Transfer Equipment:
  - Any reciprocating internal combustion engine with a brake horsepower rating of less than 50…
  - ...Any gas turbine engine that has: (A) an output power rating of less than 0.3 megawatt (MW), or (B) a maximum gross heat input rating at International Standards Organization (ISO) Standard Day Conditions of less than 1 million British thermal units (BTU) per hour…
  - …Any boiler, process heater, or steam generator with a manufacturer's maximum gross heat input rating of less than: (A) 1 million BTU per hour fired with any fuel, or (B) 5 million BTU per hour fired exclusively with natural gas and/or liquefied petroleum gas…
- … Structural modifications that cannot change the quality, nature, or quantity of air contaminant emissions…
- … Stationary storage tanks for volatile organic liquids with a capacity of less than 250 gallons and associated equipment used exclusively to transfer materials into such tanks…

- … Any portable equipment registered in accordance with the Statewide Portable Equipment Registration Program [CARB PERP] adopted pursuant to California Health and Safety Code Section 41750, et seq…" (San Diego County APCD, 2012).

Temporary Emissions Sources Permits

San Diego County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

San Diego County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants or any source that may reduce and eliminate air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of San Diego County APCD Regulation II (Permit Requirements) Rule 11 (Exemptions from Rule 10 Permit Requirements). The Placer County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

San Diego County APCD manages Fugitive Dust Emissions through Rule 55, which was adopted in 2009. Rule 55 states that "except as provided in Section (b), the provisions of this rule shall apply to any commercial construction or demolition activity capable of generating fugitive dust emissions, including active operations, open storage piles, and inactive disturbed areas. Activities subject to this regulation are also subject to the applicable requirements of Rule 50 (Visible Emissions) and Rule 51 (Nuisance)." (San Diego County APCD, 2009)

General Conformity

The San Diego County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The San Diego County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. San Diego County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. San Diego County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=San+Diego+County+APCD-Agency-Wide+Provisions.

4.1.12.28 Specific Regulatory Considerations for San Joaquin Valley Air Pollution Control District (San Joaquin Valley APCD)

National and State Ambient Air Quality Standards

The San Joaquin Valley Air Pollution Control District (San Joaquin Valley APCD) does not maintain its own ambient air quality standards. Instead, San Joaquin Valley APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (San Joaquin Valley APCD, 2013). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

San Joaquin Valley APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. San Joaquin Valley APCD Regulation II (Permits) Rule 2520 (Federally Mandated Operating Permits) describes the applicability of Title V operating permits. San Joaquin Valley APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the San Joaquin Valley APCD's major source thresholds (see Table 4.1.12-24) (San Joaquin Valley APCD, 2011). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-24: San Joaquin Valley APCD Major Air Pollutant Source Thresholds

Pollutant	Pounds Per Year
VOC and NO_x	20,000
CO and $PM_{2.5}$	200,000
PM_{10} and SO_x	140,000

Source: (San Joaquin Valley APCD, 2011)

Exempt Activities

The San Joaquin Valley APCD exempts the following from obtaining an ATC or a PTO as per Regulation II (Permits), Rule 2020 (Exemptions):

Precluded Source Categories:

- "…Motor vehicles as defined by the Vehicle Code of the State of California (California Health and Safety Code, Section 42310(a)), but not including any emissions unit mounted on such vehicle that would otherwise require a permit under the provisions of the District Rules and Regulations…"

District Exempt Source Categories:

- "…Steam generators, steam superheaters, water boilers, water heaters, steam cleaners, and closed indirect heat transfer systems that have a maximum input heat rating of 5,000,000 Btu per hour (gross) or less and is equipped to be fired exclusively with:
  - Natural gas containing no more than five (5) percent by weight hydrocarbons heavier than butane and no more than 1.0 grain of total sulfur per 100 standard cubic feet of gas;

  - Liquefied petroleum gas containing no more than two (2) percent by volume hydrocarbons heavier than butane and no more than 15 grains of total sulfur per 100 standard cubic feet of gas…

- Piston type internal combustion engines with a manufacturer's maximum continuous rating of 50 braking horsepower (bhp) or less.
- Gas turbine engines with a maximum heat input rating of 3,000,000 Btu per hour or less at ISO Standard Day Conditions…
- … Storage Equipment: Containers, reservoirs, or tanks used exclusively for:
  - …The storage of petroleum distillates used as motor fuel with 0.8251 specific gravity or higher (40ºAPI or lower) as measured by test method API 2547, ASTM D-1298, or ASTM D287 and having a capacity of 19,800 gallons (471 bbl) or less…
  - … The storage of produced fluids in portable tanks, to be used for less than six months at any one (1) location…
- … Brazing, soldering, or welding equipment…
- … Low Emitting Units[186]…

District Exempt Activities:

- … Routine replacement of a whole or partial emissions unit where the replacement part is the same as the original emissions unit in all respects except for the serial number and the action does not create a reconstructed Stationary Source…
- …Repairs or maintenance not involving structural changes to any emissions unit for which a permit has been granted (California Health and Safety Code, Section 42310(a)(5)(A))…" (San Joaquin Valley APCD, 2014).

Temporary Emissions Sources Permits

San Joaquin Valley APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

San Joaquin Valley APCD requires stationary sources that are building, altering, or replacing any operation that emits or reduces air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of San Joaquin Valley APCD Regulation II (Permits), Rule 2020 (Exemptions). The San Joaquin Valley APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

[186] Low Emitting Unit: "An emissions unit with an uncontrolled emissions rate of each air contaminant: Less than or equal to two pounds per day, or if greater than two pounds per day, is less than or equal to 75 pounds per year," (San Joaquin Valley APCD, 2014).

Fugitive Dust

San Joaquin Valley APCD Regulation VIII (Fugitive PM_{10} Prohibitions) Rule 8011 (General Requirements) applies to outdoor fugitive dust sources. Reasonable precautions to minimize fugitive dust include, but are not limited to, watering or use of other approved dust control chemicals to keep dust down and application of asphalt or gravel on dirt road surfaces. (San Joaquin Valley APCD, 2004c) More specific rules in place for the following activities:

- Construction, Demolition, Excavation, Extraction, And Other Earthmoving Activities (Rule 8021), which details requirements for construction and other earth-moving activities and Unpaved Vehicle/Equipment Traffic Areas (Rule 8071), which details requirements for unpaved vehicle/equipment traffic areas. Activities that can cause fugitive must limit Visible Dust Emission (VDE) to 20 percent opacity and stabilize surface area when applicable. (San Joaquin Valley APCD, 2004a)
- Carryout and Trackout (Rule 8041), which details requirements for "sites that are subject to any of the following rules where carryout or trackout has occurred or may occur on paved public roads or the paved shoulders of a paved public road" (San Joaquin Valley APCD, 2004b). Activities to prevent or clean dirt from roadways include, but are not limited to, sweeping dirt from roadways and installation of gravel or a wash center to remove dirt from vehicle wheels. (San Joaquin Valley APCD, 2004b)
- Unpaved Vehicle/Equipment Traffic Areas (Rule 8071), which details requirements for unpaved roads where vehicle and equipment traffic might cause fugitive dust. "Where 50 or more Average Annual Daily Trips (AADT) will occur on an unpaved vehicle/equipment traffic area, the owner/operator shall limit VDE to 20percent opacity and comply with the requirements of a stabilized unpaved road by application and/or re-application/ maintenance…" (San Joaquin Valley APCD, 2004d). Control measures include, but are not limited to, watering or use of other approved dust control chemicals to keep dust down and application of paving materials. (San Joaquin Valley APCD, 2004d)

General Conformity

The San Joaquin Valley APCD follows the federal General Conformity regulations and does not maintain their own (San Joaquin Valley APCD, 1994). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The San Joaquin Valley APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. San Joaquin Valley APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. San Joaquin Valley APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=San+Joaquin+Valley+Unified+APCD-Agency-Wide+Provisions.

4.1.12.29 Specific Regulatory Considerations for San Luis Obispo County Air Pollution Control District (San Luis Obispo County APCD)

National and State Ambient Air Quality Standards

The San Luis Obispo County Air Pollution Control District (San Luis Obispo County APCD) does not maintain any ambient air quality standards. Instead, San Luis Obispo County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (San Luis Obispo County APCD, 2011). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

San Luis Obispo County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. San Luis Obispo County APCD Regulation II (Permits) Rule 216 (Federal Part 70 Permits) describes the applicability of Title V operating permits. San Luis Obispo County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the federal major source thresholds (see Table 4.1.12-3) (San Luis Obispo County APCD, 2011). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

The San Luis Obispo County APCD exempts the following from obtaining an ATC or a PTO as per Regulation II (Permits), Rule 201 (Equipment Not Requiring a Permit):

- "Combustion and Heat Transfer Equipment:
  - Piston type internal combustion engines with a manufacturer's maximum continuous rating of less than 50.0 brake horsepower (bhp) or gas turbine engines with a maximum heat input rate of 3,000,000 British thermal units (Btu) per hour or less at ISO Standard Day Conditions. The ratings of all engines or turbines used in the same process will be accumulated to determine whether this exemption applies.
  - Any external combustion equipment that has a maximum heat input rate of less than 2,000,000 Btu per hour (gross) and is equipped to be fired exclusively with purchased quality natural gas, liquefied petroleum gas or any combination thereof. The ratings of all combustion equipment used in the same process will be accumulated to determine whether this exemption applies.
  - Internal combustion engines, except diesel fueled engines, used solely as a source of standby power when normal power line service fails or are only used for the emergency pumping of water. This exemption does not include IC engines used as standby power due to a voluntary reduction in power by the power company. No engine shall operate more than 100 hours per year for maintenance and testing purposes under this exemption.
- Vehicles - Motor vehicles as defined by the Vehicle Code of the State of California but not including any article, machine, equipment, or other contrivance mounted on such vehicle, that would otherwise require a permit under the provisions of these rules and regulations…

- …Storage and Transfer Equipment - Unheated organic liquid containers with capacities of not more than 250 gallons…
- … Structure and Equipment
  - Repairs or maintenance not involving structural changes to any equipment for which a permit has been granted.
  - Structural changes which cannot change the quality, nature, or quantity of air contaminant emissions.
  - Identical replacement in whole or in part of any article, machine, equipment or other contrivance, where a Permit to Operate had previously been granted for such equipment under Rule 202, Permits…
- … Miscellaneous… Brazing, soldering, or welding equipment and control equipment venting exclusively such equipment…
- … Portable Emissions Units - A portable emissions unit for which a written permit is otherwise required…" (San Luis Obispo County APCD, 2005).

Temporary Emissions Sources Permits

San Luis Obispo County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

San Luis Obispo County APCD requires stationary sources that are building, altering, or replacing any operation that emits or reduces air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of San Luis Obispo County Regulation II (Permits), Rule 201 (Equipment Not Requiring a Permit). The San Luis Obispo County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions. (San Luis Obispo County APCD, 2009)

Fugitive Dust Emissions

San Luis Obispo County APCD manages Fugitive Dust Emissions through Regulation X (Fugitive Dust Emission Standards, Limitations, and Prohibitions), Rule 1001 (Coastal Dunes Dust Control Requirements). "The provisions of this Rule shall apply to any operator of a coastal dune vehicle activity area, as defined by this Regulation, which is greater than 100 acres in size." (San Luis Obispo County APCD, 2016)

General Conformity

The San Luis Obispo County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The San Luis Obispo County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. San Luis Obispo County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. San Luis Obispo County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=San+Luis+Obispo+County+APCD-Agency-Wide+Provisions.

4.1.12.30 Specific Regulatory Considerations for Santa Barbara County Air Pollution Control District (Santa Barbara County APCD)

National and State Ambient Air Quality Standards

The Santa Barbara County Air Pollution Control District (Santa Barbara County APCD) does not maintain its own ambient air quality standards. Instead, Santa Barbara County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Santa Barbara County APCD, 2012a). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Santa Barbara County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Santa Barbara County APCD Regulation XIII (Part 70 Operating Permit Program) describes the applicability of Title V operating permits. Santa Barbara County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the federal major source thresholds[187] (see Table 4.1.12-3) (Santa Barbara County APCD, 2011). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Santa Barbara County APCD also has levels of sources.

- Small Sources: Stationary source that are permitted to emit less than 5 TPY of Reactive Organic Compounds, NO_2, PM_{10}, Total Suspended PM, SO_2, and 25 TPY of CO.
- Medium Sources: Stationary sources, which are not Small Sources, that are permitted to emit less than 10 TPY of Reactive Organic Compounds, NO_2, PM_{10}, Total Suspended PM, SO_2, and 25 TPY of CO.

[187] Santa Barbara County APCD refers to any air pollutants that exceed 100 TPY and not just criteria pollutants that exceed 100 TPS (Santa Barbara County APCD, 2012a).

- Large Sources: Stationary sources that do not meet the criteria of a Small or Medium Source. (Santa Barbara County APCD, 2012a)

Exempt Activities

The Santa Barbara County APCD exempts the following from obtaining an ATC and a PTO as per Regulation II (Permit) Rule 202 (Exemptions to Rule 201):

- "…A permit shall not be required for equipment, operations, or activities described in Section 42310 of the California Health and Safety Code [permits shall not be required for any vehicle]. However, the exemption for vehicles shall not be applicable to any article, machine, equipment or other contrivance mounted on such vehicles that would otherwise require a permit under the provisions of these Rules and Regulations…
- "…De minimis Exemption - Any physical change in an existing stationary source that meets each of the requirements below is exempt. Emission increases shall be based on the uncontrolled potential to emit…
  - The emission increase for any one emission unit shall not exceed 2.40 pounds per day of any affected pollutant, except carbon monoxide, which shall not exceed 19.20 pounds per day.
  - The aggregate emissions increase at the stationary source due to all de minimis physical changes at the stationary source since November 15, 1990, shall not exceed 24.00 pounds per day, except carbon monoxide, which shall not exceed 60.00 pounds per day…
  - …The physical change does not require a change to any article, machine, equipment, or contrivance used to eliminate or reduce or control the issuance of air contaminants…
- Stationary Source Permit Exemption – A permit shall not be required for any new, modified, or existing stationary source if the uncontrolled actual emissions of each individual affected pollutant from the entire stationary source are below 1.00 ton per calendar year…
- …A permit shall not be required for routine repair or maintenance of permitted equipment, not involving structural changes. As used in this paragraph, maintenance does not include operation.
- A permit shall not be required for equivalent routine replacement in whole or in part of any article, machine, equipment or other contrivance where a Permit to Operate had previously been granted under Rule 201, Permits Required, providing emissions are not increased and there is no potential for violating any ambient air quality standard…
- …Notwithstanding any exemption defined in this rule, no new or modified stationary source that has the potential to emit air contaminants in excess of the amounts specified shall be exempt from permit requirements:
  - 3.28 pounds per day of lead
  - 0.04 pounds per day of asbestos
  - 0.0022 pounds per day of beryllium

  - 0.55 pounds per day of mercury
  - 5.48 pounds per day of vinyl chloride
  - 16.44 pounds per day of fluorides
  - 38.45 pounds per day of sulfuric acid mist, or
  - 54.79 pounds per day of total reduced sulfur or reduced sulfur compounds.
  - 0.0000035 tons per year municipal waste combustor organics.
  - 15 tons per year municipal waste combustor metals.
  - 40 tons per year municipal waste combustor acid gases…
- …Internal Combustion Engines…
  - …Engines used to propel vehicles, as defined in Section 670 of the California Vehicle Code, but not including any engine mounted on such vehicles that would otherwise require a permit under the provisions of these Rules and Regulations.
  - Spark ignition piston-type internal combustion engines used exclusively for emergency electrical power generation or emergency pumping of water for flood control or firefighting if the engine operates no more than 200 hours per calendar year, and where a record is maintained and is available to the District upon request; the record shall list the identification number of the equipment, the number of operating hours on each day the engine is operated and the cumulative total hours.
  - Compression ignition engines with a rated brake horsepower of less than 50...
  - …Spark ignition piston-type internal combustion engines with a rated brake horsepower of less than 50. Notwithstanding the previous sentence, none of the individual engines in the range of less than 50 but greater than 20 rated brake horsepower are exempt if such engines at a stationary source have a total rated brake horsepower rating of 400 or greater…
  - …Gas turbine engines with a maximum heat input rating of 3 million British thermal units per hour or less at standard conditions. No gas turbine engine otherwise subject to permit shall be exempt because it has been derated...
  - A permit shall not be required for portable engines registered in the Statewide Registration Program, pursuant to California Code of Regulations, title 13, section 2451 et seq. and Health and Safety Code Section 41753 et seq [PERP]…
- …Combustion Equipment (Other than Internal Combustion Engines) - Notwithstanding the listed exemptions, any collection of articles, machines, equipment or other contrivances within each listed equipment category at a stationary source that has aggregate emissions in excess of 25 tons per calendar year of any affected pollutant is not exempt.
  - Combustion equipment with a maximum heat input of less than or equal to two (2) million British thermal units per hour is exempt from permit requirements if fired exclusively with one of the following: Natural or produced gas which meets General Order 58-A of the Public Utility Commission, b. Liquefied petroleum gas, which meets

Gas Processors Association Standards, c. A combination of natural or produced and liquefied petroleum gas, meeting the requirements of subdivisions (a) and (b)…

- …Storage and Transfer Equipment and Operations - The following storage and transfer equipment and operations are exempt from permit requirements. Notwithstanding the listed exemptions, any collection of articles, machines, equipment, or other contrivances within each listed equipment category at a stationary source that has aggregate emissions in excess of 10 tons per calendar year of any affected pollutant is not exempt. Containers, reservoirs, tanks, sumps or ponds with a capacity of 55 gallons or less are exempt and do not count towards the 10 ton per year aggregation threshold…
- …The storage of gasoline (defined as any petroleum distillate having a Reid vapor pressure of 4.0 pounds per square inch or greater) having a capacity of less than 250 gallons…" (Santa Barbara County APCD, 2012b).

Temporary Emissions Sources Permits

Santa Barbara County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

Santa Barbara County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants or any source that may reduce and eliminate air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of Santa Barbara County APCD Regulation II (Permit) Rule 202 (Exemptions to Rule 201). The Santa Barbara County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust

Santa Barbara County APCD Regulation III (Prohibitions) Rule 345 (Control of Fugitive Dust from Construction and Demolition Activities) applies to any man-made activity that generates fugitive dust. Specific requirements include:

- Preventing fugitive dust from remaining visible beyond a property or boundary line greater than 20percent opacity for more than 3 minutes (aggregate) in an hour.
- Not allowing dirt to be loaded onto outbound trucks unless they cover the load, have 6 inches below the rim of the truck bed and water, or treat with approved chemicals to minimize loss to wind.
- Removing dirt that has been tracked-out or carried-out onto paved surfaces. (Santa Barbara County APCD, 2010)

General Conformity

The Santa Barbara County APCD follows the federal General Conformity regulations and does not maintain their own (Santa Barbara County APCD, 1994). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Santa Barbara County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Santa Barbara County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Santa Barbara County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website: http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Santa+Barbara+County+APCD-Agency-Wide+Provisions.

4.1.12.31 Specific Regulatory Considerations for Shasta County Air Quality Management District (Shasta County AQMD)

National and State Ambient Air Quality Standards

The Shasta County Air Quality Management District (Shasta County AQMD) does not maintain its own ambient air quality standards (Shasta County AQMD, 2001). Instead, Shasta County AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS. See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Shasta County AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Shasta County AQMD Rule V (Title V) describes the applicability of Title V operating permits. Shasta County AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Shasta County AQMD major source thresholds (see Table 4.1.12-25) (Shasta County AQMD, 2001). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-25: Shasta County AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single Hazardous Air Pollutant (HAP)	10
Total/Cumulative HAPs	25
VOC and NO_x for a federal nonattainment area classified as serious	50
VOC and NO_x for a federal nonattainment area classified as severe	25
VOC and NO_x for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Shasta County AQMD, 2009)

Exempt Activities

According to Shasta County AQMD Rule II (Permits), Rule 2:5 (Exemptions) the following equipment may be exempt from obtaining an ATC or PTO:

- "Internal combustion engines;
- Steam generators, steam superheaters, water heaters, and closed heat transfer systems that are fired exclusively with one of the following: Natural gas; Liquefied petroleum gas; a combination of natural gas and liquefied petroleum gas.
- Self-propelled construction equipment used in land grading, paving, leveling, digging, or other similar operations, other than pavement burners.
- Any source designated as an insignificant source by the APCO [Shasta County AQMD]" (Shasta County APCD, 1984).

Shasta County AQMD Rule 5 (Title V Permits) Attachment 1 (List of Title V Insignificant Activities) lists the insignificant activities.[188]

- Combustion and Heat Transfer Equipment:
  - Any combustion equipment, other than a gas turbine, that has a maximum heat input rating of no more than five million British thermal units (mmBtu) per hour (gross) and is equipped to be fired exclusively with natural gas, liquefied petroleum gas, or any combination thereof, provided the fuel contains no more than five per cent by weight of hydrocarbons heavier than butane…
  - …Any piston-type internal combustion engine (ICE) with a manufacturer's maximum continuous rating of no more than 50 braking horsepower (bhp)…
  - …Any ICE which emits no more than 2 tons per year of NOx and is operated solely for the purpose of: 1) providing power when normal power service fails (service failure does not include voluntary power reductions); or 2) the emergency pumping of water….
  - …Any non-electric space heater that is not a boiler…
- …Storage Containers, Reservoirs, and Tanks - Fuel, Fuel Oil, Asphalt:
  - Any temporary storage of gasoline in flexible containers to support equipment responding to an emergency or for the purposes of training to support such equipment…
  - …Any equipment with a capacity of no more than 1,500 gallons used exclusively for the storage of gasoline…
  - …Any equipment with a capacity of no more than 19,800 gallons (471 barrels) used exclusively for the storage of petroleum distillates used as motor fuel with specific gravity 0.8251 or higher…
  - …Any equipment used exclusively for the storage of fuel oils…

[188] Insignificant Activities are "any activity, process, or emissions unit which is not subject to a source-specific requirement of a State Implementation Plan, preconstruction permit, or federal standard1 and which: 1) meets the "Criteria for Specific Source Categories" or 2) emits no more than 0.5 tons per year of a federal hazardous air pollutant (HAP) and no more than two tons per year of a regulated pollutant that is not a HAP" (Shasta County AQMD, 2009).

- …Brazing, Soldering, Welding, and Cutting Torches - Any brazing, soldering, welding, or cutting torch equipment used in manufacturing and construction activities and with the potential to emit hazardous air pollutant (HAP) metals, provided the total emissions of HAPs do not exceed 0.5 tons per year..." (Shasta County AQMD, 2009).

Temporary Emissions Sources Permits

Shasta County AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

Shasta County AQMD requires stationary sources that are building, altering, or replacing any source of air contaminants, both stationary and portable, to obtain an ATC prior to constructing, unless they meet the exemptions of Shasta County AQMD Rule II (Permits), Rule 2:5 (Exemptions). The Shasta County AQMD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Shasta County AQMD Rule 3:16 (Fugitive, Indirect, or Non-Traditional Sources) is intended to reduce the amount of PM_{10} emitted by anthropogenic dust sources, including but not limited to construction activities, earth-moving activities and any other activity that can result in wind erosion. The fugitive dust emissions from any activity must not remain visible beyond a property or boundary line great than 5 percent opacity or be greater than 20 percent opacity. Reasonably available control measures must be used to minimize fugitive dust, including, but not limited to, watering or using other approved dust control chemicals to keep dust down, paving dirt roads, using wind brakes, and cleaning material off of paved roads. Shasta County AQMD exempts the following situations from the Rule 3:16 "active operations conducted during emergency life-threatening situations, or in conjunction with any officially-declared disaster or state of emergency including those activities associated with fighting wildfires" (Shasta County AQMD, 2007).

General Conformity

The Shasta County AQMD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Shasta County AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Shasta County AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Shasta County AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the

criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Shasta+County+APCD-Agency-Wide+Provisions.

4.1.12.32 Specific Regulatory Considerations for Shasta County Air Pollution Control District (Siskiyou County APCD)

National and State Ambient Air Quality Standards

The Siskiyou County Air Pollution Control District (Siskiyou County APCD) does not maintain any ambient air quality standards. Instead, Siskiyou County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Siskiyou County APCD, 2001a). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Siskiyou County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Siskiyou County APCD Regulation II (Permit System), Rule 2.13 (Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990) describes the applicability of Title V operating permits (Siskiyou County APCD, 2001b). Siskiyou County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the federal major source thresholds[189] (see Table 4.1.12-3). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

According to Siskiyou County APCD Regulation II (Permit System), Rule 2.2 (Exemptions) the following equipment is exempt from obtaining an ATC or PTO:

- "Vehicles as defined by the Vehicle Code of the State of California, but not including any article, machine, equipment, or other contrivance mounted on such vehicle that would otherwise require a permit under the provisions of these rules and regulations…
- …Steam generators, water boilers, water heaters, or space heaters having an input heating value of less than 5 million BTU per hour and which are fired exclusively with one of the following:
  - Natural gas.
  - Liquefied petroleum gas.
  - Distillate fuel oil.
  - Any combination…

[189] Siskiyou County APCD refers to regulated air pollutants that exceed 100 TPY and not just criteria pollutants that exceed 100 TPY. Regulated air pollutants are any pollutants which are emitted into the ambient air and are pollutants for which the USEPA has adopted an emissions limit (Siskiyou County APCD 2001).

- …Containers, reservoirs, or tanks used exclusively for:
  - Storage of liquefied gases…
  - …The storage of lubricating oils.
  - The storage of gasoline and fuel oils and having a capacity of 20,000 gallons or less…
- …Repairs or maintenance not involving structural changes to any equipment for which a permit has been granted.
- Any article, machine, equipment or other contrivance which emits air contaminants below the significance level[190] [see Table 4.1.12-26] and which the Control Officer determines should be exempted…" (Siskiyou County APCD, 2014).

Table 4.1.12-26: Siskiyou County AQMD Air Contaminant Significance Levels Thresholds

Pollutant	TPY
CO	100
NO_X, SO_X, Halogenated Hydrocarbons, and Reactive Organic Compounds	40
PM	25
PM_{10}	15
Hydrogen Sulfide, Total Reduced Sulfur Compounds, and Reduced Sulfur Compounds	10
Sulfuric Acid Mist	7
Fluorides	3
Vinyl Chloride	1
Lead	0.6
Mercury	0.1
Asbestos	0.007
Beryllium	0.0004

Source: (Siskiyou County APCD, 2001a)

Temporary Emissions Sources Permits

Siskiyou County does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

Siskiyou County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants, both stationary and portable, to obtain an ATC prior to constructing, unless they meet the exemptions of Siskiyou County APCD Regulation II (Permit System), Rule 2.2 (Exemptions). All exempts are listed above in the Siskiyou County APCD Exemptions Section.

[190] Significance level is "the emission level at which a new or modified stationary source emits or has the potential to emit an air contaminant that would equal or exceed any rates specified in this definition S4," see Table 4.1.12-26 (Siskiyou County APCD, 2001).

Fugitive Dust Emissions

Siskiyou County APCD does not have specific Fugitive Dust Emission Regulations (CARB, 2016c); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

General Conformity

The Siskiyou County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Siskiyou County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Siskiyou County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Siskiyou County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Siskiyou+County+APCD-Agency-Wide+Provisions.

4.1.12.33 Specific Regulatory Considerations for South Coast Air Quality Management District (South Coast AQMD)

National and State Ambient Air Quality Standards

The South Coast Air Quality Management District (South Coast AQMD) does not maintain any ambient air quality standards. Instead, South Coast AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (South Coast AQMD, 2016). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

South Coast AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. South Coast AQMD Regulation XXX (Title V Permits) describes the applicability of Title V operating permits. South Coast AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the South Coast AQMD major source thresholds (see Table 4.1.12-27) (South Coast AQMD, 1997). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-27: South Coast AQMD Major Air Pollutant Source Thresholds During Phase Two

Pollutant	South Coast Air Basin TPY	Riverside County Portion of SSAB and Los Angeles County Portion of MDAB	Riverside County Portion of MDAB
Single HAP	10	10	10
Total/Cumulative HAPs	25	25	25
VOC and NO_x	10	25	100
CO	50	100	100
PM_{10}	70	70	100
SO_X	100	100	100

Source: (South Coast AQMD, 1997)

Exempt Activities

South Coast AQMD does not explicitly exempt any source from obtaining a Permit to Operate. (South Coast AQMD, 2004a)

Temporary Emissions Sources Permits

South Coast AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction PermitsSouth Coast AQMD Regulation II (Permits) Rule 201 (Permit to Construct) requires stationary sources that are building, altering, or replacing any source of air contaminants or any source that may reduce and eliminate air contaminants to obtain a Permit to Construct (PTC) prior to constructing. (South Coast AQMD, 2004b)

Fugitive Dust Emissions

South Coast AQMD Regulation IV (Prohibitions) Rule 403 (Fugitive Dust) applies to any man-made activity that generates fugitive dust. Fugitive dust emissions from any active activity, storage piles, or other disturbed areas must not remain visible beyond a property or boundary line, be greater than 20 percent opacity. Also PM_{10} levels from fugitive dust must not exceed 50 $\mu g/m^3$, and track-out is not to extend more than 25 feet and must be removed at the end of the day. Also activities which disturb five or more acres must do one of the following at each vehicle access: install a gravel wash pad, pave surfaces, and use a wheel washing system to remove dirt from tires. Control measures must be used to minimize fugitive dust, including, but not limited to, watering or using other approved dust control chemicals to keep dust down, paving dirt roads, using wind brakes, and cleaning material off of paved roads. (South Coast AQMD, 2005)

General Conformity

The South Coast AQMD follows the federal General Conformity regulations and does not maintain their own (South Coast AQMD, 1994). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The South Coast AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. South Coast AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. South Coast AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=South+Coast+Air+Quality+Management+District-Agency-Wide+Provisions.

4.1.12.34 Specific Regulatory Considerations for Tehama County Air Pollution Control District (Tehama County APCD)

National and State Ambient Air Quality Standards

The Tehama County Air Pollution Control District (Tehama County APCD) does not maintain its own ambient air quality standards. Instead, Tehama County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Tehama County APCD, 2011). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Tehama County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Tehama County APCD Regulation VII (Title V) describes the applicability of Title V operating permits. Tehama County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Tehama County APCD major source thresholds (see Table 4.1.12-28) (Tehama County APCD, 2011). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-28: Tehama County APCD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC and NO_x for a federal nonattainment area classified as serious	50
VOC and NO_x for a federal nonattainment area classified as severe	25
VOC and NO_x for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Tehama County APCD, 2011)

Exempt Activities

According to Tehama County APCD Regulation II (Permit and Registration) Rule 2:4 (Exemptions from Permit and Registration [New and Existing Operations]) the Tehama County APCD may exempt the following equipment from obtaining an ATC, a PTO, or registration:

- "Vehicles as defined by the Vehicle Code of the State of California but not including any article, machine, equipment, or other contrivance mounted on such vehicle that would otherwise require a permit under the provisions of these Rules and Regulations…
- …The following equipment:
  - …Piston type internal combustion engines…
  - …Self propelled mobile construction equipment other than pavement burners…" (Tehama County APCD, 2015).

Temporary Emissions Sources Permits

Tehama County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

Tehama County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of Tehama County APCD Regulation II (Permit and Registration) Rule 2:4 (Exemptions from Permit and Registration [New and Existing Operations]). The Tehama County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Tehama County APCD Regulation IV (Provisions) Rule 4:24 (Fugitive Dust Emissions) applies to any man-made activity that generates fugitive dust, including but not limited to, construction, unpaved roads, earthmoving activities, and track-out activities. Activities must obtain a Fugitive Dust Permit to Operate (FDPTO) unless they meet the exemptions. Reasonable control measure to minimize fugitive dust include, but are not limited to, watering or using other approved dust control chemicals to keep dust down, paving dirt roads, using wind brakes, and cleaning material off of paved roads. (Tehama County APCD, 2008)

The following exemptions apply to the Fugitive Dust requirements:

- "…A permitted stationary source located within the District that has a valid air pollution PTO issued by the District and has fugitive dust permit condition(s) listed in the permit is not required to have a separate Fugitive Dust Permit to Operate, but shall otherwise be subject to the provisions of this rule…

- …Grading activities that disturb less than 10,000 square feet of surface area shall not be subject to the provisions of this rule;
- Movement of less than 2,000 cubic yards of earth shall not be subject to the provisions of this rule…" (Tehama County APCD, 2008).

General Conformity

The Tehama County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Tehama County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Tehama County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Tehama County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Tehama+County+APCD-Agency-Wide+Provisions.

4.1.12.35 Specific Regulatory Considerations for Tuolumne County Air Pollution Control District (Tuolumne County APCD)

National and State Ambient Air Quality Standards

The Tuolumne County Air Pollution Control District (Tuolumne County APCD) does not maintain its own ambient air quality standards. Instead, Tuolumne County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Tehama County APCD, 2011). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Tuolumne County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Tuolumne County APCD Regulation V (Permit to Operate) Rule 500 (Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the 1990 Federal Clean Air Act Amendments) describes the applicability of Title V operating permits. Tuolumne County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 4.1.12-29) (Tuolumne County APCD, 2001). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-29: Tuolumne County APCD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC and NO_x for a federal nonattainment area classified as serious	50
VOC and NO_x for a federal nonattainment area classified as severe	25
VOC and NO_x for a federal nonattainment area classified as extreme	10
PM_{10} for a federal PM_{10} nonattainment area classified as serious	70

Source: (Tuolumne County APCD, 2001)

Exempt Activities

According to Tuolumne County APCD Rules 402 (Exemptions to Rule 401 [Permit Required]) and Rule 502 (Exemptions to Rule 501 [Permit Required]) the Tuolumne County APCD may exempt the following equipment and activities from an ATC and a PTO:

- "Vehicles as defined by the Vehicle Code of the State of California…
- "…Piston type internal combustion engines used on other than vehicles for transporting passengers or freight, and fired with natural gas or liquified petroleum gas, or those having 1,000 cubic inches cylinder displacement or less and fired with diesel oil or gasoline…
- …Brazing, soldering, or welding equipment.
- Steam generators, steam superheaters, water boilers, water heaters, and closed heat transfer systems that have a maximum heat input rate of less than 50,000,000 British Thermal Units (BTU) per hour gross, and are fired exclusively with one of the following: Natural gas; Liquified petroleum gas; a combination of natural gas and liquified petroleum gas.
- Self-propelled mobile construction equipment other than pavement burners…
- …Repairs or maintenance not involving structural changes to any equipment for which a Permit to Operate has been granted.
- Other sources emitting less than 1 ton per year of any criteria pollutant or precursor which may be specified by the Air Pollution Control Officer [Tuolumne County APCD]" (Tuolumne County APCD, 2012).

Temporary Emissions Sources Permits

Tuolumne County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

Tuolumne County APCD requires stationary sources that are building, altering, or replacing any source of air contaminants to obtain an ATC prior to constructing, unless they meet the

exemptions from Tuolumne County APCD Rules 402 (Exemptions to Rule 401 [Permit Required]) and Rule 502 (Exemptions to Rule 501 [Permit Required]). The Tuolumene County APCD exemptions section above details some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Tuolumne County APCD does not have specific Fugitive Dust Emission Regulations (CARB, 2012); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

General Conformity

The Tuolumne County APCD follows the federal General Conformity regulations and does not maintain their own. See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Tuolumne County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Tuolumne County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Tuolumne County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the six criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Tuolumne+County+APCD-Agency-Wide+Provisions.

4.1.12.36 Specific Regulatory Considerations for Ventura County Air Pollution Control District (Ventura County APCD)

National and State Ambient Air Quality Standards

The Ventura County Air Pollution Control District (Ventura County APCD) does not maintain its own ambient air quality standards. Instead, Ventura County APCD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Ventura County APCD, 2006). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Ventura County APCD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Ventura County APCD Regulation II (Permits) Rule 33 (Part 70 Permits) describes the applicability of Title V operating permits (Ventura County APCD, 2011). Ventura County APCD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Federal major

source thresholds[191] (see Table 4.1.12-3) (Ventura County APCD, 2011). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

Ventura County APCD Regulation II (Permits) Rule 23 (Exemptions from Permit) exempts the following source categories and equipment from an ATC and/or a PTO. An ATC or PTO shall not be required for:

- "…Heaters, Boilers
  - Space heating and heat transfer equipment rated at less than one million BTU/s per hour…
- …Vehicles, Engines
  - Vehicles, as defined by the Vehicle Code of the State of California. A vehicle may have an engine that both propels the vehicle and powers equipment mounted on the vehicle. Not included is any equipment mounted on a vehicle that would otherwise require a permit under the provisions of these Rules and Regulations…
  - …Internal combustion engines with a maximum continuous design power rating of less than 50 brake horsepower and gas turbines with a rated full load output of less than 0.30 megawatts (300 kilowatts) at ISO Standard Day Conditions.
  - Emergency internal combustion engines, as follows:
    - Spark-ignited internal combustion engines used exclusively for the emergency pumping of water for either fire protection or flood relief. The engines may either drive pumps directly or generate electricity to drive pumps. Such engines may be operated for engine maintenance.
    - Spark-ignited emergency internal combustion engines used only when electrical power line or natural gas service fails. Such engines may be operated for engine maintenance.
    - Portable engines used for emergency purposes. An engine powering a generator connected to a facility's electrical grid in preparation for a future emergency shall not be considered a portable emergency engine.
      - Engine maintenance operation is limited to 50 hours per calendar year per engine. An emergency internal combustion engine may not be operated to replace an internal combustion engine or a turbine that has failed or requires maintenance; to supplement a primary power source when the load capacity or rating of the primary power source has been either reached or exceeded; nor to reduce the demand for electrical power when normal electrical power line service has not failed.

[191] Ventura County APCD refer to regulated air pollutants that exceed 100 TPY and not just criteria pollutants that exceed 100 TPY. Regulated air pollutants are any pollutants which are emitted into the ambient air and are pollutants for which the USEPA has adopted an emissions limit (Ventura County APCD, 2011).

  - Portable internal combustion engines, including any turbines qualified as military technical support equipment under Health and Safety Code Section 41754, used pursuant to registration in the California Statewide Portable Engine Registration Program (PERP) under Health and Safety Code Section 41753…

- Portable internal combustion engines, including any turbines qualified as military technical support equipment under Health and Safety Code Section 41754, used pursuant to registration in the California Statewide Portable Engine Registration Program (PERP) under Health and Safety Code Section 41753…"
- Metals and Ceramics…Brazing, soldering, or welding equipment…" (Ventura County APCD, 2013).

Temporary Emissions Sources Permits

Ventura County APCD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

Ventura County APCD Regulation II (Permits) Rule 10 (Permits Required) requires that a person obtain an ATC prior to building, installation, modification or replacement of any air emissions producing or reducing article, machine, equipment, or other component, unless exempt by Regulation II (Permits) Rule 23 (Exemptions from Permit) or the following:

- "New, modified or replacement emissions units at a small stationary source[192].
- Relocation of an emissions unit within Ventura County where the new location is no more than five miles from the previous location, provided the emissions unit is at a small or medium source as defined in Rule 11, and provided that there is no emission increase" (Ventura County APCD, 2004).

Fugitive Dust Emissions

Ventura County APCD Regulation IV (Prohibitions) Rule 55 (Fugitive Dust) details regulations to control fugitive dust. This rule applies to "any operation, disturbed surface area, or man-made condition capable of generating fugitive dust, including bulk material handling, earth-moving, construction, demolition, storage piles, unpaved roads, [or] track-out..." (Ventura County APCD, 2008).

Activities should not cause fugitive dust emissions that remain visible beyond the property line and should not exceeds 20 percent opacity for longer than three minutes in any one. Track-out will not extend more than 25 feet "unless one or more of the following is utilized: Track-out Area Improvement, Trak-out Prevention, or Track-out Removal. (Ventura County APCD, 2008)

[192] A small source is defined as a source where the permitted emissions will be less than 5 TPY of ROC and NO_X, 15 TPY of PM_{10} and SO_X, and 30 TPY of CO and must not trigger any federal requirements (Ventura County APCD, 2006).

General Conformity

The Ventura County APCD follows the federal General Conformity regulations and does not maintain their own (Ventura County APCD, 1995). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Ventura County APCD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Ventura County APCD's SIP is a conglomeration of separate actions taken for each of the pollutants. Ventura County APCD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the six criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Ventura+County+APCD-Agency-Wide+Provisions.

4.1.12.37 Specific Regulatory Considerations for Yolo-Solano Air Quality Management District (Yolo-Solano AQMD)

National and State Ambient Air Quality Standards

The Yolo-Solano Air Quality Management District (Yolo-Solano AQMD) does not maintain its own ambient air quality standards. Instead, Yolo-Solano AQMD defers to the CARB which as previously noted adopted the federal NAAQS as well as promulgated a set of state AAQS (Yolo-Solano AQMD, 1994a). See Section 4.1.12.2 for a discussion of California's AAQS.

Title V Operating Permits/State Operating Permits

Yolo-Solano AQMD has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. Yolo-Solano AQMD Regulation III (Permit System), Regulation 3.8 (Federal Operating Permits) describes the applicability of Title V operating permits (Yolo-Solano AQMD, 2015). Yolo-Solano AQMD regulations requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the Yolo-Solano AQMD major source thresholds (see Table 4.1.12-30) (Yolo-Solano AQMD, 2015). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-30: Yolo-Solano AQMD Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Regulated Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25
VOC or NO_X	25

Source: (Yolo-Solano AQMD, 2015)

Exempt Activities

According to the Yolo-Solano AQMD Regulation III (Permit System), Rule 3.2 (Exemptions) the Yolo-Solano AQMD may exempt the following equipment from obtaining an ATC or PTO:

- "…Motor vehicles as defined by the Vehicle Code of the State of California used to transport freight or passengers, but not including any article, machine, equipment or other contrivance mounted on such vehicle that would otherwise require a permit under provisions of these rules and regulations…
- …Combustion and Heat Transfer Equipment:
  - Internal combustion engines with a manufacturer's maximum continuous rating of 50 brake horsepower or less or gas turbine engines with a maximum heat input rate of 3,000,000 British Thermal Units (BTU) per hour or less at ISO standard day conditions. The ratings of all engines or gas turbines use in the same process shall be accumulated to determine whether this exemption applies.
  - Any combustion equipment that has a maximum heat input of less than 1,000,000 British Thermal Units (BTU) per hour (Gross) and is equipped to be fired exclusively with natural gas, liquefied petroleum gas or any combination thereof, the ratings of all combustion equipment used in this process shall be accumulated to determine whether this exemption applies…
- …Repairs or maintenance not involving structural changes to any equipment for which a permit has been granted. Maintenance, as used herein does not include operation….
- …Portable Equipment: A portable emissions unit, as defined in Section 205 of Rule 3.3, PORTABLE EQUIPMENT, for which a written permit is otherwise required, shall be exempt from the permitting requirements of District Rule 3.1, GENERAL PERMIT REQUIREMENTS, provided that all of the following conditions are met:
  - The emissions unit has a valid registration obtained in accordance with the provisions of Rule 3.3, PORTABLE EQUIPMENT; and
  - The portable emissions unit is not subject to the provisions of District Rule 3.8, FEDERAL OPERATING PERMITS, (Title V)…" (Yolo-Solano AQMD, 1994b).

Temporary Emissions Sources Permits

Yolo-Solano AQMD does not have separate temporary emission source permitting; however, the state PERP program can be used if an entity intends to use portable equipment for statewide use, see Section 4.1.12.2, Temporary Emissions Sources Permits. If the equipment does not meet the definition of portable, the stationary source permitting requirements must be followed.

State Preconstruction Permits

Yolo-Solano AQMD requires stationary sources that are building, altering, or replacing any source of air contaminants or eliminate and reduce air contaminants to obtain an ATC prior to constructing, unless they meet the exemptions of Yolo-Solano AQMD Regulation III (Permit System), Rule 3.2 (Exemptions). The Yolo-Solano AQMD exemptions section above details

some of the exemptions that are most directly relevant to FirstNet actions, not all of the possible exemptions.

Fugitive Dust Emissions

Yolo-Solano APCD does not have specific Fugitive Dust Emission Regulations (CARB, 2016a); however, all sources should refer to the State Nuisance Law, Section 41700, see Section 4.1.6.2, Fugitive Dust, for more information.

General Conformity

The Yolo-Solano AQMD follows the federal General Conformity regulations and does not maintain their own (Yolo-Solano AQMD, 1995). See Section 4.1.12.2 for a general discussion of the federal General Conformity regulations.

State Implementation Plan Requirements

The Yolo-Solano AQMD SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Yolo-Solano AQMD's SIP is a conglomeration of separate actions taken for each of the pollutants. Yolo-Solano AQMD's SIP actions are codified under 40 CFR Part 52 Subpart F. The SIP actions for the criteria pollutants can be found on USEPA's website at http://yosemite.epa.gov/r9/r9sips.nsf/Agency?ReadForm&count=500&state=California&cat=Yolo-Solano+AQMD-Agency-Wide+Provisions.

4.1.12.38 Environmental Setting: Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Figure 4.1.12-2 and Table 4.1.12-31 present the nonattainment areas in California as of January 30, 2015. The year(s) listed in the table for each pollutant indicate when USEPA promulgated the standards for that pollutant. Note certain pollutants have more than one standard in effect. Unlike Table 4.1.12-31, Figure 4.1.12-2 does not differentiate between standards for the same pollutant.

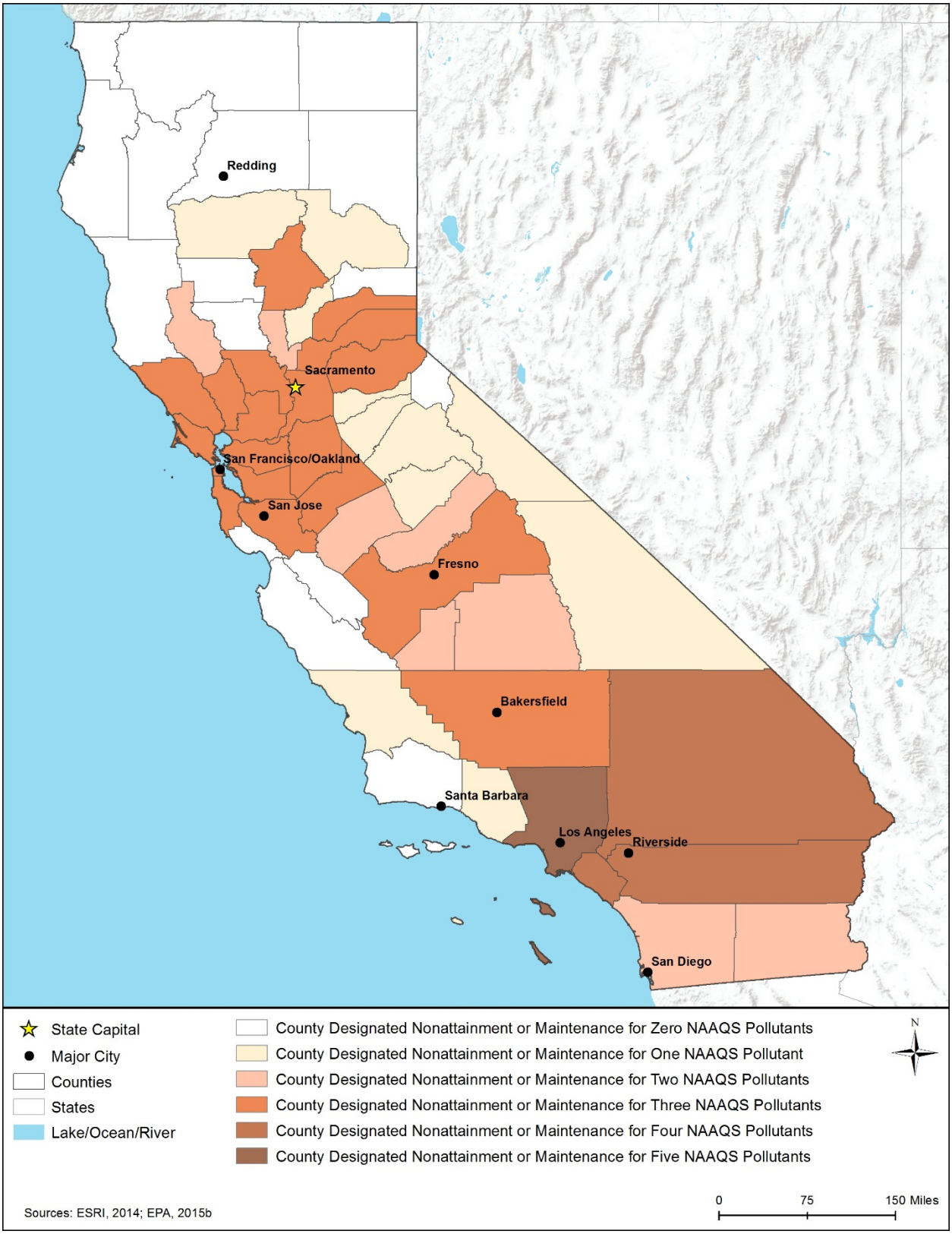


Figure 4.1.12-2: Nonattainment and Maintenance Counties in California

Additionally, given that particulate matter is the criteria pollutant of concern, PM_{10} and $PM_{2.5}$, merge in the figure to count as a single pollutant.

Table 4.1.12-31: California Nonattainment and Maintenance Areas by Pollutant Standard and County

County	Pollutant and Year USEPA Implemented Standard											
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$			O_3		SO_2	
	1971	1978	2008	1971	1987	1997	2006	2012	1997	2008	1971	2010
Alameda	M						X-4		X-5	X-5		
Amador									X-4			
Butte	M						X-4		X-5	X-5		
Calaveras									X-4	X-5		
Contra Costa	M						X-4		X-5	X-5		
El Dorado	M						X-4		X-2	X-2		
Fresno	M				M	X-3	X-4	X-4	X-1	X-1		
Imperial					X-3	X-4	X-4	X-4	X-4	X-5		
Inyo (Coso Junction)					M							
Inyo (Owens Valley)					X-3							
Kern (Eastern Kern)					X-3				X-4	X-5		
Kern (San Joaquin Valley)					X-3	X-3	X-4	X-4	X-1	X-1		
Kern (Bakersfield)	M											
Kern (Indian Wells)					M							
Kern (San Joaquin Valley Air Basin)					M							
Kings					M	X-3	X-4	X-4	X-1	X-1		
Los Angeles-San Bernardino Cos. (W Mojave Desert)									X-2	X-2		
Los Angeles (Los Angeles-South Coast Air Basin)	M		X-6	M	M	X-4	X-4	X-4	X-1	X-1		
Madera					M	X-3	X-4	X-4	X-1	X-1		
Marin	M						X-4		X-5	X-5		
Mariposa									X-4	X-5		
Merced					M	X-3	X-4	X-4	X-1	X-1		
Mono					X-4							
Morongo Band of									X-2	X-3		

County	Pollutant and Year USEPA Implemented Standard											
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$			O_3		SO_2	
	1971	1978	2008	1971	1987	1997	2006	2012	1997	2008	1971	2010
Mission Indians												
Napa	M						X-4		X-5	X-5		
Nevada									X-4	X-5		
Orange	M			M	M	X-4	X-4	X-4	X-1	X-1		
Pechanga Band of Luiseno Mission Indians									M	X-4		
Placer	M						X-4		X-2	X-2		
Plumas								X-4				
Riverside (Los Angeles-South Coast Air Basin)	M			M	M	X-4	X-4	X-4	X-1	X-1		
Riverside (Coachella Valley)					X-3				X-2	X-2		
Sacramento	M				M		X-4		X-2	X-2		
San Bernardino (Los Angeles-San Bernardino Cos. - W Mojave Desert)									X-2	X-2		
San Bernardino (Los Angeles-South Coast Air Basin)	M			M	M	X-4	X-4	X-4	X-1	X-1		
San Bernadino (Trona)					X-4							
San Bernadino					X-4							
San Diego	M								M	X-5		
San Francisco	M						X-4		X-5	X-5		
San Joaquin	M				M	X-3	X-4	X-4	X-1	X-1		
San Luis Obispo										X-5		
San Mateo	M						X-4		X-5	X-5		
Santa Clara	M						X-4		X-5	X-5		
Solano (Sacramento Metro)									X-2	X-2		

County	Pollutant and Year USEPA Implemented Standard											
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$			O_3		SO_2	
	1971	1978	2008	1971	1987	1997	2006	2012	1997	2008	1971	2010
Solano (San Francisco Bay Area)							X-4		X-5	X-5		
Solano (San Francisco-Oakland-San Jose)	M											
Solano (Sacramento)							X-4					
Sonoma	M						X-4		X-5	X-5		
Stanislaus	M				M	X-3	X-4	X-4	X-1	X-1		
Stutter (Sacramento Metro)									X-2	X-2		
Stutter (Sutter Buttes)									X-5			
Stutter (Yuba City-Marysville)							M					
Tehema										X-5		
Tulare					M	X-3	X-4	X-4	X-1	X-1		
Tuolumne									X-4			
Ventura									X-3	X-3		
Yolo	M						X-4		X-2	X-2		
Yuba							M					

Source: (USEPA, 2015m)

X-1 = Nonattainment Area (Extreme)
X-2 = Nonattainment Area (Severe)
X-3 = Nonattainment Area (Serious)
X-4 = Nonattainment Area (Moderate)
X-5 = Nonattainment Area (Marginal)
X-6 = Nonattainment Area (Unclassified)
M = Maintenance Area

Air Quality Monitoring and Reporting

California has 35 separate and distinct air regulatory authorities. CARB is responsible for the air quality monitoring for 25 of the air districts. The other 10 air districts submit annual air quality reports to USEPA and submit the data to CARB to keep in the state database. Across California, $PM_{2.5}$, $PM_{10,}$ and O_3 are main pollutants of concern and are reported on CARBs website as well as many of the air districts website to inform the public.

CARB measures and receives air pollutants for over 250 sites across the state as part of the National Air Monitoring Stations Network and the County Air Monitoring Stations Network, including the 10 air districts that monitor independently. Annual CARB Ambient Air Quality Reports are prepared, containing pollutant data summarized by the CARB. CARB reports real-

time pollution levels of $PM_{2.5}$, $PM_{10,}$ and O_3 on the AirNOW[193] website at http://airnow.gov/index.cfm?action=airnow.local_state&stateid=5to inform the public.

CARB queried the number of days in 2014 that exceeded the federal standards utilizing the Ambient Air Quality Data Summaries (ADAM) database on December 11, 2015. According to the ADAM query throughout 2014, O_3 measurements exceeded the federal standard of 0.075 ppm 1,577 times. Also in 2014, $PM_{2.5}$ measurements exceeded the federal standard of 35 $\mu g/m^3$ 396 times. Additionally in 2014, PM_{10} measurements exceeded the federal standard of 150 $\mu g/m^3$ 79 times. No other criteria pollutants exceeded federal standards.[194] (CARB, 2015e)

Air Quality Control Regions

USEPA classified all land in the United States as a Class I, Class II, or Class III Federal Air Quality Control Region (AQCR) (42 U.S.C. § 7470). Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size. Class I areas cannot be re-designated as Class II or Class III and are intended to maintain pristine air quality. Although USEPA developed the standards for a Class III AQCR, to date they have not actually classified any area as Class III. Therefore, any area that is not classified as a Class I area is, by default, automatically designated as a Class II AQCR (42 U.S.C. § 7470).

In a 1979 USEPA memorandum, the Assistant Administrator for Air, Noise, and Radiation (USEPA, 1979) advised USEPA Regional Offices to provide notice to the Federal Land Manager (FLM) of any facility subject to the Prevention of Significant Deterioration (PSD) permit requirements and within 100 kilometers[195] of a Class I area. "The USEPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (Page, 2012). The 2005 USEPA guidelines for air quality modeling do not provide a precise modeling range for Class I areas.

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the USEPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 100 kilometers[196] (the normal useful range of USEPA-approved Gaussian plume models"[197] (USEPA, 1992).

[193] AirNow is a government website that posts daily Air Quality Index for more than 400 cities.

[194] CARB (Rebekka Fine) performed the queries cited in this paragraph in December 2015. The email exchange with CARB and the results of the queries are included in the AR.

[195] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.

[196] The memorandum and associated guidance use kilometers. 50 kilometers is equal to about 31 miles.

[197] Gaussian plume model is a computer based model used to calculate air pollution concentrations.

California contains 33 Federal Class I areas and the rest of the land within the state is classified as Class II (USEPA, 2012c). If an action is considered a major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (USEPA, 1992). Oregon has three Class I areas where the 100-kilometer buffer intersects a few California counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 4.1.12-3 provides a map of California highlighting all relevant Class I areas and all areas within the 100-kilometer radiuses. The numbers next to each of the highlighted Class I areas in Figure 4.1.12-3 correspond to the numbers and Class I areas listed in Table 4.1.12-32.

Table 4.1.12-32: Relevant Federal Class I Areas

#a	Area	Acreage	State
1	Redwood NP	27,792	CA
2	Marble Mountain Wilderness	213,743	CA
3	Lava Beds/Black Lava Flow Wilderness	28,640	CA
4	Lava Beds/Schonchin Wilderness		CA
5	South Warner Wilderness	68507	CA
6	Thousand Lakes Wilderness	15,695	CA
7	Lassen Volcanic NP	105,800	CA
8	Caribou Wilderness	19,080	CA
9	Yolla Bolly-Middle Eel Wilderness	109,091	CA
10	Desolation Wilderness	63,469	CA
11	Mokelumne Wilderness	50,400	CA
13	Emigrant Wilderness	104,311	CA
14	Hoover Wilderness	47,916	CA
15	Yosemite NP	759,172	CA
16	Minarets Wilderness Area (Ansel Adams Wilderness)	109,484	CA
17	Kaiser Wilderness	22,500	CA
18	John Muir Wilderness	484,673	CA
19	Kings Canyon NP	459,994	CA
20	Sequoia NP	386,642	CA
21	Pinnacles Wilderness	12,952	CA
22	Ventana Wilderness	95,152	CA
23	Domeland Wilderness	62,206	CA
24	San Rafael Wilderness	142,722	CA
25	San Gabriel Wilderness	36,137	CA
26	Cucamonga Wilderness	9,022	CA
27	San Gorgonio Wilderness	34,644	CA
28	San Jacinto Wilderness	20,564	CA
29	Joshua Tree Wilderness	429,690	CA
30	Agua Tibia Wilderness	15,934	CA
31	Kalmiopsis Wilderness	76,900	OR
32	Gearhart Mountain Wilderness	18,709	OR
33	Mountain Lakes Wilderness	23,071	OR

Source: (USEPA, 2012c)

[a] The numbers correspond to the shaded regions in Figure 4.1.12-3.

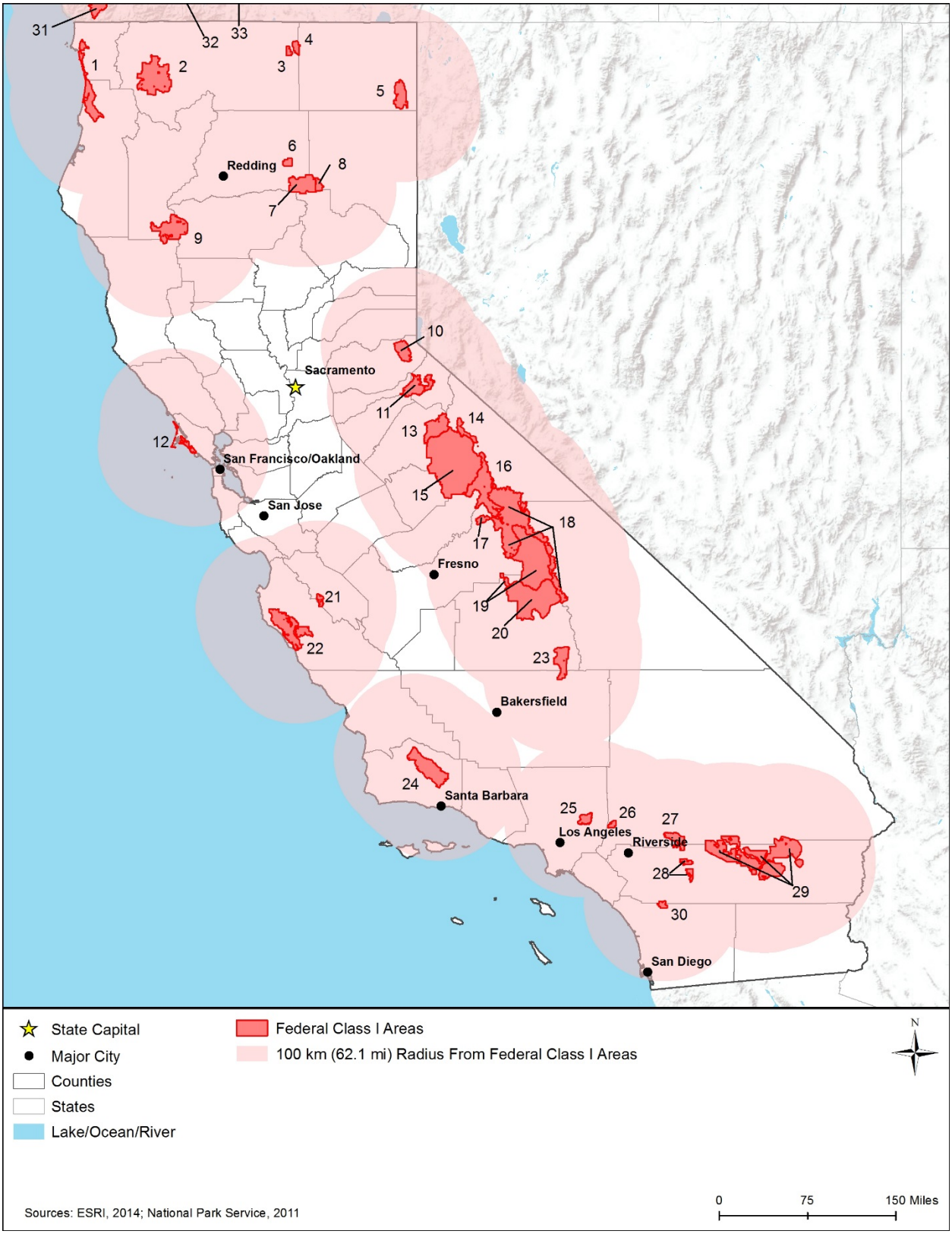


Figure 4.1.12-3: Federal Class I Areas with Implications for California

4.1.13 Noise

This section presents a discussion of a basic understanding of environmental noise, background/ambient noise levels, noise standards, and guidelines.

4.1.13.1 Definition of the Resource

Noise is caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012d). Noise is one of the most common environmental issues that interferes with normal human activities and otherwise diminishes the quality of the human environment. Typical sources of noise that result in this type of interference in urban and suburban surroundings includes interstate and local roadway traffic, rail traffic, industrial activities, aircraft, and neighborhood sources like lawn mowers, leaf blowers, etc.

The effects of noise can be classified into three categories:

- Noise events that result in annoyance and nuisance;
- Interference with speech, sleep, and learning; and
- Physiological effects such as hearing loss and anxiety (USEPA, 2015n).

Fundamentals of Noise

For environmental noise analyses, a noise metric refers to the unit that quantitatively measures the effect of noise on the environment. The unit used to describe the intensity of sound is the decibel (dB). Audible sounds range from 0 dB ("threshold of hearing") to about 140 dB ("threshold of pain") (OSHA, 2016a). The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound (FTA, 2006). The normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 2015i). The A-weighted scale, denoted as dBA, approximates the range of human hearing by filtering out lower frequency noises, which are not as damaging as the higher frequencies. The dBA scale is used in most noise ordinances and standards (OSHA, 2016a).

Measurements and descriptions of noise (i.e., sounds) are based on various combinations of the following factors (FTA, 2006):

- The total sound energy radiated by a source, usually reported as a sound power level.
- The actual air pressure changes experienced at a particular location, usually measured as a sound pressure level (SPL) (the frequency characteristics and SPL combine to determine the loudness of a sound at a particular location).
- The duration of a sound.
- The changes in frequency characteristics or pressure levels through time.

Figure 4.1.13-1 presents the sound levels of typical events that occur on a daily basis in the environment. For example, conversational speech is measured at about 55 to 60 dBA, whereas a band playing loud music may be as high as 120 dBA (OSHA, 2013).

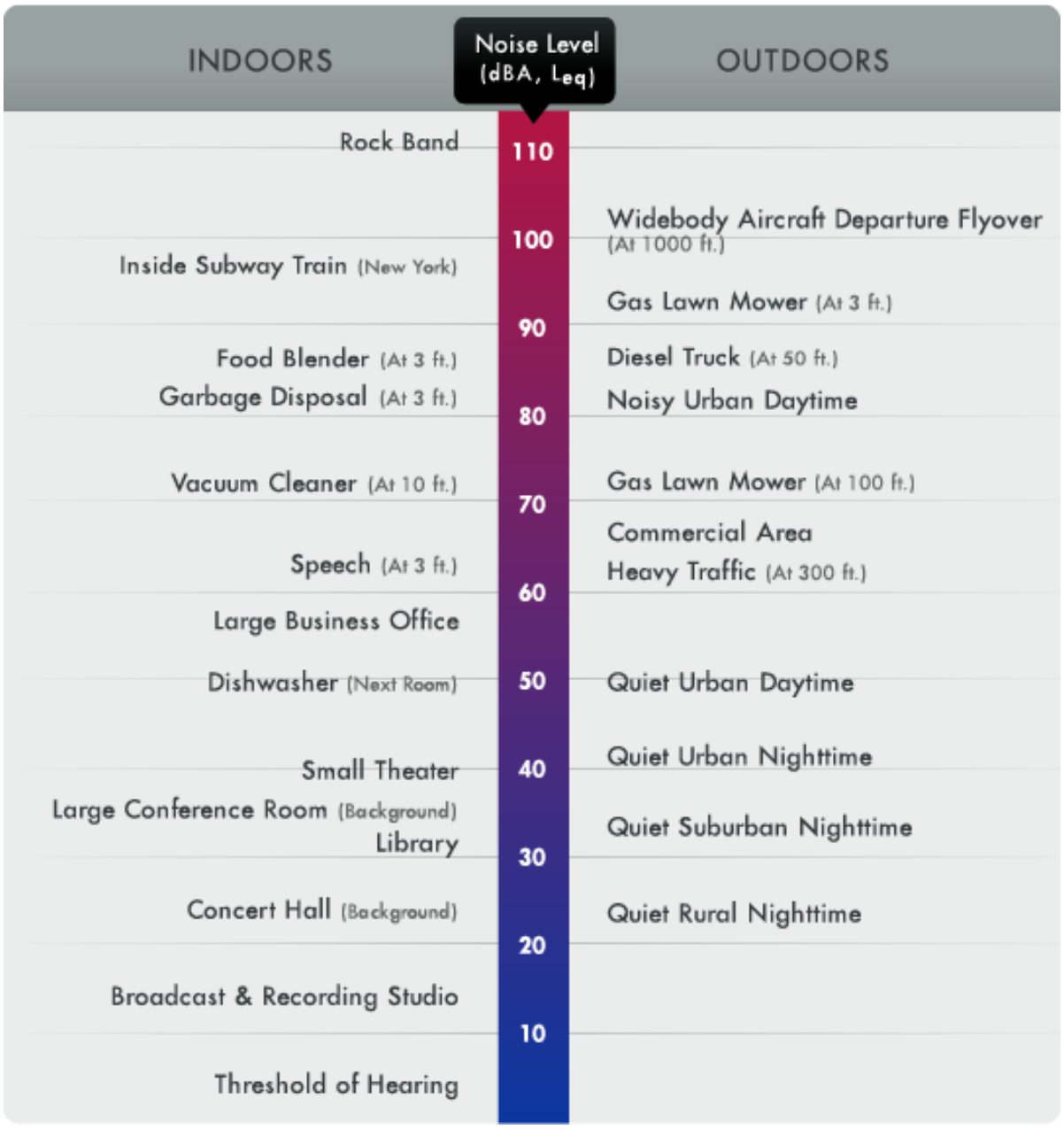


Figure 4.1.13-1: Sound Levels of Typical Sounds

Leq: Equivalent Continuous Sound Level
Source: (Sacramento County Airport System, 2015)
Prepared by: Booz Allen Hamilton

Because of the logarithmic unit of measurement, sound levels cannot be added or subtracted linearly. However, several methods of estimating sound levels can be useful in determining approximate sound levels. First, if two sounds of the same level are added, the sound level increases by approximately three dB (for example: 60 dB + 60 dB = 63 dB). Secondly, the sum of two sounds of a different level is slightly higher than the louder level (for example: 60 dB + 70 dB = 70.4 dB).

The changes in human response to changes in dB levels is categorized as follows (FTA, 2006):

- A 3-dB change in sound level is considered a barely noticeable difference;
- A 5-dB change in sound level will typically result in a noticeable community response; and
- A 10-dB change, which is generally considered a doubling of the sound level, almost certainly causes an adverse community response.

In general, ambient noise levels are higher during the day than at night and typically this difference is about 10 dB. Ambient noise levels can differ considerably depending on whether the environment is urban, suburban, or rural. (USEPA, 1973)

4.1.13.2 Specific Regulatory Considerations

As identified in Appendix C, Environmental Laws and Regulations, the Noise Control Act of 1972, along with its subsequent amendments (e.g., Quiet Communities Act of 1978 [42 U.S.C. Parts 4901−4918]), delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Although no federal noise regulations exist, the USEPA has promulgated noise guidelines (USEPA, 1974). Similarly, many states have no quantitative noise-limit regulations (FindLaw, 2016).

However, California has several statewide noise laws and regulations that could apply to several of the proposed alternatives in this EIS. For instance, the California Noise Control Act of 1973 created a noise control office in California and covers a wide variety of noise sources, including vehicles, industrial equipment, construction activities, and aircraft. (Manaster & Selmi, 2016)

In addition, California has a unique noise metric, the Community Noise Exposure Level (CNEL) that can be applied to aircraft operations, as well as highway and rail operations. CNEL is similar to Ldn,[198] where it is an average of all of the noise levels across a 24-hour period. However, where Ldn adds a 10-dB penalty for activities conducted between 10:00 pm and 7:00 am, CNEL also adds an evening hour penalty of 5-dB for activities conducted from 7:00 pm to 10:00 pm in California. This additional penalty makes noise measurements in California more conservative than in most other states, but makes it easier for government actions to constitute a significant effect on the noise environment. (NoiseMeters.Inc, 2016)

Many cities and towns in California may have additional, local noise ordinances to further manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Large cities and towns are likely to have different regulations than rural or suburban communities largely due to the population density and difference in ambient noise levels (FHWA, 2011). Table 4.1.13-1 provides an overview of California's state laws relating to noise.

[198] Ldn: "The Ldn is the average equivalent sound level over a 24 hour period, with a penalty added for noise during the nighttime hours of 22:00 to 07:00. During the nighttime period 10 dB is added to reflect the impact of the noise" (NoiseMeters.Inc, 2016).

Table 4.1.13-1: Relevant California Noise Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
California Health and Safety Code, Division 29	Office of Noise Control	Sets up the California Office of Noise Control to create policies that handle a wide variety of noise sources.
California Vehicle Code Sections 27000-27007	Caltrans	Places limits on amplified noise from vehicles.

4.1.13.3 Environmental Setting: Ambient Noise

The range and level of ambient noise in California varies widely based on the area and the environment. The population of California can choose to live and interact in a variety of areas such as that are large cities, rural communities, and national and state parks. Figure 4.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of California may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to California. As such, this section describes the areas where the population of California can potentially be exposed to higher than average noise levels.

- **Urban Environments:** Urban areas are likely to have higher noise levels on a daily basis due to highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (U.S. Department of Interior, 2008). The areas that are likely to have the highest ambient noise levels in the state are: Los Angeles, San Diego, San Francisco, San Jose, and Fresno (and their neighboring cities).
- **Airports:** Areas surrounding airports tend to be more sensitive to noise due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2007). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports are in the proximity of urban communities; therefore, aircraft operations (arrivals/departures) can result in noise exposure in the surrounding areas to be at higher levels with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In California, LAX, SFO, and SAN have more than 1.2 million annual operations combined (FAA, 2015j). These operations result in increased ambient noise levels in the surrounding communities. Other large airports with similar increased ambient noise levels in California include Bob Hope Airport (BUR), Long Beach/Daugherty Field (LGB), Metropolitan Oakland International Airport (OAK), Ontario

International Airport (ONT), Sacramento International Airport (SMF), Norman Y. Mineta San Jose International Airport (SJC), and John Wayne Airport-Orange County (SNA) (FAA, 2014a).

- **Highways:** Communities near major highways also experience higher than average noise levels when compared to areas that are not in close proximity to a highway (FHWA, 2015d). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living in those areas. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA, 2015d). See Section 4.1.1, Infrastructure, for more information about the major highways in California.
- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (FTA, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (FRA, 2015). California has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend mainly from the major California cities to each other, as well as to nearby cities such as Las Vegas, Nevada. There are also a number of other rail corridors that join these major rail lines and connect with other cities (Caltrans, 2013b). See Section 4.1.1, Infrastructure, for more information about rail corridors in California.
- **National and State Parks:** The majority of national and state parks are likely to have lower than average ambient noise levels given their sizes and locations. National and state parks, historic areas, and monuments are protected areas, which are regions that are given legal safeguards in order to maintain biological diversity and natural resources (NPS, 2013a). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014f). California has 27 National Park units, and several other affiliated sites, as well as 36 National Natural Landmarks (NPS, 2015t). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 4.1.8, Visual Resources, for more information about national and state parks in California.

4.1.13.4 Environmental Setting: Sensitive Noise Receptors

Noise-sensitive receptors include residences, schools, medical facilities, places of worship, libraries, churches, nursing homes, concert halls, playgrounds, and parks. Sensitive noise receptors are typically areas where the intrusion of noise can disrupt the use of the environment. A quiet urban area usually has a typical noise level in the daytime of 50 dBA, and 40 dBA during the evening. Noise levels in remote wilderness and rural nighttime areas are usually 30 dBA (BLM, 2014). Most cities and towns in California have at least one school, church, or park, in addition to likely having other noise-sensitive receptors. There are most likely thousands of sensitive receptors in California.

4.1.14 Climate Change

4.1.14.1 Definition of the Resource

Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is defined as "…a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or human activity." (IPCC, 2007)

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 2012b). The IPCC is now 95 percent certain that humans are the main cause of current global warming (IPCC, 2013). Human activities result in emissions of four main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons (a group of gases containing fluorine, chlorine, or bromine) (IPCC, 2007). The common unit of measurement for GHGs is metric tons of CO_2-equivalent (MT CO_2e), which equalizes for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units are in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units are in MMT CO_2e.

The IPCC reports that "global concentrations of these four GHGs have increased significantly since 1750" with "Atmospheric concentrations of CO_2 increased from 280 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (IPCC, 2007). The atmospheric concentration of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270 parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (IPCC, 2007). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (IPCC, 2007).

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this PEIS (see Chapter Four, Environmental Consequences). Existing climate conditions in the project area are described first by state and sub-region, where appropriate, and then by future projected climate scenarios. The discussion focuses on the following climate change impacts: (1) temperature; (2) precipitation; (3) sea level; and (4) severe weather events (including tropical storms, tropical cyclones, and hurricanes).

4.1.14.2 Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C, Environmental Laws and Regulations. California has established many goals and regulations to reduce GHG emissions to combat climate change. Some of the most relevant goals for climate change preparedness and GHG emissions are shown in Table 4.1.14-1.

Table 4.1.14-1: Relevant California Climate Change Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Assembly Bill 4420 (September 28, 1988)	State of California	The California Energy Commission (CEC) was directed to prepare and maintain the inventory of GHG emissions and to study the effects of GHGs and the climate change impacts on the state's energy supply and demand, economy, environment, agriculture, and water supplies. The study also required recommendations for avoiding, reducing, and addressing related impacts - and required the CEC to coordinate the study and any research with federal, state, academic, and industry research projects.
Senate Bill 1771 (September 30, 2000)	State of California	Senate Bill 1771 establishes the creation of the non-profit organization, the California Climate Action Registry and specifies functions and responsibilities to develop a process to identify and qualify third-party organizations approved to provide technical assistance and advice in monitoring GHG emissions, and setting GHG emissions baselines in coordination with CEC. Also, the bill directs the Registry to enable participating entities to voluntarily record their annual GHG emissions inventories. Also, SB 1771 directs CEC to update the state's GHG inventory from an existing 1998 report and continuing to update it every five years.
Assembly Bill 32: California Global Warming Solutions Act (September 27, 2006)	State of California	The California Global Warming Solutions Act of 2006 would require CARB to adopt a statewide GHG emissions limit equivalent to the statewide GHG emissions levels in 1990 to be achieved by 2020. ARB shall adopt regulations to require the reporting and verification of statewide GHG emissions and to monitor and enforce compliance with this program. AB 32 directs Climate Action Team established by the Governor to coordinate the efforts set forth under Executive Order S-3-05 to continue its role in coordinating overall climate policy.
Executive Order S-03-05 (June 1, 2005)	State of California	The Governor signed Executive Order S-03-05, which "establishes GHG emission reduction targets, creates the Climate Action Team, and directs the Secretary of Cal/EPA to coordinate efforts with meeting the targets with the heads of other state agencies. The EO requires the Secretary to report back to the Governor and Legislature biannually on progress toward meeting the GHG targets, GHG impacts to California, Mitigation, and Adaptation Plans."
Executive Order S-13-08 (November 14, 2008)	State of California	The Governor signed Executive Order S-13-08, which "directs state agencies to plan for sea level rise and climate impacts through coordination of the state Climate Adaptation Strategy."
Executive Order B-20-15 (April 29, 2015)	State of California	The Governor signed EO-B-30-15, which "sets a GHG emissions target for 2030 at 40 percent below 1990 levels."

4.1.14.3 California Greenhouse Gas Emissions

Estimates of California's total GHG emissions vary. The Department of Energy's (DOE) Energy Information Agency (EIA) collects and disseminates national-level emissions data on other GHGs such as CH_4 and nitrous oxide (NO_x), but not at the state level (EIA, 2011). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015o). Individual states have developed their own GHG inventories, which are updated with different frequencies and trace GHG in a variety of ways.

For the purposes of this PEIS, the EIA data on CO_2 emissions will be used as the baseline metric to ensure consistency and comparability across the 50 states. However, if additional data sources on GHG emissions are available for a given state, including other GHGs such as CH_4, they are described and cited.

According to the EIA, California emitted a total of 353.1 MMT of CO_2 in 2013 with the transportation sector as the largest emitter at 54 percent of the total, almost entirely from petroleum products (Table 4.1.14-2) (EIA, 2015e). Annual emissions between 1980 and 2013 are presented in Figure 4.1.14-1 (EIA, 2015e). Between 1980 and 2013, California's CO_2 emissions decreased from 347.2 MMT to 292.2 MMT, then increased 392.8 MMT in 2007 before declining to their current levels. The 1980 and 1983 decline was mostly a result of the almost complete elimination of emissions from petroleum products from the electric generation sector. Natural gas consumption by the electric power sector increased from 100.1 MMT in 1980 to its current levels, which together with petroleum products in the transportation sector was the underlying driver for the long-term increase. The post-2007 decline was mostly in emissions from petroleum products by the industrial and transportation sectors (32.1 MMT in 1980, falling to 2.3 MMT by 1984). In 2013, California was the second-largest emitter of CO_2 in the U.S. in 2012 but was ranked 48th in per-capita energy-related GHG emissions (EIA, 2015f).

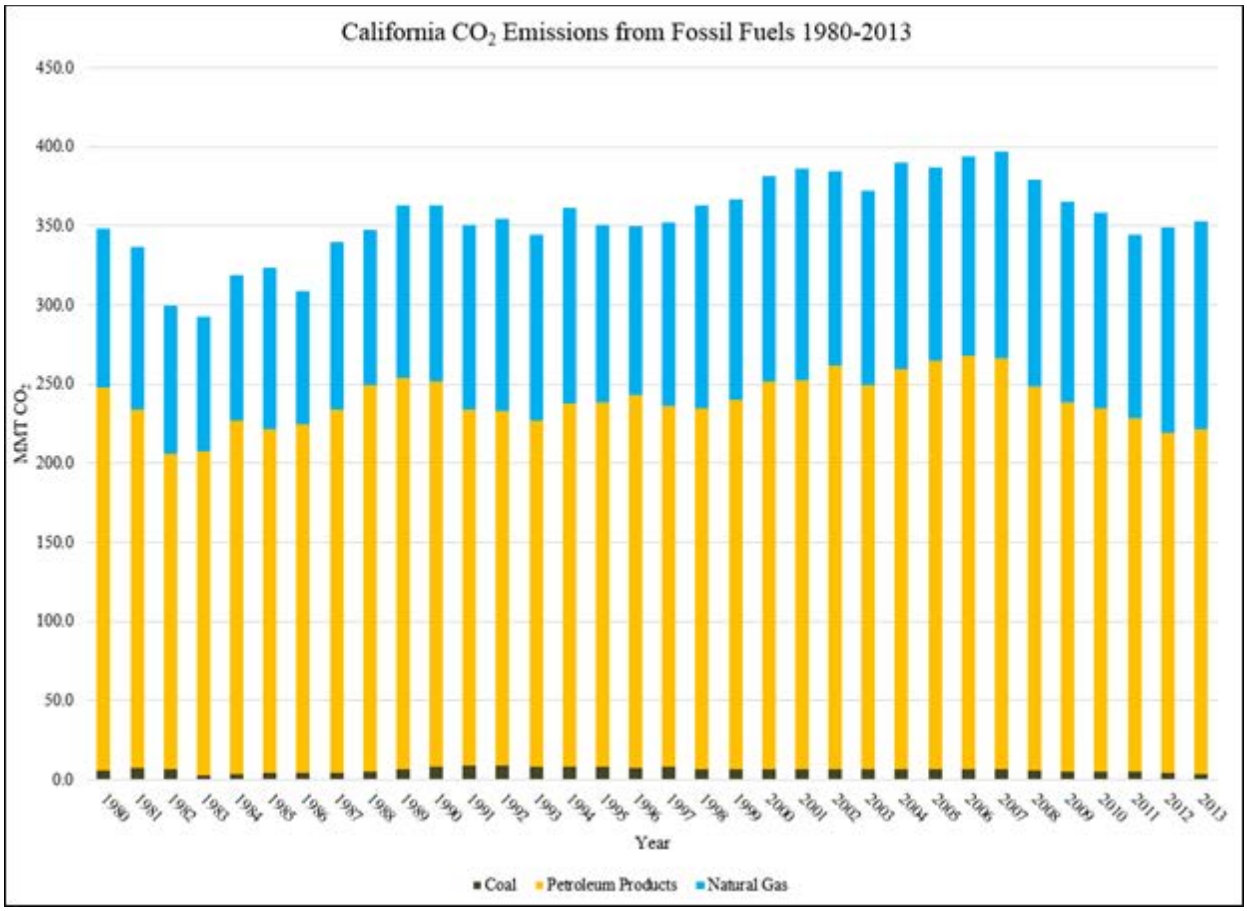


Figure 4.1.14-1: California CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015e)

Table 4.1.14-2: California CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	3.6	Residential	27.7
Petroleum Products	217.1	Commercial	16.0
Natural Gas	131.8	Industrial	72.9
		Transportation	190.7
		Electric Power	45.7
Total	**353.1**	**Total**	**353.1**

Source: (EIA, 2015e)

The majority of California's GHG emissions is CO_2. These emissions are the result of fossil fuel combustion for the purpose of producing energy, mostly petroleum products used in the transportation sector. Other major GHGs emitted in California are CH_4, hydrofluorocarbons, NO_x, sulfur hexafluoride (SF_6) and perfluorocarbons (EIA, 2015g).

CalEPA keeps an updated state greenhouse gas emission inventory, which was most recently updated in 2015 for years 2000 to 2012 (CalEPA, 2015i). Total U.S. GHG greenhouse were 6,673 million metric tons (14.7 trillion pounds) in 2013. Natural gas is the main resource that generates electricity in California. "Until 2012, California's two nuclear power plants with their four reactors typically provided about one-sixth of the state's total net electricity generation" (CalEPA, 2015i). One-sixth of electricity is generated by hydroelectric power while three-tenths of electricity comes from surrounding states. California also uses resources such as solar, geothermal, wind and biomass which helps keep emissions lower (CalEPA, 2015i). Natural gas production has declined in the last 30 years and only accounts for about 1 percent of the nation's total natural gas production. California has 14 natural gas storage fields that can store up to 600 billion cubic feet (EIA, 2015g) (CalEPA, 2015i).

In the last three decades, crude oil production in California has declined. However, the state remains the top U.S. state for crude oil production. California is also a large refining state and processes oil from Alaska, Saudi Arabia, Iraq, and Ecuador. California does not produce coal and only consumes a small amount for the industrial facilities and the electric power sector. (EIA, 2015g) (CalEPA, 2015i)

The transportation sector continues to be the largest contributor. Emissions declined between 2007 and 2012 while emissions from in-state transportation increased by 1 percent in 2013 which is likely a result of a growth in heavy-duty vehicles. Light-duty vehicles accounted for 71 percent in 2013. "Contributions from the transportation sector include emissions from combustion of fuels sold in-state that are used by on-road and off-road vehicles, aviation, rail, and water-borne vehicles, as well as a few other smaller sources" (CalEPA, 2015i). Emissions from high-GWP continue to grow "as they replace ozone depleting substances banned under the Montreal Protocol" (CalEPA, 2015i).

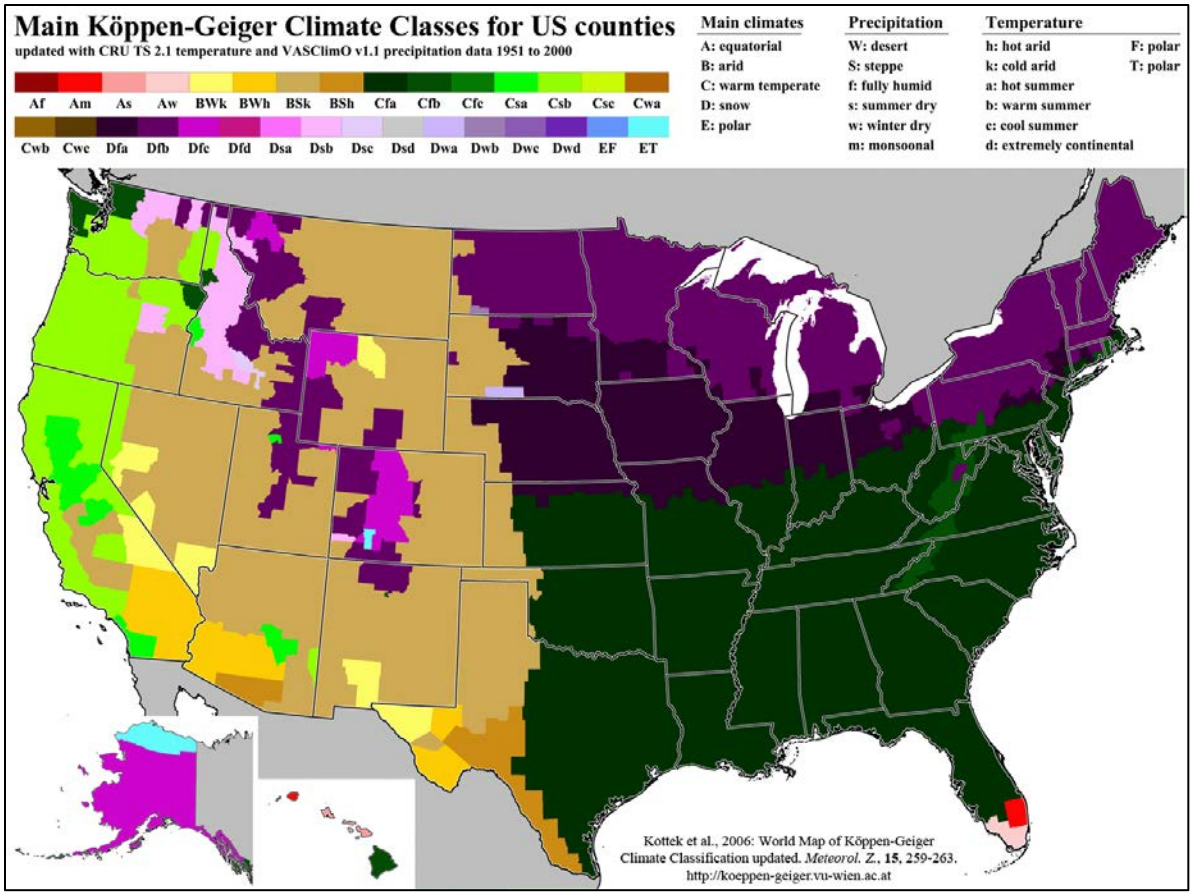
Emissions from the industrial sector declined between 2009 and 2013. Refinery and hydrogen production emission continued to increase but starting in 2010 emissions started to decrease. This is likely a result of the refineries producing more diesel than gasoline, a resource that requires less energy to produce (CalEPA, 2015i).

The residential and commercial sector emissions vary on an annual basis because emissions fluctuate depending on the weather. These sectors are large consumers of natural gas. Housing population increased between 2000 and 2013, but emissions per housing unit decreased. This is likely a result of new energy efficient technology (CalEPA, 2015i).

4.1.14.4 Environmental Setting: Existing Climate

The National Weather Service defines climate as the "reoccurring average weather found in any particular place" (NWS, 2011a). The widely-accepted division of the world into major climate categories is referred to as the Köppen-Geiger climate classification system. Climates within this system are classified based "upon general temperature profiles related to latitude" (NWS, 2011a). The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly temperature characteristics (NWS, 2011b).

Across the United States, the five most common climate groups are (A), (B), (C), (D), and (E). The majority of California, including northern, southern, and central parts of the state, falls into climate group (C). Climates classified as (C) are warm, with humid summers and mild winters. During winter months, "the main weather feature is the mid-latitude cyclone" (NWS, 2011a). During summer months, thunderstorms are frequent. Areas of central and southern California fall into climate group (B). Climates classified as (B) are dry climates, "in large continental regions of the mid-latitudes often surrounded by mountains" (NWS, 2011a). "The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation" (NWS, 2011a). California has five sub-climate categories, which are described in the paragraphs below.



Source: (Kottek, 2006)

Figure 4.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

BWk – The Köppen-Geiger climate classification system classifies areas of eastern California, along the Nevada border, as BWk. Climates classified as BWk are mid-latitude deserts, with mean annual temperatures that are less than 64 ^{o}F and are too dry to support most plant life. Evaporation in BWk climates "exceeds precipitation on average but is less than half potential evaporation" (NWS, 2011b). Winters in BWk climates zones typically experience "below freezing temperature" (NWS, 2011b) (GLOBE SCRC, 2015).

BWh – The Köppen-Geiger climate classification system classifies portions of southern California, along the Mexican and Arizona border, as BWh. Climates classified as BWh are subtropical, desert climates with arid, hot, and desert-like conditions. Mean annual temperatures in BWh climates are greater than or equal to 64.4 ^{o}F. BWh climates are too dry to support most plant life. Frost in BWh climates is absent or infrequent. (GLOBE SCRC, 2015) (NWS, 2011a) (NWS, 2011b)

Bsk – The Köppen-Geiger climate classification system classifies areas of central and south central California as Bsk. Climates classified as Bsk, are mid-latitude and dry. "Evaporation exceed precipitation on average but is less than potential evaporation" (NWS, 2011b). Average temperatures in Bsk climate zones are less than 64 ^{o}F (NWS, 2011a) (NWS, 2011b).

Csa – The Köppen-Geiger climate classification system classifies portions northern, north central, and a few areas of southern California, as Csa. Climates classified as Csa are Mediterranean climates, with mild temperatures and dry, hot summers. The warmest months in Csa climates are greater than 72 °F. A minimum of four months out of the year experience average temperatures that are greater than 50 °F. Csa climates experience frost during winter months and "at least three times as much precipitation during [the] wettest winter months as in the driest summer month" (NWS, 2011b). The coldest month in Csa climates is warmer than 26.6 °F but cooler than 64 °F. Summers in Csa climates are dry and mild. (GLOBE SCRC, 2015) (NWS, 2011a) (NWS, 2011b)

Csb – The Köppen-Geiger climate classification system classifies the majority of California as Csb. Csb climates are Mediterranean, with mild temperatures and cool, dry summers. In Csb climates, the coldest months are warmer than 26 °F but cooler than 64 °F, with at least four months averaging temperatures greater than 50 °F (GLOBE SCRC, 2015) (NWS, 2011b). Summers in Csb climates are dry and mild (GLOBE SCRC, 2015). Winters in Csb climates typically have high levels of frost, with "at least three times as much precipitation during [the] wettest winter months as in the driest summer month" (NWS, 2011b). Csb climates are typically found on western sides of continents and near the coast (GLOBE SCRC, 2015) (NWS, 2011a) (NWS, 2011b).

4.1.14.5 Environmental Setting: Existing Climate

This section discusses the current state of California's climate with regard to air temperature, precipitation, sea level, and extreme weather events (e.g., tropical storms, tropical cyclones, and hurricanes) in the state's five climate regions, BWk, BWb, Bsk, Csa, and Csb.

Air Temperature

In general, California's experiences a Mediterranean climate with "with precipitation falling from October through April and sunny, warm, and dry periods extending from May through September" (Anderson, 2015). Two of California's main climate influencers are the mountains and Pacific Ocean, as both moderate temperature and precipitation regimes throughout the state (Anderson, 2015). Latitude also affects the state's climate, with warmer, dryer conditions in the southern latitudes of the state and cooler, wetter conditions to the north" (Anderson, 2015).

Coastal regions of California generally experience more moderate temperature ranges, due to strong influences from the Pacific Ocean. By comparison, interior regions of the state generally experience greater fluctuations, "leading to record setting extremes" (Anderson, 2015). For example, San Diego, a coastal city, experiences temperatures ranging from approximately 64.7 °F during winter months such as January, to 76.4 °F during summer months such as August. Whereas, Death Valley, located in California's interior, experienced the highest temperature to ever occur in the U.S., with a recorded value of 134 °F. "Death Valley also hosts the state's longest streak of days above 90 degrees Fahrenheit with 205 days in 1992" (Anderson, 2015). The coldest temperature to occur in California was in 1937, with a record low of negative 45 °F in Boca, located along the eastern slope of the Sierra Mountains (NOAA, 2016).

The following paragraphs describe annual temperatures as they occur in the various climate classification zones:

BWk – Death Valley, located in southeastern California, is within the climate classification zone BWk. The average annual temperature in Death Valley is approximately 77.2 °F; 54.8 °F during winter months; 99.4 °F during summer months; 77.1 °F during spring months; and 76.9 °F during autumn months (NOAA, 2015h). The average minimum temperature in Death Valley is approximately 48.0 °F and the average maximum temperature is approximately 76.5 °F (California Department of Water Resources, 2015a).

BWh – Desert Center, located in southern California, is within the climate classification zone BWh. The average annual temperature in Desert Center is approximately 72.8 °F; 54.8 °F during winter months; 90.9 °F during summer months; 71.6 °F during spring months; and 73.6 °F during autumn months (NOAA, 2015h).

Bsk – Bakersfield, located in south central California, is within the climate classification zone Bsk. The average annual temperature in Bakersfield is approximately 64.0 °F; 48.3 °F during winter months; 79.8 °F during summer months; 61.9 °F during spring months; and 65.6 °F during autumn months (NOAA, 2015h).

Csa – Sacramento, located in north central California, is within the climate classification zone Csa. The average annual temperature in Sacramento is approximately 61.0 °F; 47.7 °F during winter months; 73.8 °F during summer months; 59.6 °F during spring months; and 62.9 °F during autumn months (NOAA, 2015h). The average minimum temperature in Sacramento is approximately 44.5 °F and the average maximum temperature is approximately 64.1 °F (California Department of Water Resources, 2015a). San Diego, located in southern California, is also located within the climate classification zone Csa. The average annual temperature in San Diego is approximately 63.6 °F; 57.1 °F during winter months; 69.3 °F during summer months; 61.7 °F during spring months; and 66.2 °F during autumn months (NOAA, 2015h). The average minimum temperature in San Diego is approximately 52.9 °F and the average maximum temperature in San Diego is approximately 70.0 °F (California Department of Water Resources, 2015a).

Csb – San Francisco, located in north costal California, is within the climate classification zone Csb. The average annual temperature in San Francisco is approximately 55.3 °F; 51.4 °F during winter months; 57.8 °F during summer months; 54.1 °F during spring months; and 57.7 °F during autumn months (NOAA, 2015h). The average minimum temperature in San Francisco is approximately 47.4 °F and the average maximum temperature is approximately 62.9 °F (California Department of Water Resources, 2015a).

Precipitation

Western areas of California, particularly along the mountains, are “generally wetter than the eastern slopes with snow falling in winter at higher elevations” (Anderson, 2015). In addition, higher elevations along the southern range lead to “annual runoff that is dominated by the melting of the seasonal snowpack that occurs from April through July” (Anderson, 2015).

Northern areas of the range experience the wettest conditions, where significant runoff "is formed from a mix of rain and snow processes" (Anderson, 2015).

In northern areas of the state, annual precipitation averages approximately 100 inches per year. By comparison, southern areas of the state average approximately five inches per year. Thunderstorms typically arise from colder storms, and occasionally bring hail and tornadoes. In southeastern desert-like areas of the state, afternoon thunderstorms typically reach their peak during summer months. (Anderson, 2015)

The highest annual precipitation to occur in the state was in 1909 with a total of 153.54 inches in Monumental. The greatest 24-hour precipitation accumulation to occur was in 1943, with a total of 26.12 inches in Hoegees Camp. The greatest winter snowfall accumulation occurred during the winter of 1906 through 1907, with a total of 884 inches in Tamarack in the American River watershed, east of Sacramento. The greatest 24-hour snowfall accumulation to occur was on January 5, 1982, with a total of 67 inches in the Sierra Mountains (SCEC, 2015) (Anderson, 2015).

The following paragraphs describe annual precipitation as it occurs in the various climate classification zones:

BWk – Death Valley, located in southeastern California, is within the climate classification zone BWk. The average annual precipitation accumulation in Death Valley is approximately 2.36 inches; 1.20 inches during winter months; 0.25 inches during summer months; 0.45 inches during spring months; and 0.46 inches during autumn months (NOAA, 2015h).

BWh – Desert Center, located in southern California, is within the climate classification zone BWh. The average annual precipitation accumulation in Desert Center is approximately 3.92 inches; 1.57 inches during winter months; 0.90 inches during summer months; 0.60 inches during spring months; 0.85 inches during autumn months (NOAA, 2015h).

Bsk – Bakersfield, located in south central California, is within the climate classification zone Bsk. The average annual precipitation accumulation in Bakersfield is approximately 8.03; 4.02 inches during winter months; 0.17 inches during summer months; 2.36 inches during spring months; and 1.48 inches during autumn months (NOAA, 2015h).

Csa – Sacramento, located in north central California, is within the climate classification zone Csa. The average annual precipitation accumulation in Sacramento is approximately 18.52 inches; 10.36 inches during winter months; 0.26 inches during summer months; 4.58 inches during spring months; and 3.32 inches during autumn months (NOAA, 2015h). San Diego, located in southern California, is also located within the climate classification zone Csa. The average annual precipitation accumulation in San Diego is approximately 10.34 inches; 5.78 inches during winter months; 0.12 inches during summer months; 2.71 inches during spring months; and 1.73 inches during autumn months (NOAA, 2015h).

Csb – San Francisco, located in north costal California, is within the climate classification zone Csb. The average annual precipitation accumulation in San Francisco is approximately 20.68 inches; 12.25 inches during winter months; 0.27 inches during summer months; 4.45 inches during spring months; and 3.71 inches during autumn months (NOAA, 2015h).

Sea Level

California has approximately 840 miles of coastline and 3,427 miles of tidal coastline (Department of Commerce, 2015). Since 1900, global sea level has risen by approximately 0.07 inches per year. Since 1900, approximately 8 inches of "warming-driven global seal level rise" has occurred, with approximately 0.07 inches of rise occurring per year (Climate Central, 2014) (The Union of Concerned Scientists, 2013). Unlike along the east coast of the U.S., sea level rise along the west coast is largely influenced by climate patterns such as El Niño-Southern Oscillation and Pacific Decadal Oscillation. These climate patterns affect winds and ocean circulation, "raising sea level during warm phases (e.g., El Niño) and lowering sea level during cool phases (e.g., La Niña). During large El Niño events, sea level along the coast can rise by as much as 10 to 30 centimeters (The National Academies Press, 2012).

Severe Weather Events

Unlike states along the east coast, California will not face a storm like Superstorm Sandy, because the Pacific Ocean is too cold to produce that type of weather system. Nevertheless, the state is impacted by several other severe forms of weather. For example, tropical storms and typhoons impact California with heavy rain and high winds. One of the most severe storms occurred in October 2009, "when remnants of Super-Typhoon Melor brought more than 10 inches of rain, and tropical storm force winds to many parts of the state." During another severe storm, Gasquet Ranger Station on the North Coast recorded 63 days consecutive days of measureable precipitation in 1998 while Ocotillo near the Mexico border went 468 days without any precipitation from August 1955 to January 1957". (NWS, 2015)

The majority of California is also susceptible to severe flooding, particularly flash flooding, riverine flooding, tropical storm and coastal flooding, snowmelt, dam breaks, and debris flows. During one of the most destructive flooding events since the early 1900's, over 40 counties were declared federal disaster areas, 41 people were killed, and hundreds of buildings were either damaged or destroyed during extensive flooding between January and February of 1969. During these flooding events, "324 precipitation stations, mostly in southern California, reported "the highest ever rainfalls for 60 consecutive days". In Mount Baldy Notch, over 88.5 inches of rainfall was recorded between January 13 and March 13, 1969. (NWS, 2015)

More recently, in 1986, flooding in the Central Sierra and along the Napa River caused over $400 million in property damages, 50,000 evacuations, and 13 deaths. During this storm, 237 precipitation stations reported "the highest ever rainfalls for 10 consecutive days". In addition, four precipitation stations "reported over 100% of their annual average rainfall occurred in 10 days." Heavy snowfall is also common to California, with storms that can produce over 100 inches of snowfall, or 10 inches of precipitable water, during a single snowstorm event. (NWS, 2015)

4.1.15 Human Health and Safety

4.1.15.1 Definition of the Resource

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the deployment, operation, and maintenance of towers, antennas, cables, utilities, and other equipment and infrastructure at existing and potential FirstNet telecommunication sites. There are two human populations of interest within the existing environment of health and safety, (1) telecommunication occupational workers and (2) the general public near telecommunication sites. Each of these populations could experience different degrees of exposure to hazards as a result of their relative access to FirstNet telecommunication sites and their function throughout the deployment of the FirstNet telecommunication network infrastructure.

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation or vehicle traffic. Vehicle traffic is evaluated in Section 4.1.1, Infrastructure.

4.1.15.2 Specific Regulatory Considerations

Federal organizations, such as the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In California, this resource area is regulated by the California Division of Occupational Safety and Health (CADOSH), and CalEPA, California Department of Toxic Substances Control (CADTSC). Federal OSH regulations apply to workers through either OSHA, or stricter state-specific plans that must be approved by OSHA. California's Occupational Safety and Health (Cal/OSHA) State Plan is an OSHA-approved "State Plan," which has unique state and local government employment regulations for toxic chemical handling and exposure, agriculture, repetitive motion injuries, child labor, heat exposure, and noise exposure (OSHA, 2015a). Occupational safety and health regulations are enforced at the state level by Cal/OSHA compliance officers and at the federal level by OSHA. Public health is regulated by the California Department of Public Health (CADPH).

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders. Table 4.1.15-1 below summarizes the major California laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 4.1.15-1: Relevant California Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
California Health and Safety Code: Section 25249.5 to 25249.13	Office of Environmental Health Hazard Assessment (CAOEHHA)	Adds new requirements to the California Safe Drinking Water and Toxic Enforcement Act of 1986 under Proposition 65 that prohibits the contamination of drinking water with chemicals that may cause cancer or reproductive toxicity.
CCR: Title 8 Chapter 4, Subchapter 5	Division of Occupational Safety and Health (CADOSH)	Sets safety requirements for the elimination of accidents resulting from the operation, installation, and maintenance of electrical equipment and tools.
CCR: Title 8, Chapter 4, Subchapter 21	CADOSH	Sets safety and health standards for work performed at telecommunications sites outdoors or in building spaces.

4.1.15.3 Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over water bodies, and on communication towers. Tasks may also be performed at dangerous heights or in confined spaces, while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring (OSHA, 2016b). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

- *Working from height, overhead work, and slips, trips, or falls* – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights up to 2,000 feet above the ground's surface (OSHA, 2015b). In addition to tower climbing hazards, telecommunication workers have restricted workspace on rooftops or work from bucket trucks parked on uneven ground. Cumulatively, these conditions present fall and injury hazards to telecommunication workers, and the general public who may be observing the work or transiting the area (International Finance Corporation, 2007).
- *Trenches and confined spaces* – Installation of underground utilities, building foundations, and work in utility manholes[199] are examples of confined space work is necessary. Installation of telecommunication activities involves laying conduit and in small trenches (generally 6 to 12 inches in width). Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics. (OSHA, 2015b)
- *Heavy equipment and machinery* – New and replacement facility deployment and maintenance can involve the use of heavy equipment and machinery. During the lifecycle of

[199] Manholes may be used for telecommunications activities, especially in cities and urban areas, depending on the location of other utilities. In cities, power, water, and telecommunication lines are often co-located; if access is through a manhole in the street, that access will be used.

a telecommunication site, heavy equipment such as bulldozers, backhoes, dump trucks, cement trucks, and cranes are used to prepare the ground, transport materials, and soil, and raise large sections of towers and antennas. Telecommunication workers may be exposed to the additional site traffic and often work near heavy equipment to direct the equipment drivers and to accomplish work objectives. Accessory machinery such as motorized pulley systems, hydraulic metal shears, and air driven tools present additional health and safety risks as telecommunication work sites. These pieces of machinery can potentially sever skin and bone, or cause other significant musculoskeletal injuries to the operator.

- *Energized equipment and existing utilities* – Electrical shock from energized equipment and utilities is an elevated risk at telecommunication sites due to the amount of electrical energy required for powering communication equipment and broadcasting towers. Telecommunication cables are often co-located with underground and overhead utilities, which can further increase occupational risk during earth-breaking and aerial work.
- *Optical fiber safety* – Optical fiber cable installation and repair presents additional risks to telecommunications workers, including potential eye or tissue damage, through ingestion, inhalation, or other contact with glass fiber shards. The shards are generated during termination and splicing activities, and can penetrate exposed skin (International Finance Corporation, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation presents risk of fire or explosion (Fiber Optic Association, 2010).
- *Noise* – Sources of excess noise at telecommunication sites include heavy equipment operation, electrical power generators and other small engine equipment, air compressors, electrical and pneumatic power tools, and road vehicles, such a diesel engine work trucks. The cumulative noise environment has the potential to exceed the OSHA acceptable level of 85 decibels (dB) per 8-hour time weighted average (TWA) (see Section 4.1.13, Noise) (OSHA, 2015b). Fugitive noise may emanate beyond the telecommunication work site and impact the public living in the vicinity, observing the work, or transiting through the area.
- *Hazardous materials and hazardous waste* – Work at telecommunication sites may require the storage and use of hazardous materials such as fuel sources for backup power generators and compressed gases used for welding and metal cutting (new towers only). In some cases, telecommunication sites require use of potentially hazardous products (e.g., herbicides). Secondary hazardous materials (e.g., exhaust fumes) may be a greater health risk than the primary hazardous material (e.g., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. While it is unlikely that any FirstNet activities would involve the generation or storage of hazardous waste, older existing telecommunication structures and sites could have hazardous materials present, such as lead-based (exterior and interior) paint at outdoor structures or asbestos tiles and insulation in equipment sheds. The general public, unless a telecommunication work site allows unrestricted access, are typically shielded from hazardous materials and hazardous wastes that are components of telecommunication site work.

- *Aquatic environments* – Installation of telecommunication lines may include laying, burying, or boring lines under wetlands and waterways, including lakes, rivers, ponds, and streams. Workers responsible for these activities operate heavy equipment from soft shorelines, boats, barges, and other unstable surfaces. There is potential for equipment and personnel falls, as well as drowning in waterbodies. Wet work conditions also increase risks of electric shock and hypothermia.
- *Outdoor elements* – Weather conditions have the potential to quickly and drastically reduce safety, and increase hazards at telecommunication work sites. Excessive heat and cold conditions impact judgement, motor skills, hydration, and in extreme cases may lead to hyper- or hypothermia. Precipitation, such as rain, ice, and snow, create slippery climbing conditions and wet or muddy ground conditions. Lightning strikes are risks to telecommunication workers climbing towers or working on top of buildings.

Telecommunication Worker Occupational Health and Safety

The U.S. Department of Labor, BLS uses established industry and occupational codes to classify telecommunications workers. For industry classifications, BLS uses the North American Industry Classification System (NAICS) codes, which identify the telecommunications industry (NAICS code 517XX) as being within the information industry (NAICS code 51). For occupational classifications, BLS uses the Standard Occupational Classification (SOC) system to identify workers as belonging to one of 840 occupations. Telecommunications occupations are identified as either telecommunication equipment installers and repairers, except line installers (SOC code 49-2022), or telecommunication line installers and repairers (SOC code 49-9052). Both occupations are reported under the installation, maintenance and repair occupations (SOC code 49-0000).

As of May 2015, 28,020 telecommunication equipment installers and repairers, and 12,090 telecommunication line installers and repairers (Figure 4.1.15-1) work in California (BLS, 2013a). In 2014, the most recent year data are available, California had 3.6 cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2013b). By comparison, there were 1.9 nonfatal occupational injury cases nationwide in both 2012 and 2013 per 100 full-time workers in the telecommunications industry (BLS, 2013b).

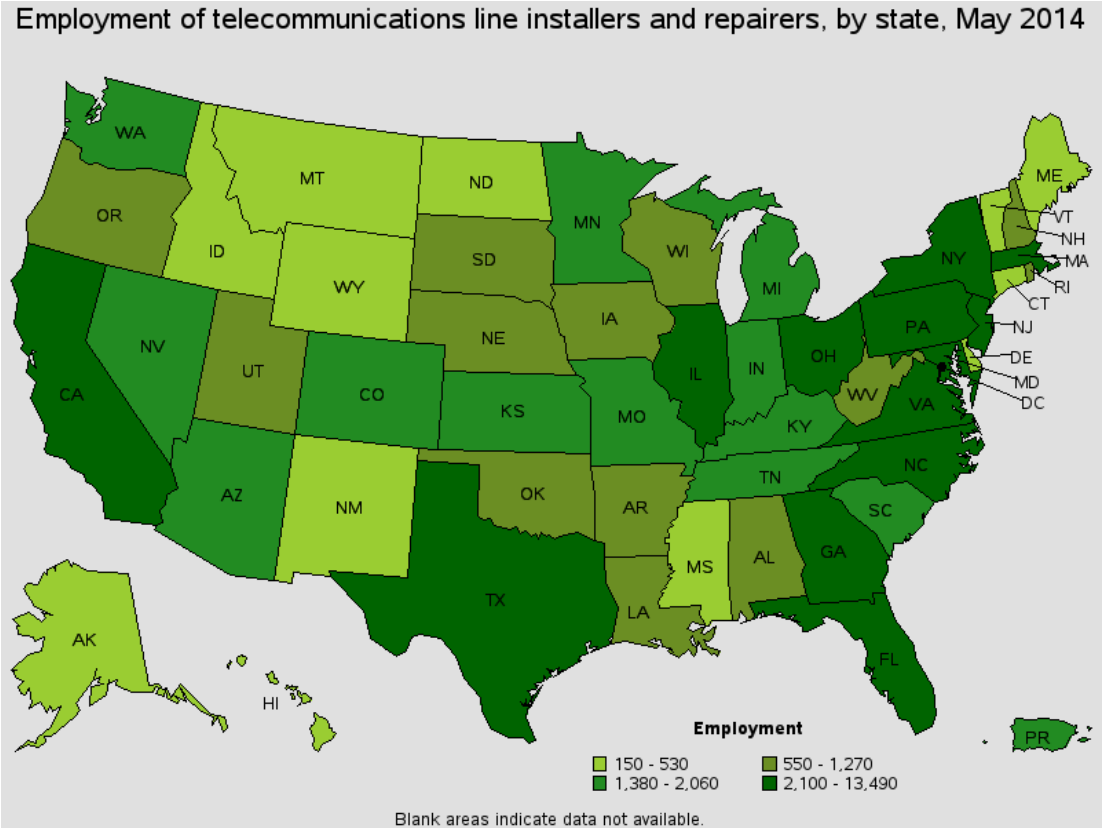


Figure 4.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015b)

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; 7 due to slips, trips, or falls; and 3 due to unknown causes), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2013c). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of occupational fatalities (4,585 total). California had four fatalities in 2005 and three fatalities in 2007 within the telecommunication line installers and repairers occupations (SOC code 49-9052). By comparison, within the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 377 fatalities in California between 2003 and 2014, with the highest fatality year being 2003 with 51 fatalities (BLS, 2015c).

Public Health and Safety

The general public is unlikely to encounter occupational hazards at telecommunication sites due to limited access. CADPH collects environmental and public health data through the California Environmental Health Tracking Program (CEHTP) (California Department of Public Health, 2015). The same data are reported with more specificity at the federal level through the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (WONDER). While the WONDER database cannot be searched for cases specific to telecommunication sites, many available injury categories are consistent with risks present at telecommunication sites. For example, in California, between 1999 and 2013, there were 772 fatalities due to a fall from, out of, or through a building or structure; 170 fatalities due to being caught, crushed, jammed or pinched in or between objects; and 100 fatalities due to exposure to electric transmission lines (Centers for Disease Control and Prevention, 2015). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

4.1.15.4 Environmental Setting: Contaminated Properties at or near Telecommunication Sites

Existing and surrounding land uses, including landfills or redeveloped brownfields, near telecommunication sites have the potential to impact human health and safety. Furthermore, undocumented environmental practices of telecommunication site occupants, including practices before current environmental laws, could result in environmental contamination, affecting the quality of soil, sediments, groundwater, surface water, and air.

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[200] or listed on the National Priorities List (NPL), as well as the Resource Conservation and Recovery Act (RCRA) Corrective Action sites and Brownfields. These regulated cleanup sites are known to contain environmental contaminants at concentrations exceeding acceptable human health exposure thresholds. Contact with high concentrations of contaminated media can result in adverse health effects, such as dermatitis, pulmonary and cardiovascular events, organ disease, central nervous system disruption, birth defects, and cancer. It generally requires extended periods of exposure over a lifetime for the most severe health effects to occur.

The CADTSC administers the California Superfund Program, and uses state funds to clean up hazardous substance releases (California Department of Toxic Substances Control, 2015a). As of December 2015, California had 221 RCRA Corrective Action sites,[201] 1,597 brownfield sites, and 98 proposed or final Superfund/NPL sites (USEPA, 2015o). Based on a December 2015 search of USEPA's Cleanups in My Community (CIMC) database, there are eight Superfund

[200] The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted in 1980, commonly referred to as the Superfund Program, governs abandoned hazardous waste sites, and collects a tax on chemical and petroleum industries. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986; see Appendix C, Environmental Laws and Regulations (USEPA, 2011b).

[201] Data gathered using USEPA's CIMC search on December 10, 2015, for all sites in California, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (USEPA, 2013d).

sites (BLM-Klau Mine near Paso Robles, CA; Lava Cap Mine near Nevada City, CA; McCormick & Baxter Creosoting in Stockton, CA; Montrose Chemical in Torrance, CA; Omega Chemical in Whittier, CA; Fort Ord Military Community near Monterey, CA; Sulphur Bank Mercury Mine in Clearlake Oaks, CA; and United Heckathorn in Richmond, CA) (USEPA, 2015p) and one RCRA Corrective Action site (Mineral King Minerals in Hanford, CA) (USEPA, 2015q) in California where contamination has been detected at an unsafe level, or a reasonable human exposure risk still exists.

Brownfield sites in California may be enrolled in a variety of programs managed by the CADTSC, including the Brownfield Voluntary Program (California Department of Toxic Substances Control, 2015b). One example of a brownfield site is the Rumrill Sports Park in San Pablo, CA, used as a railroad maintenance yard until the 1980s. By 1988, the yard had become a community eyesore with drums of waste and debris piles throughout the site. The City of San Pablo purchased the site and entered into a voluntary cleanup agreement with CADTSC, capping contaminated soils to protect public health, and redeveloping the site into a park. (California Department of Toxic Substances Control, 2015c).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. As of December 2015, California had 1, 280 TRI reporting facilities. The identification of a TRI facility does not necessarily indicate that the facility is actively releasing to the environment; the majority of TRI reports involve permitted disposal facilities. According to the USEPA, in 2014, the most recent data available, California released 27.7 million pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from hazardous waste/solvent recovery and metal mining industries. This accounted for 0.69 percent of nationwide TRI releases, ranking California 48th of 56 U.S. states and territories based on total releases per square mile. (USEPA, 2015r)

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment. As of November 12, 2015, California had 271 permitted major discharge facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015s).

California's Office of Environmental Health Hazard Assessment (OEHHA) administers the Safe Drinking Water and Toxic Enforcement Act of 1986, commonly known as Proposition 65. This act requires businesses to notify the public about hazardous chemicals in their products, and prohibits businesses from discharging significant amounts of these chemicals into drinking water sources. California publishes a list of approximately 800 chemicals known to cause cancer, birth defects, or reproductive harm. (California Office of Health Hazard Assessment, 2013)

The National Institutes of Health, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's

TRI and Superfund Program" (NIH, 2015). Figure 4.1.15-2 provides an overview of potentially hazardous sites in California.

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over water bodies. Indoor air quality may also be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. As of December 2015, there are 307 USEPA-regulated telecommunications sites in California (USEPA, 2015t). These sites are regulated under one or more environmental programs including NPDES compliance, Superfund/NPL status, and TRI releases.

According to BLS data, California has had 56 occupational fatalities since 2003, within the installation, maintenance, and repair occupations (SOC code 49-0000) from exposure to "harmful substances or environments," although these were not specific to telecommunications (BLS, 2015c). By comparison, the BLS reported three fatalities in 2011 and three fatalities[202] in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (BLS, 2015e). In 2014, BLS also reported four fatalities within the telecommunications line installers and repairers occupation (SOC code 49-9052), and no fatalities within the telecommunications equipment installers and repairers occupation (SOC code 49-2022) due to exposure to harmful substances or environments (BLS, 2014).

Public Health and Safety

As described earlier, access to telecommunications sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunications sites present an inherent low risk to non-occupational workers, the general public could be potentially exposed to contaminants and other hazards in a variety of ways. One example would be if occupational workers disturb contaminated soil while digging, causing hazardous chemicals to mix with an underlying groundwater drinking water sources. If a contaminant enters a drinking water source, the surrounding community could inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors.

[202] BLS Census of Fatal Occupational Injuries data for 2014 is for preliminary reporting only. Final data is expected to be released in spring 2016 (BLS, 2015e).

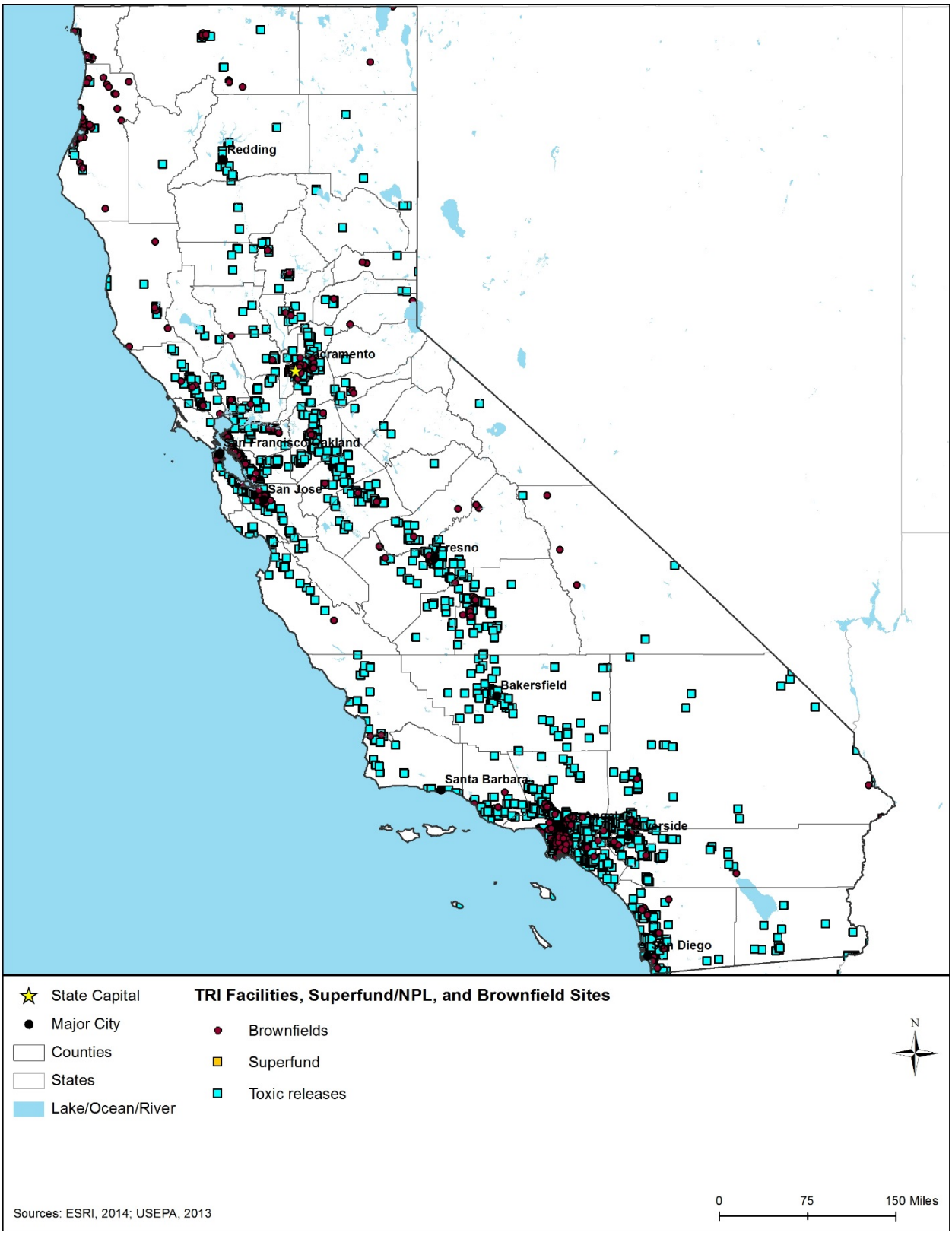


Figure 4.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in California (2013)

Spotlight on California Superfund Sites: Lava Cap Mine Site

The Lava Cap Mine site is a 33-acre mining area in a residential area near Nevada City, CA (Nevada County). Gold and silver mining at the site began around 1861 and continued until 1943, when the plant was closed due to World War II. While in operation, processing plants produced and deposited slurries into an onsite ravine, contained by a log dam. The log dam failed during a winter storm in 1979, releasing more than 10,000 cubic yards of tailings into Little Clipper Creek and Lost Lake. The California Department of Fish and Game and the Nevada County Department of Environmental Health inspected the site and found arsenic-containing tailings deposits in the waterbodies and adjacent wetlands. (USEPA, 2015h)

The Agency for Toxic Substances and Disease Registry classified the site as a Public Health Hazard after determining that exposure risk to arsenic exists through surface water contact, fish consumption, contaminated well water, and inhalation or ingestion of dust and dirt from the mine site (ATSDR 2001) To decrease exposure to arsenic, USEPA constructed a 1.5-mile municipal water distribution line to connect residences impacted by contaminated groundwater (USEPA, 2012f). In 2006, USEPA also excavated, consolidated, and capped contaminated soils and tailings from the mine area, and installed a stone buttress to prevent surface water infiltration (USEPA, 2015h).

Figure 5.1.15-3 Mine Tailing Deposits from the Lava Cap Mine, Nevada County, CA

Source: (California Department of Toxic Substances Control 2010)

4.1.15.5 Environmental Setting: Abandoned Mine Lands at or near Telecommunications Sites

Another health and safety hazard in California includes surface and subterranean mines. In 2014, the California mining industry ranked 6th for non-fuel minerals (primarily boron minerals, portland cement, sand and gravel, crushed stone, and gold), generating a value of $3.30B (USGS, 2016a). Health and safety hazards at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack

of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (USGS, 2016a).

The California Department of Conservation, Abandoned Mined Lands Unit (CAAMLU) is responsible for managing health and safety hazards at AML sites in California (California Department of Conservation, 2015b). The CAAMLU estimates there are approximately 47,000 AMLs in California, with about 2,400 (5 percent) inventoried by state and federal agencies. Identified AMLs in California are assigned a preliminary appraisal and ranking (PAR) score from 1 to 5, with PAR 5 and 4 AMLs representing sites with the greatest public health and safety hazards. Additionally, identified AMLs are assigned a priority score from 1 to 3 (with Priority 1 being the highest priority) based on remediation costs and the number of PAR 5 or 4 mines and features in the area. As of March 2007, California had 59 Priority 1 AMLs (primarily multiple PAR 5 or 4 mines), 107 Priority 2 AMLs (primarily PAR 5 mines), and 200 Priority 3 AMLs (primarily PAR 4 mines). Figure 4.1.15-3 shows the distribution of potential, inventoried, and remediated AML features in California (California Department of Conservation, Office of Mine Reclamation, 2007).

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near AMLs or mine fires, presenting occupational exposure risks from fire, toxic gases, and subsidence during FirstNet deployment, operation, and maintenance activities. Because the locations of many abandoned mines are unknown or hidden, these mines pose a risk to telecommunications workers because they may be encountered during deployment and maintenance operations.

Public Health and Safety

Subterranean mines present additional health and safety risks to the general public, by generating toxic combustible gases, which can penetrate the surface through ground fractures, potentially seeping into residential structures. Additionally, mine fires can consume enough sub-surface material, that risk of subsidence increases. As a result, AMLs and mine fires in particular, can result in evacuations of entire communities (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2015). The CAAMLU reports that over three dozen incidents involving the public and AMLs have occurred in California since 1990. Therefore, California promotes a “Stay Out - Stay Alive!” program to warn the public about the dangers of abandoned mines (California Department of Conservation, 2010).

Figure 4.1.15-3: Inventoried Abandoned Mine Land Features in California (2012)

Source: (California Department of Conservation, 2012b)

4.1.15.6 Environmental Setting: Natural and Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the public. Telecommunications, including public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Hazardous chemicals and sanitary wastes often contaminate floodwaters, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003). Another natural disaster common in California is earthquakes. Since 1811, California has recorded 3,487 earthquake-related fatalities, out of the 4,020 nationwide fatalities (87 percent) (USGS, 2015f). Health and safety risks from earthquakes include injuries and fatalities from building collapse, shattered glass, falling objects, or severed and exposed utility lines. Additionally, seismic activity in earthquakes often triggers other natural disasters, such as landslides, avalanches, flash flooding, fires, and tsunamis.

Physical hazards may also be present at disaster sites, such as downed utility lines, debris blockage or road washout conditions, which increases exposure risks to telecommunication workers. Climbing and working from tower structures damaged by wind increases the risk of slips, trips, or falls. During natural and manmade disasters, access to the telecommunication sites can be obstructed by debris.

Telecommunication Worker Occupational Health and Safety

Telecommunication workers are often called upon to provide support to natural and manmade disaster response efforts because of the critical need to restore and maintain telecommunication capabilities. The need to enter disaster areas as part of the recovery effort exposes telecommunication workers to elevated risks because chemical, biological, and physical hazards might not have not been fully identified or assessed. Transportation infrastructure and utilities in the affected areas are often compromised and present unknown chemical and biologic hazards. Correspondingly, if telecommunication workers are injured during response and repair operations, their rescue and treatment might over-extend first responder staff and medical facilities that are delivering care to victims of the initial incident.

Currently, CADPH and BLS do not report data specific to injuries or fatalities among telecommunication workers responding to natural or manmade disasters. However, the National Response Center (NRC), managed by the U.S. Coast Guard, compiles reports for oil spills, chemical releases, or other maritime security incidents and contains incident reports related to occupational health and safety. Of the 1,155 NRC-reported incidents for California in 2015 with known causes, only 18 were attributed to natural disaster (natural phenomenon), while the majority (1,137) were attributed to manmade disasters (including equipment failure and operator error). For example, in Sacramento, CA, on February 27, 2015, a contractor struck a natural gas pipeline while installing a new service port in a manhole, releasing an unknown amount of

natural gas. The incident forced a shutdown of the pipeline and road closures near the site to protect public safety (U.S. Coast Guard, 2015). Such incidents present unique, hazardous challenges to telecommunication workers responding during natural or manmade disasters.

Spotlight on California Natural Disaster Sites: 2013 Rim Fire

In August 2013, the 3rd largest wildfire in California history started in Stanislaus National Forest and Yosemite National Park, and eventually burned 257,000 acres (California Sierra Nevada Conservancy 2015a). Water and power utilities in the path of the fire were forced to shut down. The fire degraded air quality as far away as Reno, NV (100 miles from the source). The loss of vegetation increased soil erosion risk across the landscape. Fire suppression costs exceeded $127M, and $8.5M was needed for road and watershed stabilization and repairs (California Sierra Nevada Conservancy 2015b).

Destroyed communications infrastructure affected 2.6 million customers, requiring mobile telecommunications equipment deployment during and after the fire. However, the fire quickly destroyed much of the mobile equipment, while smoke from the fire (Figure 6.1.15-5) and dense forest cover blocked signals, creating challenges for first responder communication. (First Responder Network Authority 2015)

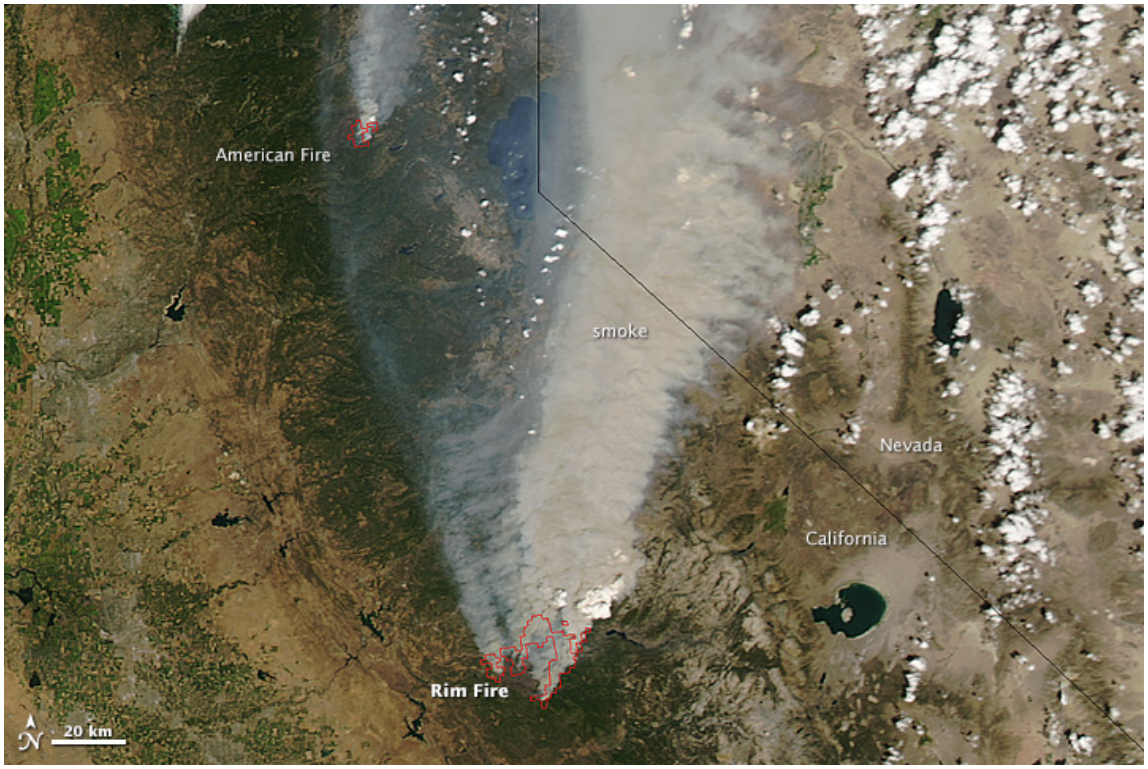


Figure 6.1.15-5 Satellite Image of Rim Fire taken August 22, 2013, Depicting Smoke Coverage near Yosemite National Park (red outlines indicate hot spots)

Source: (NASA 2013)

Public Health and Safety

Hazards present during natural and manmade disasters are often far-reaching, affecting large geographic areas and affecting all populations living within the area. Similar to telecommunication workers, the general public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities, potential for exposure to unknown chemical and biologic hazards, and inadequate medical support. In 2014, California had 20 weather-related fatalities (4 due to wind, 2 due to heat, 1 due to flooding, 1 due to lightning, and 12 due to unspecified causes) and 132 non-fatal injuries. By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year. (Antelope Valley AQMD, 2005)

4.2 ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental impacts, beneficial or adverse, resulting from the Proposed Action and Alternatives. As this is a programmatic evaluation, site- and project-specific issues are not assessed. The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews.

At the programmatic level, the categories of impacts have been defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Each resource area identifies the range of possible impacts on resources for the Proposed Action and Alternatives, include the No Action Alternative. The No Action provides a comparison to describe the effects of environmental resources of the existing conditions to the proposed Alternatives.

NEPA requires agencies to assess the potential direct and indirect impacts each Alternative could have on the existing environment (as characterized earlier in this section). Direct impacts are those impacts that are caused by the Proposed Action and occur at the same time and place, such as soil disturbance. Indirect impacts are those impacts related to the Proposed Action but result from an intermediate step or process, such as changes in surface water quality because of soil erosion.

For each resource, the potential impact is assessed in terms of context of the action and the intensity of the potential impact, per CEQ regulations (40 CFR §1508.27). *Context* refers to the timing, duration, and where the impact could potentially occur (i.e., local vs. national; pristine vs. disturbed; common species vs. protected species). In terms of duration of potential impact, context is described as short or long term. *Intensity* refers to the magnitude or severity of the effect as either beneficial or adverse. Resource-specific significance rating criteria are provided at the beginning of each resource area section.

4.2.1 Infrastructure

4.2.1.1 Introduction

This section describes potential impacts to infrastructure in California associated with construction, deployment, and operation of the Proposed Action and Alternatives. Chapter 9, Best Management Practices and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.1.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 4.1.2-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type,

including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to infrastructure addressed in this section are presented as a range of possible impacts.

Table 4.2.1-1: Impact Significance Rating Criteria for Infrastructure

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Transportation system capacity and safety	Magnitude or Intensity	Creation of substantial traffic congestion/delay and/or a substantial increase in transportation incidents (e.g., crashes, derailments).	Effect that is potentially significant, but with mitigation is less than significant.	Minimal change in traffic congestion/delay and/or transportation incidents (e.g., crashes, derailments).	No effect on traffic congestion or delay, or transportation incidents.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Persisting indefinitely.		Short-term effects will be noticeable for up to the entire construction phase or a portion of the operational phase.	NA
Capacity of local health, public safety, and emergency response services	Magnitude or Intensity	Impacted individuals or communities cannot access health care and/or emergency services, or access is delayed, due to the project activities.	Effect is potentially significant, but with mitigation is less than significant.	Minor delays to access to care and emergency services that do not impact health outcomes.	No impacts on access to care or emergency services.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Duration is constant during construction and deployment phase.		Rare event during construction and deployment phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Modifies existing public safety response, physical infrastructure, telecommunication practices, or level of service in a manner that directly affects public safety communication capabilities and response times	Magnitude or Intensity	Substantial adverse changes in public safety response times and the ability to communicate effectively with and between public safety entities.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal change in the ability to communicate with and between public safety entities.	No perceptible change in existing response times or the ability to communicate with and between public safety entities.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory.	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Permanent or perpetual change in emergency response times and level of service.		Change in communication and/or the level of service is perceptible but reasonable to maintaining effectiveness and quality of service.	NA
Effects to commercial telecommunication systems, communications, or level of service	Magnitude or Intensity	Substantial adverse changes in level service and communications capabilities.	Effect that is potentially significant, but with mitigation is less than significant.	Minor changes in level of service and communications while transitioning to the new system.	No perceptible effect to level of service or communications while transitioning to the new system.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory.	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Persistent, long-term, or permanent effects to communications and level of service.		Minimal effects to level of service or communications lasting no more than a short period (minutes to hours) during the construction and deployment phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to utilities, including electric power transmission facilities and water and sewer facilities	Magnitude or Intensity	Substantial disruptions in the delivery of electric power or to physical infrastructure that results in disruptions, including frequent power outages or drops in voltage in the electrical power supply system ("brownouts"). Disruption in water delivery or sewer capacity, or damage to or interference with physical plant facilities that impact delivery of water or sewer systems.	Effect that is potentially significant, but with mitigation is less than significant.	Minor disruptions to the delivery of electric power, water, and sewer services, or minor modifications to physical infrastructure that result in minor disruptions to delivery of power, water, and sewer services.	There would be no perceptible impacts to delivery of other utilities and no service disruptions.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory.	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Effects to other utilities would be seen throughout the entire construction phase.		Effects to other utilities would be of short duration (minutes to hours) and would occur sporadically during the entire construction phase.	NA

NA = Not Applicable

4.2.1.3 Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would primarily occur during the construction phases of deployment. Depending on the exact site locations and placement of new assets in the field, temporary impacts on traffic congestion, railway use, airport operations, or use of other transportation corridors could occur if site locations were near or adjacent to roadways and other transportation corridors, requiring temporary closures (lane closures on roadways, for example). Coordination would be necessary with the relevant transportation authority (i.e., departments of transportation, airport authorities, and railway companies) to ensure proper coordination during deployment. Based on the impact significance criteria presented in Table 4.2.1-1, such impacts would be less than significant due to the temporary nature of the deployment activities, even if impacts would be realized at one or more isolated locations. These impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

Capacity of Local Health, Public Safety, and Emergency Response Services

The capacity of local health, public safety, and emergency response services would experience less than significant impacts during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare, if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of local health, public safety, and emergency response services through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders to communicate during emergency response situations. Based on the impact significance criteria presented in Table 4.2.1-1, potential negative impacts would be less than significant. Substantial beneficial impacts are likely to result from implementation.

Modifies Existing Public Safety Response Telecommunication Practices, Physical Infrastructure, or Level of Service in a manner that directly affects Public Safety Communication Capabilities and Response Times

The Proposed Action and Alternatives contemplated by FirstNet would not cause negative impacts to existing public safety response telecommunication practices, physical infrastructure, or level of service in a manner that directly affects public safety communication capabilities and response times. Based on the impact significance criteria presented in Table 4.2.1-1, any potential impacts would be less than significant. As described above, during deployment and system optimization, existing services would likely remain operational in a redundant manner

ensuring continued operations and availability of services to the public. Once operational, state, and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to complement such practices and SOPs in a positive manner; therefore, only beneficial or complementary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience such beneficial impacts through enhanced communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus such infrastructure would also experience a positive and beneficial impact. Disposal or reuse of old public safety communications infrastructure would also likely need to be considered once the specifics are known. Any negative impacts would be expected to be less than significant given the short-term nature of deployment activities.

Effects to Commercial Telecommunication Systems, Communications, or Level of Service

Commercial assets would be using a different spectrum for communications; as such, commercial telecommunication systems, communications, or level of service would experience no impacts. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, such spectrum use may be over-built or under-utilized.[203] Anticipated impacts would be less than significant due to the limited extent and temporary nature of deployment.

Effects to Utilities, including Electric Power Transmission Facilities, and Water and Sewer Facilities

The activities proposed by FirstNet would have less than significant impacts on utilities, including electric power transmission facilities, and water and sewer facilities. Depending on the specific project contemplated, installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on a temporary or permanent basis. Also, depending on the specific project contemplated, the draw or use of power from the transmission facilities may need to be examined; however, it is not anticipated that such use of power would have negative impacts, due to the local nature of the proposed activities and the widespread availability and use of the power grid in the United States. The CPUC regulates electricity utilities and the CalEPA regulates water utilities and wastewater, while CalRecycle manages solid waste; coordination with these state agencies may be necessary depending on the project-specific implementation plans.

4.2.1.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment, and operation activities.

[203] Telecommunications equipment for specific spectrum use can be built where other equipment for other spectrum use already exists. If the new equipment and spectrum is not fully utilized, the geographic region may experience "over-build," where an abundance of under-utilized equipment may exist in that geographic location. This situation can be caused by a variety of factors including changes in current and future use patterns, changes in spectrum allocation, changes in laws and regulations, and other factors.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to infrastructure and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to infrastructure under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts on infrastructure resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would have no impacts to infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any impacts to infrastructure resources, given that construction activities would occur on existing structures, would not be expected to interfere with existing equipment, and transportation capacity and safety, and access to emergency services would not be impacted.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to infrastructure as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of direct

interface with existing infrastructure, most notably existing telecommunication infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to infrastructure include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs),[204] huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase; however, it is anticipated that this tie-in would cause less than significant impacts as the activity would be temporary and minor. New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new, or replacement of existing, telecommunications poles.
  - Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact, other than harbor operations. However, impacts to infrastructure resources could potentially occur as result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept submarine cable, depending on the exact site location and proximity to existing infrastructure.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment such as small boxes or huts, or access roads, could potentially impact infrastructure. Impacts could include disruption of service in transportation corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current utility services during installation or interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. In addition, installation activities would have beneficial impacts due to expansion of infrastructure at a local level. Such activities could enhance public safety infrastructure, and other telecommunications as the site could potentially be available for subsequent collocation.

[204] Points of Presence are connections or access points between two different networks, or different components of one network.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units are needed, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
- Deployable Technologies: Deployable technologies such as COWs, COLTs, and SOWs are composed of cellular base stations, sometimes with expandable antenna masts, and generators that connect to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however, this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road ROWs and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation congestion and delays. Implementation of deployable technologies could result in potential impacts to infrastructure resources in terms of infrastructure expansion, if deployment requires paving of previously unpaved surfaces or other new infrastructure build to accommodate the deployable technology. In addition, beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Where deployable technologies would be implemented on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, or where aerial deployable technologies may be utilized but launched from existing paved surfaces, it is anticipated that there would be no impacts to infrastructure resources because there would be no disturbance of the natural or built environment.

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. These impacts are expected to be less than significant as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the on-going phase of deployment, and minor. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Positive impacts to infrastructure resources may result from the expansion of public safety and commercial telecommunications capacity and an improvement in public safety telecommunications coverage, system resiliency, response times, and system redundancy.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts on infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if further construction related activities are required along public road and utility ROWs, increased traffic congestion, current telecommunication system interruption, and utility interruptions could occur. These potential impacts would be expected to be minor and temporary as explained above.

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would likely result in substantial improvements in level of service and communications capabilities. Operation of the NPSBN is intended to involve high-speed data capabilities, location information, images, and eventually streaming video, which would likely significantly improve communications and the ability of the public safety community to effectively engage and respond. The NPSBN is also intended to have a higher level of redundancy and resiliency than current commercial networks to support the public safety community effectively, even in events of extreme demand. This improvement in the level of resiliency and redundancy is intended to increase the reliability of systems, communications, and level of service, and also minimize disruptions and misinformation resulting from limited or disrupted service. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.1.5 Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[205]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the

[205] As mentioned above and in Section 2.1.2 Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure build to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try and avoid any negative impacts to such resources. Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts on infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access road or utility ROW, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts would likely still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated deployment or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on infrastructure as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

4.2.2 Soils

4.2.2.1 Introduction

This section describes potential impacts to soil resources in California associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.2.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 4.2.2-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to soil resources addressed in this section are presented as a range of possible impact.

Table 4.2.2-1: Impact Significance Rating Criteria for Soils

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Soil erosion	Magnitude or Intensity	Severe, widespread, and observable erosion in comparison to baseline, high likelihood of encountering erosion-prone soils.	Effect that is potentially significant, but with mitigation is less than significant.	Perceptible erosion in comparison to baseline conditions; low likelihood of encountering erosion-prone soil types.	No perceptible change in baseline conditions.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	Chronic or long-term erosion not likely to be reversed over several years.		Isolated, temporary, or short-term erosion that that is reversed over few months or less.	NA
Topsoil mixing	Magnitude or Intensity	Clear and widespread mixing of the topsoil and subsoil layers.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal mixing of the topsoil and subsoil layers has occurred.	No perceptible evidence that the topsoil and subsoil layers have been mixed.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	NA		NA	NA
Soil compaction and rutting	Magnitude or Intensity	Severe and widespread, observable compaction and rutting in comparison to baseline.	Effect that is potentially significant, but with mitigation is less than significant.	Perceptible compaction and rutting in comparison to baseline conditions.	No perceptible change in baseline conditions.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	Chronic or long-term compaction and rutting not likely to be reversed over several years.		Isolated, temporary, or short term compaction and rutting that is reversed over a few months or less.	No perceptible change in baseline conditions.

NA = Not Applicable

4.2.2.3 Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern for nearly every construction activity that involves ground disturbance. Construction erosion typically only occurs in a small area of land with the actual removal of vegetative cover from construction equipment or by wind and water erosion. Of concern in California and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment could impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Areas exist in California that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Albolls, Aqualfs, Aquands, Aquents, Aquepts, Aquerts, Aquolls, Argids, Calcids, Cambids, Cryands, Cryepts, Cryolls, Durids, Fluvents, Humults, Orthents, Psamments, Salids, Saprists, Udalfs, Udepts, Udolls, Ustalfs, Usterts, Ustolls, Xeralfs, Xerands, Xerepts, Xererts, Xerolls, and Xerults (see Section 4.1.2.4, Soil Suborders and Figure 4.1.2-2).

Based on the impact significance criteria presented in Table 4.2.2-1, building of some of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. For the majority of projects, impacts to soils would be expected to be less than significant given the short-term and temporary duration of the activities. To the extent practicable, FirstNet would attempt to minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures where practicable and feasible, to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 9).

Topsoil Mixing

The loss of topsoil (i.e., organic and mineral topsoil layers) by mixing is a potential impact at all ground disturbing construction sites, including actions requiring clearing, excavation, grading, trenching, backfilling, or site restoration/remediation work.

Based on impact significance criteria presented in Table 4.2.2-1, and due to the relatively small-scale (less than 1 acre) of most FirstNet project sites, impacts would be less than significant.

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 4.1.2.4, Soil Suborders). The most compaction susceptible soils in California are hydric soils with poor drainage conditions, which include Albolls, Aquands, Aquents, Aquepts, Aquerts, Aquolls, Argids, Durids, Fluvents, Saprists, and Xeralfs. These suborders constitute approximately 32.1

percent of California's land area,[206] and are found mostly in the southwestern and northeastern portions of the state (see Figure 4.1.2-2). The potential for compaction or rutting impact would be generally low at FirstNet network deployment sites where other soil types predominate.

Based on impact significance criteria presented in Table 4.2.2-1, the risk of soil compaction and rutting resulting from FirstNet deployment activities would be less than significant due to the limited geographic extent of susceptible soils in each county or region where potential FirstNet activities could occur in the state.

4.2.2.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to soil resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to soil resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand-holes, pulling vaults, junction boxes, huts, and point of presence structures and would not impact soil resources because it would not produce perceptible changes to soil resources.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no impacts to soil resources. If physical access is required to light dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite

[206] This percentage was calculated by dividing the acres of soils that fall within the suborders listed above by the total soil land cover for the state.

phones, and video cameras, or adding equipment to satellites launched for other purposes, would not impact soil resources because those activities would not require ground disturbance.

Activities with the Potential to Have Impacts

Implementation of the Preferred Alternatives could include potential deployment-related impacts to soil resources resulting from ground disturbance activities, including soil erosion, topsoil mixing, and soil compaction and rutting. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to soil resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in limited nearshore and inland bodies of water could potentially impact soil resources at and near the landings or facilities on shores or the banks of waterbodies that accept submarine cable. Soil erosion and topsoil mixing could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Perceptible soil compaction and rutting could potentially occur due to heavy equipment use during these activities depending on the duration of the construction activity.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of optical transmission equipment or centralized transmission equipment, including associated new utility poles, hand holes, pulling vault, junction box, hut, and POP structure installation, would require ground disturbance that could potentially impact soil resources. Potential impacts to soils resulting from soil erosion, topsoil mixing, soil compaction, and rutting are anticipated to be small-scale and short-term.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, and COLTs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts on soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads, and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility ROW for deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts on soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, soil compaction and rutting impacts could result as explained above. The impacts are expected to be less than significant due to the temporary nature and small scale of operations activities with the potential to create impacts. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.2.5 Alternatives Impact Assessment

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to soil resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to soil resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas. However, these potential impacts are expected to be less than significant due to the small scale and short term nature of the deployment. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and

mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts on soil resources associated with routine inspections of deployable assets, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, less than significant soil compaction and rutting impacts could result as previously explained above. Finally, if deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in minimal soil erosion. However, it is anticipated that the potential soil erosion would result in less than significant impacts as described above. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on soil resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.2, Soils.

4.2.3 Geology

4.2.3.1 Introduction

This section describes potential impacts to California geology resources associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.3.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 4.2.3-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to geology addressed in this section are presented as a range of possible impacts.

Table 4.2.3-1: Impact Significance Rating Criteria for Geology

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Seismic Hazard	Magnitude or Intensity	High likelihood that a project activity could be located within a high-risk earthquake hazard zone or active fault.	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located within an earthquake hazard zone or active fault.	No likelihood of a project activity being located in an earthquake hazard zone or active fault.
	Geographic Extent	Hazard zones or active faults are highly prevalent within the state/territory.		Earthquake hazard zones or active faults occur within the state/territory, but may be avoidable.	Earthquake hazard zones or active faults do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Volcanic Activity	Magnitude or Intensity	High likelihood that a project activity could be located near a volcano lava or mud flow area of influence.	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located near a volcanic ash area of influence.	No likelihood of a project activity located within a volcano hazard zone.
	Geographic Extent	Volcano lava flow areas of influence are highly prevalent within the state/territory.		Volcano ash areas of influence occur within the state/territory, but may be avoidable.	Volcano hazard zones do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Landslide	Magnitude or Intensity	High likelihood that a project activity could be located within a landslide area.	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located within a landslide area.	No likelihood of a project activity located within a landslide hazard area.
	Geographic Extent	Landslide areas are highly prevalent within the state/territory.		Landslide areas occur within the state/territory, but may be avoidable.	Landslide hazard areas do not occur within the state/territory.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	NA		NA	NA
Land Subsidence	Magnitude or Intensity	High likelihood that a project activity could be located within an area with a hazard for subsidence (e.g., karst terrain).	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located within an area with a hazard for subsidence.	Project activity located outside an area with a hazard for subsidence.
	Geographic Extent	Areas with a high hazard for subsidence (e.g., karst terrain) are highly prevalent within the state/territory.		Areas with a high hazard for subsidence occur within the state/territory, but may be avoidable.	Areas with a high hazard for subsidence do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Potential Mineral and Fossil Fuel Resource Impacts	Magnitude or Intensity	Severe, widespread, observable impacts to mineral and/or fossil fuel resources.	Effect that is potentially significant, but with mitigation is less than significant.	Limited impacts to mineral and/or fossil resources.	No perceptible change in mineral and/or fossil fuel resources.
	Geographic Extent	Regions of mineral or fossil fuel extraction areas are highly prevalent within the state/territory.		Mineral or fossil fuel extraction areas occur within the state/territory, but may be avoidable.	Mineral or fossil fuel extraction areas do not occur within the state/territory.
	Duration or Frequency	Long-term or permanent degradation or depletion of mineral and fossil fuel resources.		Temporary degradation or depletion of mineral and fossil fuel resources.	NA
Potential Paleontological Resources Impacts	Magnitude or Intensity	Severe, widespread, observable impacts to paleontological resources.	Effect that is potentially significant, but with mitigation is less than significant.	Limited impacts to paleontological and/or fossil resources.	No perceptible change in paleontological resources.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory.		Areas with known paleontological resources occur within the state/territory, but may be avoidable.	Areas with known paleontological resources do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Surface Geology, Bedrock, Topography, Physiography, and Geomorphology	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes.	Effect that is potentially significant, but with mitigation is less than significant.	Minor degradation or alteration of surface geology, bedrock, topography that do not result in measurable changes in physiographic characteristics or geomorphological processes.	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes.
	Geographic Extent	State/territory.		State/territory.	NA
	Duration or Frequency	Permanent or long-term changes to characteristics and processes.		Temporary degradation or alteration of resources that is limited to the construction and deployment phase.	NA

NA = Not Applicable

4.2.3.3 Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, landslides, and volcanic activity, and those that would be impacts from the project, such as land subsidence and effects on mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Volcanic Activity

A concern related to deployment would be placement of equipment in areas that are highly susceptible to volcanic activity. Equipment that is exposed to volcanic activity is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss.

As discussed in Section 4.1.3.8, California is at risk to volcanic eruptions. California's 8 volcanoes have erupted 10 times within the last 1,000 years. Based on the impact significance criteria presented in Table 4.2.3-1, volcanic impacts from deployment or operation of the Proposed Action would have no impact on volcanic activity; and volcanic impacts to the Proposed Action would be less than significant if FirstNet's deployment locations were within an area with low likelihood of exposure to volcanic eruptions and/or ash. Given the potential for volcanic eruptions in or near California, some amount of infrastructure could be subject to volcanic hazards. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Seismic Hazard

Similar to volcanic hazards, a concern related to deployment is placement of equipment in highly active seismic zones. Equipment that is exposed to earthquake activity is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. As discussed in Section 4.1.3.8, California is at risk to severe earthquake events. As shown in Figure 4.1.3-4, western California is more susceptible to earthquakes than the remainder of the state. Earthquakes between magnitude 7.0 and 7.9 on the Richter scale occur in California on average once every 10 years. Based on the impact significance criteria presented in Table 4.2.3-1, seismic impacts from deployment or operation of the Proposed Action would have no impact on seismic activity; however, seismic impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within high-risk earthquake hazard zones or active fault zones. Given the potential for severe earthquakes in or near California, some amount of infrastructure could be subject to earthquake hazards. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Landslides

Similar to seismic and volcanic hazards, another concern would be placement of equipment in areas that are highly susceptible to landslides. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss.

As discussed in Section 4.1.3.8, portions of California, particularly in the western portions of the state, are at moderate to high risk of experiencing landslide events. Based on the significance criteria presented in Table 4.2.3-1, potential impacts to landslides from deployment or operation of the Proposed Action would have less than significant impacts as it is likely that the project would attempt to avoid areas that are prone to landslides; however, landslide impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. There is high potential for landslides in or near the cities of San Francisco, Oakland, and San Jose as well as other areas throughout the state. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that several of California's major cities are in or near areas that experience landslides with moderate to high frequency, some amount of infrastructure could be subject to landslide hazards. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Land Subsidence

Equipment that is exposed to land subsidence, such as sinkholes created by karst topography, is subject to misalignment, alteration, or, in extreme cases, destruction. All of these activities could result in connectivity loss.

As discussed in Section 4.1.3.8 and shown in Figure 4.1.3-6, although portions of California are underlain by karst topography, the threat of land subsidence in California is not considered to be a major threat. Land subsidence is not included as a geologic hazard on the state's geologic hazard page (California Department of Conservation, 2015c) nor is it included in the state's Hazard Mitigation Plan (California Governor's Office of Emergency Management, 2013)Cal. Figure 4.1.3-6 shows the location of areas in California that are underlain by karst topography.

Based on the significance criteria presented in Table 4.2.3-1, potential impacts to soil subsidence from deployment or operation of the Proposed Action would have less than significant impacts. However, subsidence impacts could be potentially significant if FirstNet's deployment locations were within areas at high risk of aquifer compaction or karst topography. To the extent practicable, FirstNet would avoid deployment in known areas of subsidence. However, where infrastructure is subject to subsidence hazards, BMPs and mitigation measures could help avoid or minimize the potential impacts. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Mineral and Fossil Fuel Resource Impacts

As discussed in Section 4.1.3.7 and shown in Figure 4.1.3-4, portions of California contain mineral resources. Equipment deployment near mineral and fossil fuel resources would have less than significant effects on these resources as new construction could temporarily limit access to extraction of these resources. Based on the impact significance criteria presented in Table 4.2.3-1, impacts to mineral and fossil fuel resources is unlikely as the Proposed Action could only be potentially significant if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. To the extent practicable, FirstNet would avoid construction in areas where these resources exist. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Paleontological Resource Impacts

Equipment installation and construction activities that require ground disturbance could damage existing paleontological resources, which are both fragile and irreplaceable. Based on the impact significance criteria presented in Table 4.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations were to cause impacts to paleontological resources. As discussed in Section 4.1.3.6, fossils are abundant throughout parts of California. It is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized. Potential impacts to paleontological resources should be considered on a site-by-site basis, and BMPs and mitigation measures could further help avoid or minimize the potential impacts. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that degrade or alter surface geology, bedrock, or topography could cause measurable changes in physiographic characteristics of an area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 4.2.3 1, impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and less than significant as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures could be implemented to help avoid or minimize the potential impacts. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

Implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities have the potential to be impacted by geologic hazards, some activities could result in potential impacts to geology, and other activities would have no impacts. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to geology under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. In most cases, there would be no impacts on geologic resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact geologic resources, it is anticipated that this activity would have no impact on geologic resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral and fuel resources and paleontological resources. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water is not expected to impact geologic resources including marine paleontological resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or disturbance of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could

occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.

- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, and COLTs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts on/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. However, where equipment is permanently installed in locations that are susceptible to landslides, earthquakes, volcanoes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact to the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could result in incidental removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet projects are likely to be small-scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small-scale as a result, these potential impacts are expected to be less than significant. For the same reason, impacts to deployment from geologic hazards are likely to be less than significant as well. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts on geology associated with routine inspections of the Preferred Alternative,

assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance.

The operation of the Preferred Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant as it is anticipated that deployment locations would avoid, as practicable and feasible, locations that are more likely to be affected by potential seismic activity, landslides, or land subsidence. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.3.4 Alternatives Impact Assessment

The following section assesses potential impacts to geology associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to geology as a result of implementation of this alternative could be as described below.

Deployment Impacts

Implementation of deployable technologies on existing paved surfaces would not result in impacts to geologic resources (or from geologic hazards) as there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, and COLTs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be less than significant due to the minor amount of paving or new infrastructure needed to accommodate the deployables. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts on geologic resources (or from geologic hazards) associated with routine inspections of the Preferred Alternative because there would be no ground disturbance.

The operation of the Deployable Technologies Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant as the deployment would be temporary and likely would attempt to avoid locations that was subject to increased seismic activity, landslides, and land subsidence. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts on geologic resources (or from geologic hazards) as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.3, Geology.

4.2.4 Water Resources

4.2.4.1 Introduction

This section describes potential impacts to water resources in California associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.4.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 4.2.4-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to water resources addressed in this section are presented as a range of possible impacts.

Table 4.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, SDWA.	Effect that is potentially significant, but with mitigation is less than significant.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than six months.	NA
Floodplain degradation[a]	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is potentially significant, but with mitigation is less than significant.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than one season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, lasting no more than six months.	NA
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge.	Effect that is potentially significant, but with mitigation is less than significant.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody (stream height).
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts.	Activities do not impact groundwater or aquifers.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA

[a] Since public safety infrastructure is considered a critical facility, project activities should avoid the 500-year floodplain wherever practicable, per the Executive Orders on Floodplain Management (EO 11988 and EO 13690). (See http://www.archives.gov/federal-register/codification/executive-order/11988.html and https://www.federalregister.gov/articles/2015/02/04/2015-02379/establishing-a-federal-flood-risk-management-standard-and-a-process-for-further-soliciting-and).

NA = Not Applicable

4.2.4.3 Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the CWA requires states to assess and report on the quality of waters in their state. Section 303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

Generally, the state's waterbodies are in poor condition, with most surface waterbodies being impaired (see Table 4.1.4-2, Figure 4.1.4-3). California's rivers and streams and lakes and reservoirs are almost 100 percent impaired, mostly due to excessive nutrients, leading to low dissolved oxygen, and metals other than mercury. The main causes for these impairments are nonpoint source pollution[207] from agriculture and residential land use, and streambank erosion. California's estuaries and bays and coastal waters are also impaired; for pathogens, fecal coliform, and pesticides. The main sources of these impairments are nonpoint and point source pollution from urban areas and overruns from storm sewer systems. Pesticides, such as dichlorodiphenyltrichloroethane (DDT) and dieldrin and polychlorinated biphenyls (PCBs) are likely from historic industry uses and improper waste disposal. (USEPA, 2012b) Generally, the water quality of California's aquifers is suitable for drinking and daily water needs (CDWR, 2013a).

Deployment activities could contribute pollutants in a number of ways but the primary likely manner is increased sediment in surface waters. Vegetation removal on site exposes soils to rain and wind that could increase erosion. Impacts to water quality may occur from post construction vegetation management, such as herbicides, that may leach into groundwater or move to surface waters through soil erosion or runoff, spray drift, or inadvertent direct overspray. Fuel, oil, and other lubricants from equipment could contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, pH, dissolved oxygen levels, water odor, color, or taste, or addition of suspended solids.

Soil erosion or the introduction of suspended solids into waterways from implementation of the Preferred Alternative could contribute to degradation of water quality. If the Proposed Action and Alternatives would disturb more than 1 acre of soil, a state or USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

[207] Nonpoint source pollution: a source of pollution that does not have an identifiable, specific physical location or a defined discharge point. Non-point source pollution includes nutrients that run off croplands, lawns, parking lots, streets and other land uses. It also includes nutrients that enter waterways via air pollution groundwater, or septic systems (USEPA, 2015f).

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs would reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA, SDWA), and local regulations, cause a threat to the human environment, biodiversity, or ecological integrity through water degradation, or cause a sediment water quality violation from local construction, or otherwise substantially degrade water quality.

Therefore, based on the impact significance criteria presented in Table 4.2.4-1, water quality impacts would likely be less than significant, due to the small-scale and temporary duration of expected FirstNet deployment activities in any one location, and could be further reduced if BMPs and mitigation measures incorporated where practicable and feasible.

During implementation of the Proposed Action and Alternatives, there is the potential to encounter shallow groundwater due to clearing and grading activities, shallow excavation, or relocation of utility lines. This is unlikely, as trenching is not expected to exceed a 48-inch depth. However, groundwater contamination may exist in areas directly within or near the project area. If trenching[208] or tower construction were to occur near or below the existing water table (depth to water), then dewatering would be anticipated at the location. Residual contaminated groundwater could be encountered during dewatering activities. Construction activities would need to comply with California dewatering requirements. Any groundwater extracted during dewatering activities, or subject to the terms of a dewatering permit, may be required to be treated prior to discharge or disposed of at a wastewater treatment facility.

Trenching would not likely introduce new contamination in the California's aquifers. The Proposed Action and Alternatives are unlikely to cause new drinking water violations, or otherwise substantially degrade groundwater quality. Based on the impact significance criteria presented in Table 4.2.4-1, there would likely be less than significant impacts on groundwater quality due to the small-scale and temporary duration of expected FirstNet deployment activities in any one location. In areas where groundwater is close to the surface, then site-specific analysis, BMPs, and mitigation measures could be implemented to further reduce potential impacts.

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on human beings, buildings, roads and other infrastructure. The 500-year floodplain is the area of minimal flood

[208] Telecommunications activities involve laying conduit, with minimal trenching. Trenching activities would likely be at a minimal depth (less than 36 inches) and width (6 to 12 inches).

hazard, where there is a 0.2-percent-annual-chance flood. Some projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 4.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet's likely deployment activities, on the watershed or subwatershed level, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede or redirect flood flows or impact floodplain hydrology, and would not occur during flood events with the exception of deployable technologies which may be deployed in response to an emergency. Additionally, any effects would be temporary, lasting no more than one season or water year,[209] or occur only during an emergency.

Examples of activities that would have a less than significant impact include:

- Construction of any structure in the 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.
- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures could reduce the risk of additional impacts to floodplain degradation (see Chapter 9).

Drainage Pattern Alteration

Flooding and erosion from land disturbance could changes drainage patterns. Stormwater runoff causes erosion while construction activities and land clearing could change drainage patterns. Drainage could be directed to stormwater drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage could cause increased erosion, changes in stormwater runoff, flooding, and damage to water quality. Existing drainage patterns could be modified by channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 4.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or subwatershed level would be considered less than significant.

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited stormwater runoff.
- Where stormwater is contained on site and does not flow to or impact surface waterbodies off-site on other properties.
- Activities designed so that the amount of stormwater generated before construction is the same as afterwards.

[209] A water year is defined as "the 12-month period October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months." (USGS, 2016d)

- Activities designed using low impact development techniques for stormwater.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term; impacts to drainage patterns would be less than significant. BMPs and mitigation measures could be implemented to further reduce any potentially significant impacts.

Flow Alteration

Flow alteration refers to the modification of flow characteristics, relative to natural conditions. Human activities may change the amount of water reaching a stream, divert flow through artificial channels, or alter the shape and location of streams. Surface water and groundwater withdrawals could alter flow by reducing water volumes in streams. Withdrawals may return to the surface/groundwater system at a point further downstream, be removed from the watershed through transpiration by crops, lawns or pastures, or be transferred to another watershed altogether (e.g., water transferred to a different watershed for drinking supply). Altered flow could increase flooding and introduce more erosion and potential for pollution. Alternatively, if water is diverted from its normal flow, the opposite may occur; wetlands and streams may not receive as much water as necessary to maintain the ecology and previous functions.

Activities that do not impact discharge or stage of waterbody (stream height) are not anticipated to have an impact on flow, according to Table 4.2.4-1. Projects that include minor consumptive use of surface water with less than significant impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) are likely to have less than significant impacts on flow alteration, on a watershed or subwatershed level. Examples of projects likely to have less than significant impacts include:

- Construction of any structure in a 100-year or 500-year floodplain but is built above base flood pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns off site or into surface water bodies that have not received that volume of stormwater previously.
- Minor clearing or grading activities.

Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be less than significant impacts to flow alteration. BMPs, mitigation measures, and avoidance could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 4.1.4.7, groundwater supplies approximately 38 percent of California's total water supply under non-drought conditions. During dry years, it can contribute 46 percent or more of the state's water supply. Many city, agricultural, and disadvantaged communities rely on groundwater for up to 100 percent of their water supply needs. Generally, the water quality of California's aquifers is suitable for drinking and daily water needs (CDWR, 2013a). Once a groundwater supply is exhausted or contaminated, it is very expensive, and sometimes

impossible, to replace. Water supply demand from the deployment activities is unlikely to exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would not likely cause significant impacts to water quality due to the expected small volume of these materials. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater, generation.
- Storage of petroleum or chemical products.

Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).

Deployment activities should be less than significant since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. The siting of deployment activities should be considered to avoid areas that would extract groundwater from potable groundwater sources in the area. According to Table 4.2.4-1, potentially significant impacts to groundwater or aquifer characteristics would only occur if actions resulted in substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime on a watershed or within multiple watersheds that is ongoing and permanent. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.4.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to water resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts on water resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to water resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to marine and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
- New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
- Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts on water resources.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Deployable Technologies: Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The

activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Where deployable technologies would be implemented on existing paved surfaces, or where aerial and vehicular deployable technologies may be used on existing paved surfaces, it is anticipated that there would be no impacts on water resources because there would be no ground disturbance.

- Deployment of drones, balloons, blimps, or piloted aircraft could have indirect impacts on water quality if fuels spill or other chemicals seep into ground or surface waters. In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts, but are expected to be less than significant due to the small-scale individual activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure would likely be less than significant due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is complete. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along exiting roads and utility ROW. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.4.5 Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to water resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to water resources if those activities occurred on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving; however, these activities would be isolated and short term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites and from fuels leaking into the surface or groundwater. However, spills from vehicles or machinery used during deployment tend to be associated with re-fueling operations, and as such, would likely be a few gallons or less in volume and would likely be easily contained or cleaned up, and therefore would have less than significant impacts. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be no impacts to water resources associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies,

potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies; however, due to the limited and temporary nature of the deployment activities, it is anticipated that these potential impacts would be less than significant. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies; however, due to the limited and temporary nature of the deployable activities, it is anticipated that these potential impacts would be less than significant. Site maintenance, including mowing or herbicides, may result in less than significant effects to water quality, due to the small scale of expected FirstNet activities in any particular location, depending on the location and amount of herbicides used. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on water resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.4, Water Resources.

4.2.5 Wetlands

4.2.5.1 Introduction

This section describes potential impacts to wetlands in California associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.5.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 4.2.5-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to wetlands addressed in this section are presented as a range of possible impacts.

Table 4.2.5-1: Impact Significance Rating Criteria for Wetlands

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Direct wetland loss (fill or conversion to non-wetland)	Magnitude[a] or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 404 of the CWA.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No direct loss of wetlands.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality degradation (spills or sedimentation)	Magnitude[a] or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Indirect effects: [b] change in function(s)[c] change in wetland type	Magnitude[a] or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.).	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No changes in wetland function or type.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Long-term or permanent.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA

[a] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories. Category 1 are the highest quality, highest functioning wetlands

[b] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type

[c] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

NA = Not Applicable

4.2.5.3 Description of Environmental Concerns

Potential Direct Wetland Loss (Fill or Conversion to Non-Wetland)

Construction-related impacts from several of the deployment activities have the potential for direct wetland impacts such as filling, draining, or conversion to a non-wetland. Examples include placement of fill in a wetland to construct a new tower, trenching through a wetland or directly connected waterway to install a cable, and placement of a structure (tower, building) within the wetland.

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, light, and other human disturbance.

To the extent practicable or feasible, FirstNet, and/or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre). Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (see Chapter 9).

Based on the 2014 NWI data, there are more than 3 million acres of wetland in the state (USFWS, 2014a). In California, the main types of wetland is palustrine (freshwater) wetlands found on river and lake floodplains across the state, as shown in Figure 4.1.5-1 and Figure 4.1.5-2. Lacustrine, riverine, and estuarine/marine (tidal) wetlands also occur within in the state.

Based on the impact significance criteria presented in Table 4.2.4-1, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, the deployment activities would not violate applicable federal, state, and local regulations.

In California, as discussed in Wetlands, Section 4.1.5.4, regulated high quality wetlands (or wetlands of special concern) include vernal pools, fens, bogs and peatlands and in wetlands contiguous with fens (USACE, 2012) (see Section 4.1.5.4 for a full description of these wetlands). If any of the proposed deployment activities were to occur in these high quality wetlands, potentially significant impacts could occur. Site-specific analysis would occur prior to development near wetlands, in addition to BMPs and mitigation measures to avoid potentially significant impacts to wetlands. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and

mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Other Direct Effects

Other direct impacts consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, other direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through chemical, mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the on the impact significance criteria presented in Table 4.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) may cause potentially significant impacts. In addition, introduction and establishment of invasive species to high quality wetlands within a watershed or multiple watersheds are potentially significant. Other direct effects to high- and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Examples of activities that could have other direct effects to wetlands in California include:

- *Vegetation Clearing*: removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.
- *Ground Disturbance*: Increased amounts of stormwater runoff in wetlands could alter water level response times, depths, and duration of water detention. Reduction of watershed infiltration capacity could cause wetland water depths to rise more rapidly following storm events.
- *Direct Hydrologic Changes (flooding or draining):* Greater frequency and duration of flooding could destroy native plant communities, as could depriving them of their water supply. Hydrologic changes could make a wetland more vulnerable to pollution. Increased water depths or flooding frequency could distribute pollutants more widely through a wetland. Sediment retention in wetlands is directly related to flow characteristics, including degree and pattern of channelization, flow velocities, and storm surges.

- *Direct Soil Changes:* Changes in soil chemistry, from nonpoint pollution or increased runoff, could lead to degradation of wetlands that have a specific pH range and/or other parameter, such as the acidic conditions of bogs and alkaline conditions of fens (which are high quality wetlands in California).
- *Water Quality Degradation (spills or sedimentation):* The loss of wetlands results in a depletion of water quality both in the wetland and downstream. Filtering of pollutants by wetlands is an important function and benefit. High levels of suspended solids (sedimentation) could reduce light penetration, dissolved oxygen, and overall wetland productivity. Toxic materials in runoff could interfere with the biological processes of wetland plants, resulting in impaired growth, mortality, and changes in plant communities.

Indirect Effects:[210] Change in Function(s)[211] or Change in Wetland Type

Indirect effects to wetlands could include change in wetland function or conversion of a resource to another type (i.e., wetland to an open body of water). The construction of curb and gutter systems diverts surface runoff and could cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to high- and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures, as practicable and feasible (see Chapter 9).

Examples of functions related to wetlands in California that could be potentially impacted from construction-related deployment activities include:

- *Flood Attenuation:* Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they could lower flood peaks by providing detention of storm flows.
- *Bank Stabilization:* By reducing the velocity and volume of flow, wetlands provide erosion control, floodwater retention, and reduce stream sedimentation.
- *Water Quality:* Water quality impacts on wetland soils could eventually threaten a wetland's existence. Where sediment inputs exceed rates of sediment export and soil consolidation, a wetland would gradually become filled.
- *Nutrient Processing*: Wetland forests retain ammonia during seasonal flooding. Wetlands absorb metals in the soils and by plant uptake via the roots. They also allow metabolism of

[210] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type

[211] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

oxygen-demanding materials and reduce fecal coliform populations. These pollutants are often then buried by newer plant material, isolating them in the sediments.

- *Wildlife Habitat:* Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding could harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes could have impacts on the preferred food supply and animal cover.
- *Recreational Value:* Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- *Groundwater Recharge:* Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According to the significance criteria defined in Table 4.2.5-1, impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity), would be considered potentially less than significant, based on their species habitat and diversity, sensitivity to stormwater changes and vegetation diversity. Since the majority of the 3 million acres wetlands in California are not considered high quality, deployment activities could have less than significant indirect impacts on wetlands in the state. In areas of the state with high quality wetlands, there could be potentially significant impacts at the project level that would be analyzed on a case-by-case basis. If avoidance were not possible, BMPs and mitigation measures would help to mitigate impacts. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.5.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations could be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wetlands and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to wetlands under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts on wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launched for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact on wetlands.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments, including coastal and marine environments.
- New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
- Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct

impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, or blimps piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be less than significant due to the small about of land disturbance (generally less than one acre) and the short timeframe of deployment activities. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing potential other direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are expected to be less than significant due to the limited nature of deployment activities. It is also anticipated that routine maintenance activities would be conducted on existing roads and utility ROW. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.5.5 Alternative Impacts Assessment

The following section assesses potential impacts to wetlands associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new

construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wetlands as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be less than significant due to the small-scale and temporary duration of expected FirstNet deployment activities in any one location. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance could result in impacts similar to the abovementioned deployment impacts. The wetlands impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the wetland's quality and function.

It is anticipated that there would be less than significant impacts to wetlands associated with routine inspections of the Deployable Technologies Alternative as it is likely existing roads and utility ROWs would be utilized for maintenance and inspection activities. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects to wetlands due to the limited nature of site maintenance activities, including mowing and application of herbicides. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.5, Wetlands.

4.2.6 Biological Resources

4.2.6.1 Introduction

This Section describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in California associated with deployment and operation of the Proposed Action and its alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.6.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on terrestrial vegetation, wildlife, fisheries, and aquatic habitats were evaluated using the significance criteria presented in Table 4.2.6-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 4.2.6.3, 4.2.6.4, and 4.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 4.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in California.

Table 4.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury/mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including Marine Mammal Protection Act (MMPA), Magnuson Stevens Fishery Conservation And Management Act (MSFCMA), MBTA, and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed within California for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Habitat alteration in locations not designated as vital or critical for any period. Temporary losses to individual plants within cover types, or small habitat alterations take place in important habitat that is widely distributed and there are no cover type losses or cumulative effects from additional projects.	Sufficient habitat would remain functional to maintain viability of all species. No damage or loss of terrestrial, aquatic, or riparian habitat from project would occur.
	Geographic Extent	Regional effects observed within California for at least one species. Anthropogenic disturbances that lead to the loss or alteration of nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances that lead to mortality, disorientation, the avoidance, or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic disturbances are measurable but minimal as determined by individual behavior and propagation, and the potential for habituation or adaptability is high given time.	No stress or avoidance of feeding or important habitat areas. No reduced population resulting from habitat abandonment.
	Geographic Extent	Regional or site specific effects observed within California for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience, and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts, resulting in injury or mortality.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long-term loss of migratory pattern/path or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Temporary loss of migratory rest stops due to anthropogenic activities take place in important habitat that is widely distributed and there are no cumulative effects from additional projects.	No alteration of migratory pathways, no stress, or avoidance of migratory paths/patterns due to project.
	Geographic Extent	Regional effects observed within California for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success.
	Geographic Extent	Regional effects observed within California for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning or stress, abandonment, and loss of productivity for endemics or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated, or short-term effects that are reversed within one breeding season.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout California.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons.	NA

NA = Not Applicable

4.2.6.3 Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in California are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are permanent or temporary loss or disturbance of individual plants. Based on the impact significance criteria presented in Table 4.2.6-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, FirstNet deployment events are expected to be relatively small in scale and therefore would have less than significant impacts. The implementation of standard BMPs, mitigation measures, and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical disturbances that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the potential impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat.

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. In general, these impacts are expected to be less than significant due to the short-term, localized nature of the deployment activities. Further, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case, BMPs and mitigation measures would be recommended and consultation with appropriate resource agencies, if required, would be undertaken to minimize or avoid potential impacts. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impact.

Indirect Injury/Mortality

"Indirect effects" are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality

could include stress related to disturbance. The alteration of soils or hydrology within a localized area could result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to the small size of expected FirstNet activities. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment. Overall, these impacts are expected to be less than significant due to the short-term and small-scale nature of deployment activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for terrestrial vegetation (e.g., forest migration) are expected as a result of the Proposed Action given the small-scale of deployment activities.

Reproductive Effects

No reproductive effects to terrestrial vegetation are expected as a result of the Proposed Action given the small-scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species could have a dramatic effect on natural resources and biodiversity. In California, laws and related regulations control the movement of noxious weeds. The Plant Quarantine and Pest Control regulation (FAC Division 4, Section 6305, 6344, 6461 and 6465) provides quarantine authority against all weed pests, specifically related to the transport of seeds, the shipment of seeds, and the abatement, reshipment, and treatment of weed pests (CDFA, 2005b). California regulates 197 state-listed noxious weeds, each assigned one of five ratings based on the overall distribution in the state and the severity of threat (CDFA, 2015).

As described in Section 4.1.6.4, when non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. The potential to introduce invasive plants within construction zones and during long-term site maintenance could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. Overall, these impacts are expected to be less than significant due to the small-scale, localized nature of deployment activities. BMPs could help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be

implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to terrestrial vegetation resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology[212], and the nature as well as the extent of the habitats affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to terrestrial vegetation under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to terrestrial vegetation because there would be no ground disturbance
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not

[212] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

impact terrestrial vegetation because those activities would not require ground disturbance.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have no impact on biological resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to terrestrial vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Although lighting up of dark fiber would have no impacts to terrestrial vegetation as mentioned above, installation of new associated huts or equipment or construction for laterals/drops, if required, could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be temporary, and FirstNet would attempt to avoid conducting activities in locations designated as vital or critical habitat during any period.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water would not impact terrestrial vegetation. However, impacts to terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. BMPs and mitigation measures could be implemented to help minimize potential impacts.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct or indirect injury to plants, vegetation loss, and invasive species effects. BMPs and mitigation measures could be implemented to help minimize potential impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads), microwave facilities, or access roads could result in impacts to terrestrial vegetation. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to terrestrial vegetation. However, if new power units, replacement towers, structural hardening, and physical security measures require land clearing or excavation activities, impacts would be similar to new wireless construction.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct impacts to terrestrial vegetation if deployment occurs on vegetated areas, or the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact terrestrial vegetation if launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs in those launching or recovery areas.

In general the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale,

could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology,[213] and the nature and extent of the vegetation affected. These potential impacts are expected to be less than significant due to the small-scale of expected deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in less than significant effects due to the small-scale of expected activities. These potential impacts could result from accidental spills from maintenance equipment or release of herbicides or because these areas would not be allowed to revert to a more natural state. If usage of heavy equipment or land clearing activities occurs off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species could occur to terrestrial vegetation; however, impacts are expected to be less than significant due to the small-scale of expected activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternative Impact Assessment

The following section assesses potential impacts to terrestrial vegetation associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land

[213] The timing of natural events, such as flower blooms and animal migration, which is influenced by changes in climate. Phenology is the study of such important seasonal events. Phenological events are influenced by a combination of climate factors, including light, temperature, rainfall, and humidity.

clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to terrestrial vegetation as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from land/vegetation clearing, excavation, and paving activities. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts. However, impacts are expected to be less than significant due to the small-scale of FirstNet activities at individual locations. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. The impacts could vary greatly among species, vegetative community, and geographic region, but are expected to be less than significant. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to terrestrial vegetation associated with routine operations and maintenance due to the relatively small scale of likely FirstNet project sites. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on terrestrial vegetation as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.6.3, Terrestrial Vegetation.

4.2.6.4 Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates occurring in California and California's near offshore environment (i.e., less than two miles from the edge of the coast) are discussed in this section. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle or vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 4.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet Proposed Actions, impacts to individual behavior of animals would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed; therefore, impacts are generally expected to be less than significant, as discussed further below. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in California. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, foraging, and migration (FHWA, 2009). Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur.

Entanglement in fences or other barriers could be a source of mortality or injury to terrestrial mammals, though entanglements would likely be isolated, individual events.

For example, if bats – particularly maternity colonies -- are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small-scale and would be dependent on the location and type of deployment activity, and tree removal. Site avoidance measures could be implemented to avoid disturbance to bats.

Marine Mammals

Marine mammals swimming or hauled out on land are sensitive to boats, aircraft, and human presence. Noises, smells, sounds, and sights may elicit a flight reaction. Trampling deaths associated with haulout disturbance are known source of mortality for seals but are not anticipated from likely FirstNet deployment activities.

Entanglements from marine debris as well as ingestion of marine debris could result in injury or death to marine mammals. Marine debris is any manmade object discarded, disposed of, or abandoned that enters the marine environment. Entanglements from marine debris are not anticipated from FirstNet activities.

All of the whale species known to occur offshore of California are also protected under the Endangered Species Act. Environmental consequences pertaining to these whales are discussed in Section 4.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and could violate the MBTA and the BGEPA. Generally, collision events occur to night-migrating birds, "poor" fliers (e.g., ducks), heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (Gehring, Kerlinger, & Manville., 2011).

Avian mortalities or injuries could also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds could occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation, and trenching, and other ground disturbing activities. Removal of trees during land clearing activities, could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for resting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, et al., 1997).

Direct mortality and injury to birds of California are not likely to be widespread or affect populations of species as a whole; individual species impacts may be realized depending on the nature of the deployment activity. Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small scale of likely FirstNet actions. If siting considerations and BMPs and mitigation measures are implemented (Chapter 9), potential impacts could be minimized. Additionally, potential impacts under MBTA and BGEPA could be addressed through BMPs and mitigation measures developed in consultation with USFWS.

Reptiles and Amphibians

Some of California's amphibian and reptile species are widely distributed throughout the state; however, some species have more limited ranges. Direct mortality to amphibians or reptiles could occur in construction zones either by excavation activities or by vehicle strikes; however, these events are expected to be temporary and isolated, affecting only individual animals.

Three species of marine reptiles – all listed as threatened or endangered under the ESA – occur in California's offshore environment. Environmental consequences pertaining to these reptiles are discussed in Section 4.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Terrestrial Invertebrates

The terrestrial invertebrate populations of California are so widely distributed that injury/mortality events are not expected to affect populations of species as a whole.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical disturbances that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat, and impeding access to resources and mates. There are areas in California that have experienced extensive land use changes from urbanization and agriculture. However, there are portions of the state are forested and remain relatively unfragmented.

Additionally, habitat loss could occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the Proposed Action would cause exclusion effects only in very special circumstances, as in most cases an animal could fly, swim, or walk to a nearby area that would provide refuge.

In general, potential effects of vegetation and habitat loss, alteration, or fragmentation are expected to be less than significant because of the small-scale nature of expected deployment activities. These potential impacts are described for California's wildlife species below. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout California and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., black bear) by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals (e.g., bats, foxes) that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could potentially be avoided or minimized by implementing BMPs and mitigation measures.

Marine Mammals

Common marine mammals observed in California waters include seals, sea lions, whales, and dolphins (CDFW, 1997). Seals can be found in open waters and also using rocks, beaches or other coastal habitats. Seals could be temporarily excluded from a resource due to the presence of humans, noise, or vessel traffic during deployment activities. For example, the seals would

need to find a new shore habitat, likely at a less favorable location. Effects on seals from exclusion from resources would be low impact and temporary in duration.

Loss of habitat or exclusions from these areas for marine mammals could potentially be avoided or minimized by implementing BMPs and mitigation measures (see Chapter 9). Environmental consequences pertaining to the endangered marine mammals protected under the ESA are discussed in Section 4.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Birds

The direct removal of migratory bird nests is prohibited under the MBTA. The USFWS and the CDFW provide regional guidance on the most critical periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation could affect avian species directly by loss of nesting, foraging, stopover, and cover habitats.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced in IBAs within the state as birds may temporarily avoid these areas (Hill, et al., 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[214] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration could have major impacts to species that migrate in large flocks and concentrate at stop overs (e.g., shorebirds). BMPs and mitigation measures, including nest avoidance during construction-related activities, could help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for California's amphibians and reptiles typically consist of wetlands and the surrounding upland forest. Impacts are expected to be less than significant given the short-term nature and limited geographic scope of individual activities. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 9) could be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 4.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects on California's amphibian and reptile populations, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.[215]

[214]Passerines are an order of "perching" birds that have four toes, three facing forward and one backward, which allows the bird to easily cling to both horizontal and nearly vertical perches.
[215] See Chapter 9, Wetlands, for a discussion of BMPs for wetlands.

Terrestrial Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many common terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state; therefore no significant effects to terrestrial invertebrates are expected. Impacts to sensitive invertebrate species are discussed below in Section 4.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment. Overall, impacts are expected to remain less than significant due to the short-term nature and limited geographic scope of expected activities, though BMPs and mitigation measures could further help to avoid or minimize the potential impacts. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Stress from repeated disturbances during critical periods (e.g., roosting and mating) could reduce the overall fitness and productivity of young and adult terrestrial mammals. Indirect effects could occur to roosting bats from noise, light, or human disturbance causing them to leave their roosting locations or excluding them from their summer roosting/maternity colony roosts. For example, some bat species establish summer roosting or maternity colonies in the same general area that they return to year and after year. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur

Marine Mammals

Repeated disturbance (e.g., from vessel traffic) could cause stress to individuals resulting in lower fitness and productivity. Given that the majority of FirstNet deployment activities are not expected to be located offshore or in the oceanic environment, less than significant impacts to no impacts would be anticipated for marine mammals.

Birds

Repeated disturbance, especially during the breeding and nesting season, could cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, could cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur.

Terrestrial Invertebrates

Terrestrial invertebrates could experience chronic stress, either by changes in habitat composition or competition for resources, resulting in lower productivity. Due to the large number of invertebrates distributed throughout the state, and given the short-term nature of most of the deployment activities, this impact would likely be less than significant.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. Overall, potential impacts are anticipated to be less than significant due to the small-scale and localized nature of expected activities. Potential effects to migration patterns of California's amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates are described below. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Some large mammals (e.g., black bears) will perform seasonal migrations between foraging/breeding habitats and denning habitats. Some small mammals (e.g., bats) also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula[216].

Any clearance, drilling, and construction activities needed for network deployment, including noise associated with these activities, has the potential to divert mammals from these migratory routes. Impacts could vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be less than significant because they would be unlikely to result in long-term avoidance. BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Marine Mammals

Noise associated with the installation of cables in the near/offshore waters of coastal California could impact marine mammal migration patterns, though impacts are likely to be short-term provided the noise sources are not wide ranging and below Level A and B sound exposure thresholds[217]. It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. Marine mammals have the capacity to divert from sound sources during migration, therefore impacts are expected to be less than significant since noise-generating activities would be of short duration and are not

[216] A location chosen by an animal for hibernation.

[217] Level A: 190 dB re 1µPa (rms) for seals and 180 dB re 1µPa (rms) for whales, dolphins, and porpoises. It is the minimum exposure criterion for injury at the level at which a single exposure is estimated to cause onset of permanent hearing loss. Level B: 160 dB re 1µPa (rms). It is defined as the onset of significant behavioral disturbance is proposed to occur at the lowest level of noise exposure that has a measurable transient effect on hearing (Southall, et al., 2007).

likely to result in long-term avoidance. BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over distances often involving many different countries. For example, as a group, shorebirds undertake some of the longest-distance migrations of all animals. California is located within the Pacific Flyway spans 5,000 in total including 4,000 miles from the Arctic to the west coast of Mexico and 1,000 miles from the Rocky Mountains to the Pacific Ocean. California has 149 IBAs throughout the state serving as important stopover, breeding, and wintering areas for migratory birds (National Audubon Society - California, 2015). Many migratory routes are passed from one generation to the next. Impacts could vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, and impacts are expected to be less than significant given the short-term nature and limited geographic scope for individual activities. BMPs and mitigation measures could help to avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of salamanders and frogs are known to seasonally migrate in California. Post-metamorphic salamanders, such as the tiger salamander, migrate out of the ponds where they were born and into the uplands where they live until they move back to ponds to breed as adults (USFWS, 2016dm). Mortality and barriers to movement could occur as result of the Proposed Action (Berven & Grudzien, 1990) (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but impacts are expected to be less than significant given the short-term nature and limited geographic scope for individual activities. BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature in nature. No effects to migratory patterns of California's terrestrial invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which could affect the overall population of individuals. Overall, potential impacts are anticipated to be less than significant due to the short-term and limited nature of expected activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and dens for large mammals, such as the black bear, has the potential to negatively affect body condition and reproductive success of mammals in California.

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small-scale and impacts are expected to be less than significant. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

Marine Mammals

Marine mammals return to their calving grounds annually for reproductive success. For example, although unlikely, the displacement of female whales from preferred calving habitats due to deployment and operations may reduce fitness and survival of calves potentially affecting overall productivity. However, activities are likely to be small-scale in nature and contribute only minimally to minor, short-term displacement, and BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Disturbance to marine mammals from activities associated with the Proposed Action could result in the abandonment, or death of offspring, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Birds

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less suitable habitat and thus reduce survival and reproduction. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, et al., 1997). The majority of FirstNet deployment or operation activities are likely to be small-scale in nature. Applicable BMPs and mitigation measures, as defined through consultation with USFWS for MBTA or BGEPA, if required, could help to avoid or minimize the potential impacts. Environmental consequences pertaining to federally listed species will be discussed in Section 4.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Reptiles and Amphibians

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, or alter water quality through sediment infiltration or obstruction of natural water flow to pools, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; therefore, no reproductive effects to terrestrial invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species could have a dramatic effect on natural resources. FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites, although these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Therefore, potential impacts are expected to be less than significant. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential invasive species effects to California's wildlife are described below.

Terrestrial Mammals

In California, red foxes can adversely impact native wildlife through competition for food and den sites (CDFW, 1993). However, this "introduced" species is not officially considered as invasive.

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations.

Marine Mammals

Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would likely not occur.

Birds

FirstNet deployment activities could result in short-term or temporary changes to specific project sites, although these sites are expected to return to their natural state in a year or two. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities from machiney or construction workers.

Reptiles and Amphibians

Although FirstNet deployment activities could result in short-term or temporary changes to specific project sites, these sites are expected to return to their natural state in a year or two. Invasive reptile or amphibian species are not expected to be introduced at project sites as part of deployment activities. Invasive terrestrial reptile or amphibian species are not expected to be introduced at project sites from machinery or laborers

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects could pose a threat to California's forest and agricultural resources (USFS, 2015b). The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive terrestrial invertebrate species during implementation of the Proposed Action. Invasive species effects related to terrestrial invertebrates could be minimized with the implementation of BMPs and mitigation measures. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology and the nature and extent of the habitats affected. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to wildlife resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by

equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wildlife resources because there would be no ground disturbance.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities are anticipated to be less than significant to wildlife resources:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g., reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects. Implementation of BMPs and mitigation measures could help avoid or minimize potential impacts.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Impacts may vary depending on the number or individual poles installed and the extent of ground

disturbance, but could include direct injury/mortality of individuals as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.

- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept submarine cables could potentially impact wildlife, marine mammals in particular (see Section 4.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/mortality could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wildlife. However, if new power units, replacement towers, or structural hardening were required, impacts would be similar to new wireless construction. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to wildlife on roadways. If external generators are used, noise disturbance could potentially impact migratory

patterns of wildlife. RF hazards could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be less than significant given the small scale of likely individual FirstNet projects; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts. The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews, as appropriate. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to wildlife resources associated with routine inspections of the Preferred Alternative. Site maintenance would be infrequent, including mowing or herbicides, and it is anticipated to result in less than significant effects to wildlife including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides. Potential spills of these materials would be expected to be in small quantities.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms.

Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support

facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and therefore would likely than less than significant given the short-term nature and limited geographic scope for individual activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternative Impact Assessment

The following section assesses potential impacts to wildlife resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wildlife resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to be less than significant because deployment activities are expected to be temporary, likely affecting only a small number of wildlife. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts because deployable activities are expected to be temporary and likely affecting only a small number of wildlife. The impacts could vary greatly among species and geographic region. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on wildlife resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.6.4, Terrestrial Wildlife.

4.2.6.5 Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in California and California's near offshore environment are discussed in this section. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 4.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts to fisheries and aquatic invertebrate population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical disturbances that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on

the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the breaking down of continuous and connected habitat, and impeding access to resources and mates.

Depending on the location, the construction of new infrastructure and long-term facility maintenance could result in the shoreline habitat alteration in localized areas; in some instances, the permanent loss of riparian vegetation could occur, which could lead to water quality impacts and in turn aquatic habitat alteration. Habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location depending on the nature of the deployment activity. Additionally, deployment activities with potential impacts under the MSFCMA or other aquatic habitats could be addressed through BMPs and mitigation measures as defined through consultation with the appropriate resource agency.

Indirect Injury/Mortality

Water quality impacts from exposure to contaminants from accidental spills from vehicles and equipment, and erosion or sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, streams, and other aquatic habitats, could result in changes to habitat, food sources, or prey resulting in indirect mortality/injury to fish and aquatic invertebrates. Indirect injury/mortality impacts vary depending on the species, time of year, and duration of deployment. These impacts are expected to be less than significant due to the short-term nature and limited geographic scope of deployment activities. BMPs and mitigation measures to protect water resources (see Section 4.2.4, Water Resources) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. For example, restrictions or alterations to waterways could alter migration patterns, limit fish passage, or affect foraging and spawning site access. Impacts would vary depending on the species, time of year, and duration of deployment, but would be localized and small-scale, and therefore are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which could affect the overall population of individuals. Restrictions to spawning/breeding areas for fish and aquatic invertebrates and the alteration of water quality through sediment infiltration, obstruction of natural water flow, or loss of submerged vegetation resulting from the deployment of various types of infrastructure, are not anticipated, and therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive plants within construction zones could occur from vessels and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. FirstNet deployment activities could result in short-term or temporary changes to specific project sites and these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Therefore, impacts are anticipated to be less than significant. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to fisheries and aquatic habitats under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to fisheries and aquatic habitat would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to fisheries and aquatic habitats because there would be no disturbance of the aquatic environment.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have no impact on the aquatic environment.

Activities with the Potential to Have Impacts

Potential/deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects. Implementation of BMPs and mitigation measures could help avoid or minimize potential impacts.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could, if conducted near water resources that support fish, result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept submarine cables could result in direct

injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g., mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to fisheries and aquatic habitats. However, if additional power units, replacement towers, structural hardening, or physical security measures required ground disturbance, impacts would be similar to new wireless construction. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect

injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be less significant due to the small scale and localized nature of deployment activities that have the potential to impact aquatic habitats. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance activities that may result in accidental spills from maintenance equipment or pesticide runoff near fish habitat are expected to have less than significant effects to fisheries and aquatic habitats. Potential spills of these materials would be expected to be in small quantities.

Fisheries and aquatic habitat could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition, the presence of new access roads and transmission line ROWs near water resources that support fish may increase human use of the surrounding areas, which could increase disturbance to fisheries and aquatic habitats resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. Fisheries and aquatic habitat may also be impacted if increased access leads to an increase in the legal or illegal take of biota. However, impacts are expected to be less than significant due to the small scale of expected activities with the potential to affect fisheries and aquatic habitat. As a result of the small scale, only a limited number of individuals are anticipated to be impacted, furthermore, habitat impacts would also be minimal in scale. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to fisheries and aquatic habitats associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to fisheries and aquatic habitats as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts from habitat loss, alteration, and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant due to the limited nature of expected deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to fisheries and aquatic habitats associated with routine operations and maintenance due to the limited nature of expected deployment activities. The impacts could vary greatly among species and geographic region. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on fisheries and aquatic habitats as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.6.5, Fisheries and Aquatic Habitats.

4.2.6.6 Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in California and California's offshore environment associated with deployment and operation of the Proposed Action and Alternatives. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

4.2.6.7 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on threatened and endangered species and their habitat were evaluated using the significance criteria presented in Table 4.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes across the state, the potential impacts to threatened and endangered species addressed below are presented as a range of possible impacts.

Table 4.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Injury/Mortality of a Listed Species	Magnitude or Intensity	As per the ESA, this impact threshold applies at the individual level so applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under likely to adversely affect category). Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Includes permitted take.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species.	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to infrequent, temporary, and short-term effects.	
Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success of a listed species.	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success.	No measurable effects on listed species.
	Geographic Extent	Reduced breeding success of a listed species at any geographic extent.	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success of listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success of a listed species.	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success of a listed species within a breeding season.	
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat.
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 4.2.6-2, any direct injury or mortality of a listed species at the individual-level, as well as any impact that has the potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency, may affect and likely adversely affect a listed species. Direct injury/mortality environmental concerns pertaining to federally listed terrestrial mammals, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in California are described below. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Terrestrial Mammals

Twenty-one endangered and one threatened terrestrial mammal species are federally listed and known to occur in California, as summarized in Table 4.1.6-6.

Direct mortality to the federally listed terrestrial mammals could occur from vehicle strikes, as these species are occasionally found along transportation corridors, or if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Entanglement in fences or other barriers could also be a source of mortality or injury to these species. Impacts would likely be isolated, individual events and therefore may affect, but are not likely to adversely affect, a listed species.

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Marine Mammals

Five endangered and two threatened marine mammals are federally listed and known to occur in California's near offshore environment; they are the humpback whale, killer whale, Guadalupe fur seal, finback whale, blue whale, Sei whale, southern sea otter, and sperm whale. Direct injury or mortality to these species could occur from entanglements from marine debris as well as ingestion of marine debris, but are unlikely as the majority of FirstNet projects would not occur in the aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation

measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Birds

Nine endangered and seven threatened species are federally listed and known to occur in California, as summarized in Table 4.1.6-7. Depending on the project type and location, direct mortality or injury to these birds could occur from collisions or electrocutions with manmade cables and wires, vehicle strikes, or by disturbance or destruction of nests during ground disturbing activities. However, these potential impacts may affect, but are not likely to adversely affect, listed species as FirstNet would attempt to avoid deployment activities in these areas. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Fish

Twenty-one fish species are federally listed as threatened and endangered in California, as summarized in Table 4.1.6-8. Direct mortality or injury to this species could occur from entanglements resulting from the Proposed Action, but are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Reptiles and Amphibians

Nine amphibian species are federally listed as threatened and endangered and are known to occur in California (Table 4.1.6-9); they are the Arroyo toad, California red-legged frog, California tiger salamander, desert slender salamander, mountain yellow-legged frog, Oregon spotted frog, Santa Cruz long-toed salamander, Sierra Nevada yellow-legged frog, and Yosemite toad. Direct mortality to these species could occur in construction zones either by excavation activities or by vehicle strikes. Potential effects would likely be isolated, individual events, and FirstNet would attempt to avoid areas where the species may occur. Therefore potential impacts may affect, but would not likely adversely affect, the listed species.

Two endangered and four threatened terrestrial reptile species are federally listed and known to occur in California; they are the blunt-nosed leopard lizard, Coachella Valley fringe-toed lizard, desert tortoise, giant garter snake, San Francisco garter snake, and whipsnake. Direct mortality to these species could occur in construction zones either by excavation activities or by vehicle strikes. Potential effects would likely be isolated, individual events, and therefore may affect, but would likely not adversely affect, listed species.

One endangered and two threatened marine reptiles are federally listed and known to occur in the coastal area and offshore environment of California; they include the green sea turtle,

leatherback sea turtle, and the Olive ridley sea turtle. The majority of FirstNet deployment projects would not occur in an aquatic environment. Direct mortality or injury occurring from watercraft and vessels strikes are unlikely as the majority of the FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but would not likely adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Invertebrates

Twenty-seven endangered and six threatened species are federally listed for California, as summarized in Table 4.1.6-11. Direct mortality to terrestrial invertebrate species could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. First Net would attempt to avoid areas where these species may occur.

The majority of FirstNet deployment projects would not occur in an aquatic environment. Direct mortality or injury to aquatic invertebrate species are unlikely but could occur from entanglements resulting from the Proposed Action. Potential impacts may affect, but are not likely to adversely affect the listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Plants

There are 183 federally listed plant species in California. Currently, there are 138 endangered plant taxa and 46 threatened plant taxa, as listed in Table 4.1.6-12 (USFWS, 2015bz) (USFWS, 2016dd). Only 61 plant taxa have critical habitat designated (USFWS, 2016dp). Listed plant species occur throughout California. Direct mortality to federally listed plants could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. FirstNet would attempt to avoid areas where these species may occur; therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce the breeding success of a listed species either by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which could affect the breeding success. Potential effects to federally listed terrestrial mammals, marine mammals, birds, terrestrial reptiles and marine reptiles, amphibians, fish, invertebrates, and plants with known occurrence in California are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action could affect federally listed terrestrial mammals within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities; however, they are anticipated to be small-scale and localized. FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Marine Mammals

The federally listed humpback, finback, and sei whales found in the offshore areas of California are migrants. Therefore, no long-term reproductive effects to these federally listed marine mammal are expected as a result of the Proposed Action. The blue and sperm whales, Guadalupe fur seal, and Southern sea otter are found in the coastal waters of California. Effects to reproduction of federally listed marine mammals in California is unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Birds

Noise, light, or human disturbance within nesting areas could cause federally listed birds to relocate to less desirable locations, or cause stress to individuals reducing survival and reproduction. The San Clemente loggerhead shrike and San Clemente Sage sparrow can only be found on San Clemente Island off the coast of southern California. The majority of FirstNet deployment activities would not occur on beaches; therefore, impacts to these bird species are not anticipated. The other bird species occur throughout California; FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Reptiles and Amphibians

Changes in water quality, especially during the breeding seasons, resulting from ground disturbing activities could cause stress to federally listed species, resulting in lower productivity. Land clearing activities, noise, and human disturbance during the critical time periods (e.g., mating, nesting) could lower fitness and productivity. FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate

resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

The three federally listed sea turtles can be found along the coast of California. The majority of FirstNet deployment activities would not occur on beaches; therefore, no long-term reproductive effects to federally listed sea turtles are expected as a result of the Proposed Action.

Fish

Deployment activities resulting in increased disturbance (e.g., humans, noise), especially during spawning activity, and changes in water quality could cause stress resulting in lower productivity (see Section 4.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects to reproduction of the federally listed fish species in California are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment and FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Invertebrates

Changes in water quality could cause stress resulting in lower productivity for federally listed aquatic invertebrate species known to occur in California. The introduction of invasive plants to habitats utilized by federally listed terrestrial invertebrate species could lead to potentially adverse effects on these species. Potential impacts to federally listed invertebrate species may affect, but are not likely to adversely affect, those species, as FirstNet would attempt to avoid these areas. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Plants

Potential impacts could occur from ground-disturbing activities to listed plant species as a result of the Proposed Action. However, FirstNet would attempt to avoid these areas. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered potentially significant. Potential effects to federally listed terrestrial mammals, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in California are described below.

Terrestrial Mammals

Habitat loss or alteration, particularly from fragmentation or invasive species, could affect breeding and foraging sites of the federally listed terrestrial mammals, resulting in reduced survival and productivity. However, the localized nature of disturbances during deployment activities are not anticipated to stress federally listed terrestrial mammals. Ground disturbing activities could impact food sources for the federally listed terrestrial mammals in California. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species causing them to abandon breeding locations or alter migration patterns. Terrestrial mammals have the capacity to divert from sound sources during feeding and migration. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Marine Mammals

Noise associated with the installation of cables in the near/offshore waters of coastal California could affect marine mammal migration patterns, though impacts are likely to be short-term provided the noise sources are not wide ranging and below Level A and B sound exposure thresholds. Marine mammals have the capacity to divert from sound sources during migration. The majority of FirstNet activities would not take place in the aquatic environment. Therefore, potential impacts may affect, but would likely not adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over distances often involving many different countries. Disturbance in stopover, foraging, or breeding areas (visual or noise) or habitat loss/fragmentation could cause stress to individuals causing them to abandon areas for less desirable habitat and potentially reduce over fitness and productivity. Activities related to the Proposed Action, such as aerial deployment or construction activities, could result in effects to federally listed birds. FirstNet would attempt to avoid areas where these species are known to occur; therefore potential impacts may affect, but are not likely to adversely affect federally listed birds. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Reptiles and Amphibians

Habitat loss or alteration, particularly from fragmentation or invasive species, could affect nesting and foraging sites of the federally listed reptile species, resulting in reduced survival and productivity; however, the localized nature of disturbances during deployment activities are not anticipated to stress federally listed reptiles or amphibians. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Fish

Changes in water quality as a result of ground-disturbing activities could impact food sources for the federally fish species in California. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species causing them to abandon spawning locations or altering migration patterns. Behavioral changes to these listed species are unlikely as the majority of FirstNet deployment projects would not occur in aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Invertebrates

Changes in water quality, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed aquatic invertebrate species resulting in lower productivity. Disturbances to food sources utilized by the federally listed terrestrial invertebrate species, especially during the breeding season, could impact foraging behavior. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary for geographic extent. In some cases, large-scale impacts could occur that would not diminish the functions and values of the habitat, while in other cases

small-scale changes could lead to potentially significant adverse effects, such as impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically. Potential effects to federally listed terrestrial mammals, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with designated critical habitat in California are described below.

Terrestrial Mammals

Seven of the 22 federally listed terrestrial mammal species in California have federally designated habitat. Land clearing, excavation activities, and other ground disturbing activities in these critical habitats in California could lead to habitat loss or degradation, which could affect these federally listed mammals depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed terrestrial mammal species in California; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Marine Mammals

No designated critical habitat occurs for federally listed marine mammals in California. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Birds

Nine of the federally listed bird species in California have federally designated critical habitat. Land clearing, excavation activities, and other ground disturbing activities in these critical habitats in California could lead to habitat loss or degradation, which could lead affect these federally listed bird species depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other eight federally listed bird species in California; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Reptiles and Amphibians

Eight of the federally listed reptiles and amphibian species in California have federally designated critical habitat. Land clearing, excavation activities, and other ground disturbing activities in these critical habitats in California could lead to habitat loss or degradation, which could affect these federally listed reptile and amphibian species depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed reptile and amphibian species in California; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Fish

Thirteen of the federally listed fish species in California have federally designated critical habitat.

Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water and therefore would not likely disturb critical habitat. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other eight federally listed fish species in California; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Invertebrates

Of the 33 federally listed invertebrate species in California, 15 of them have federally designated critical habitat. Land clearing, excavation activities, and other ground disturbing activities in these critical habitats in California could lead to habitat loss or degradation, which could affect these invertebrates depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed invertebrate species in California; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Plants

Of the 183 federally listed plant species in California, 61 of them have federally designated critical habitat. Land clearing, excavation activities, and other ground disturbing activities in these critical habitats in California could lead to habitat loss or degradation, which could affect these plants depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed plant species in California; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential effects to threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Activities Likely to Have No Effect

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no effect on threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would have not impact threatened and endangered species because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to affect protected species, it is anticipated that this activity would have no effect on protected species.

Activities that May Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of effects that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g., mollusks, small mammals, and young). Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, or behavioral changes if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential effects to threatened and endangered

species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.

- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat to threatened and endangered species. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept submarine cables could potentially affect threatened and endangered species and their habitat, particularly aquatic species (see Section 4.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical periods, reproductive effects and behavioral changes could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no impacts to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers, or structural hardening are required, effects would be similar to new wireless construction. Hazards related to security/safety lighting and fencing may produce direct injury/mortality,

reproductive effects, and behavioral changes. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. FirstNet would attempt to avoid areas where these species are known to occur, therefore, these impacts may affect, but are not likely adversely affect protected species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts.

It is anticipated that operational activities may affect, but are not likely to adversely affect, threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may affect, but is not likely to adversely affect, threatened and endangered species, as they would be conducted infrequently and BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. FirstNet would attempt to avoid areas where these species are known to occur. Therefore, listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented.

Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. FirstNet would attempt to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Alternative Impact Assessment

The following section assesses potential effects to threatened and endangered species associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential effects to threatened and endangered species as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species as a result of direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. FirstNet would attempt to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred

Alternative, it is anticipated that operational activities are not likely to adversely effect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. FirstNet would attempt to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, could be implemented, as appropriate, to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no effect on threatened and endangered species as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.6.6, Threatened and Endangered Species and Species of Concern.

4.2.7 Land Use, Recreation, and Airspace

4.2.7.1 Introduction

This section describes potential impacts to land use, recreation, and airspace resources in California associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.7.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on land use, recreation, and airspace resources were evaluated using the significance criteria presented in Table 4.2.7-1. As described in Section 4.2, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to land use, recreation, and airspace resources addressed in this section are presented as a range of possible impacts.

Table 4.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception.	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA
Indirect land use change	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses.	Effect that is potentially significant, but with mitigation is less than significant.	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses.	No conflicts with adjacent existing or planned land uses.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities.	Effect that is potentially significant, but with mitigation is less than significant.	Restricted access to recreation land or activities.	No disruption or loss of access to recreational lands or activities.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites.	Effect that is potentially significant, but with mitigation is less than significant.	Small reductions in visitation or duration of recreational activity.	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace.	Effect that is potentially significant, but with mitigation is less than significant.	Alteration to airspace usage is minimal.	No alterations in airspace usage or flight patterns.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Airspace altered indefinitely.		Short-Term: Airspace altered for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

4.2.7.3 Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of ROW or. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the right-of-way, easement, or access road. These characteristics, such as the length, width, and location could change the existing land use to another category or result in the short- or long-term loss of the existing land use.

Based on the impact significance criteria presented in Table 4.2.7-1, less than significant impacts would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of ROW or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 4.2.7-1, less than significant impacts would be anticipated as any new land use would be small scale; only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

The deployment, operation, and maintenance of facilities and the acquisition of ROW or easement could influence access to public or private recreation land or activities. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features. In the long-term, the deployment and installation of poles, towers, structures, or other above ground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 4.2.7-1, less than significant impacts would be anticipated as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features could temporarily impact enjoyment of recreation land. The deployment of poles, towers, structures, or other above ground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 4.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Potential impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could, but are not likely to, obstruct navigable airspace depending on tower locations.

Based on impact significance criteria presented in Table 4.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. Drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period, FirstNet would not have a significant impact airspace resources.

4.2.7.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure, and the specific deployment requirements, some activities would result in potential impacts to land use, recreation, and airspace resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to land use, recreation, and airspace resources under the conditions described below:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road ROWs.
    - Land Use: See *Activities with the Potential to Have Impacts* below.
    - Recreation: See *Activities with the Potential to Have Impacts* below.
    - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 4.1.7.5 Obstructions to Airspace Considerations).
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts on land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: See *Activities with the Potential to Have Impacts* below.
    - Airspace: It is anticipated that there would be no impacts on airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 4.1.7.5 Obstructions to Airspace Considerations).
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: See *Activities with the Potential to Have Impacts* below.

- Recreation: See *Activities with the Potential to Have Impacts* below.
- Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.

- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
  - Land Use: See *Activities with the Potential to Have Impacts* below.
  - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
  - Airspace: No impacts are anticipated to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
  - Airspace: Lighting of dark fiber would have no impacts on airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable.
  - Land Use: See *Activities with the Potential to Have Impacts* below.
  - Recreation: See *Activities with the Potential to Have Impacts* below.
  - Airspace: The installation of cables in or near bodies of water and construction of landings and/or facilities on shores or the banks of water bodies that accept the submarine cable would not impact flight patterns or cause obstructions that would require FAA and/or District review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 4.1.7.5 Obstructions to Airspace Considerations).
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
  - Land Use: See *Activities with the Potential to Have Impacts* below.
  - Recreation: See *Activities with the Potential to Have Impacts* below.
  - Airspace: The installation of cables in or near bodies of water and construction of landings and/or facilities on shores or the banks of water bodies that accept the submarine cable would not impact flight patterns or cause obstructions that would require FAA and/or District review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 4.1.7.5 Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See *Activities with the Potential to Have Impacts* below.
    - Airspace: See *Activities with the Potential to Have Impacts* below.
- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: It is anticipated that there would be no impacts on existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: No impacts to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
    - Airspace: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet above ground level or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 4.1.7.5.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: It is anticipated that there would be no impacts on existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed but would not restrict access to, or enjoyment of, recreational lands.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact airspace because those activities would not result in changes to flight patterns and airspace usage or result in obstructions to airspace.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact land use, recreation, or airspace, it is anticipated that this activity would have no impact on land use, recreation, or airspace.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to land use, recreation resources, or airspace as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road ROWs.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed ROWs or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: No impacts are anticipated – see previous section
  - New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shores or the banks of waterbodies that accept submarine cable.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.

    - Airspace: No impacts are anticipated – see previous section
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
    - Airspace: No impacts are anticipated – see previous section

- Wireless Projects
  - New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.
    - Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet AGL or meets other criteria listed in Section 4.1.7.6, Airspace. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight patterns of an airport if the aerial fiber optic plant is located in proximity to one of California's airports.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airports or air navigation facilities.

- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: No impacts are anticipated – see previous section.
    - Airspace: Implementation of deployable aerial communications architecture could result in temporary or intermittent impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near California airports (See Section 4.1.7.8 Obstructions to Airspace Considerations). Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones and untethered balloons and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: No impacts are anticipated – see previous section
    - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace could include obstructions. These potential impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Additionally FirstNet (or its network partners), would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts on land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections because there would be no ground disturbance, no airspace activity, and no access restrictions to recreational lands. If routine maintenance or inspection activities would conflict with existing or surrounding land uses, impact recreation resources, or conflict with airspace, impacts could result as explained above.

Operation of the Deployable Technologies options of the Preferred Alternative could result in the temporary presence of deployable vehicles and equipment (including airborne equipment), potentially for up to two years in some cases. Operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections, assuming that the same access roads used for deployment are also used for inspections.

The degree of change in the visual environment (see Section 4.2.8, Visual Resources)—and therefore the potential indirect impact on a landowner's ability to use or sell of their land as desired—would be highly dependent on the specific deployment location and length of deployment. Once deployment locations are known, the location would be subject to an environmental review to help ensure environmental concerns are identified. The use of deployable aerial communications architecture could temporarily add new air traffic or aerial navigation hazards. The magnitude of these effects would depend on the specific location of airborne resources along with the duration of their use. FirstNet would coordinate with the FAA to review required certifications. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.7.5 Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land

clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to land use, recreation, and airspace resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected; however, impacts would be less than significant due to the temporary nature of likely deployment activities. If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, FirstNet (or its partners) would consult with the FAA to determine how to proceed. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts on land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall, these potential impacts would be less than significant due to the temporary nature of deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or

satellites and other technologies. As a result, there would be no impacts on land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 4.1.7, Land Use, Recreation, and Airspace.

4.2.8 Visual Resources

4.1.1.1. Introduction

This section describes potential impacts to visual resources in California associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.1.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 4.2.8-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to visual resources addressed in this section are presented as a range of possible impacts.

Table 4.2.8-1: Impact Significance Rating Criteria for Visual Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse change in aesthetic character of scenic resources or viewsheds	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character.	Effect that is potentially significant, but with mitigation is less than significant.	Intermittently noticeable change in aesthetic character that is marginally negative.	No visible effects.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to aesthetic character lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but aesthetics of the area would be returned to original state following the construction and deployment phase.	Transient or no visible effects.
Nighttime lighting	Magnitude or Intensity	Lighting dramatically alters night-sky conditions.	Effect that is potentially significant, but with mitigation is less than significant.	Lighting alters night-sky conditions to a degree that is only intermittently noticeable.	Lighting does not noticeably alter night-sky conditions.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to night-sky conditions lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but lighting would be removed and night-sky conditions would be returned to original state following the construction and deployment phase.	Transient or no visible effects.

4.1.1.3. Description of Environmental Concerns

Adverse Change in Aesthetic Character of Scenic Resources or Viewsheds

A primary concern during and following construction of structures, towers, roads or other permanent features is the long-term disruption of scenery and viewsheds. In California, residents and visitors travel to many NHLs, national parks, and state parks, such as Yosemite National Park to see El Capitan and Half Dome, hike to the many waterfalls, or to drive through the alpine peaks of Tuolumne Meadows. If lands considered visually significant or scenic were subject to vegetation loss or removal, short- or long-term effects to viewsheds or scenic resources could occur. Bare ground or interruption of a landscape due to vegetation removal could be considered an adverse change in the aesthetic character of scenic resources or viewsheds. New towers or structures constructed within scenic areas could disrupt the perceived aesthetic character or scenery of an area. If new towers were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas

California regulates impacts to visual resources through their CEQA by "requiring state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible" (State of California Legislature, 1970).

Based on the impact significance criteria presented in Table 4.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered potentially significant if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. Given the small scale of likely FirstNet activities, impacts are expected to be less than significant.

Nighttime Lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility that caused regional impacts or permanent changes to night sky conditions, those effects could be considered potentially significant.

Based on the impact significance criteria presented in Table 4.2.8 1, lighting that illuminates the night sky, diminishes night sky viewing over long distances, and persists over the long-term could be considered potentially significant. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience potentially significant impacts to night skies, although potentially minimized to less than significant with implementation of BMPs and mitigation measures, as defined in Chapter 9, BMPs and Mitigation Measures. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented.

4.1.1.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to visual resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to visual resources under the conditions described below:

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts on visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to visual resources because there would be no ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are

already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact on visual resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to visual resources. The degree of impact would depend on the timing and location of the project; installation of a hut or POP would be permanent, whereas ground disturbing activities would be short-term. In most cases, development in or next to existing roadways would not affect visual resources unless vegetation were removed or excavation occurred in scenic areas.
  - New Build – Aerial Fiber Optic Plant: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public ROW would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the

aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units, structural hardening, and physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lightning.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. As discussed above, potential impacts to night skies from lighting are expected to be less than significant with BMPs and mitigation measures incorporated. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts on visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park would be less than significant with BMPs and mitigation measures incorporated during operations. Additionally, FirstNet would work closely with the NPS to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.1.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to visual resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be less than significant as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts on visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. The potential visual impacts—including aesthetic conditions and nighttime lighting—of the operation of deployable technologies would be less than significant given the limited geographic scope for individual activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on visual resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.8, Visual Resources.

4.2.9 Socioeconomics

4.2.9.1 Introduction

This section describes potential impacts to socioeconomics in California associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.9.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 4.2.9-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to socioeconomics addressed in this section are presented as a range of possible impacts.

Table 4.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible impact to property values and/or rental fees.	No impacts to real estate in the form of changes to property values or rental fees.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible economic change.	No change to spending, income, industries, and public revenues.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated cities/towns.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Impacts to employment	Magnitude or Intensity	High level of job creation at the state or territory level.	Effect that is potentially significant, but with mitigation is less than significant.	Low level of job creation at the state/territory level.	No job creation due to project activities at the state/territory level.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated cities/towns.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Changes in population number or composition	Magnitude or Intensity	Substantial increases in population, or changes in population composition (age, race, gender).	Effect that is potentially significant, but with mitigation is less than significant.	Minor increases in population or population composition.	No changes in population or population composition.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

4.2.9.3 Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts Related to Changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values due to below average public safety communication services. Improved services would reduce response times and improve responses. These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Affected Environment, property values vary considerably across California. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $600,000 in the Concord, San Francisco/Oakland, and San Jose areas, to below and around $200,000 in the Bakersfield and Fresno areas. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts Related to Changes in Spending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and partner(s) make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the

installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's partner(s) may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

FirstNet may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment could be a minor, direct, beneficial impact of expenditures on FirstNet. Additional, indirect employment increases would occur as additional businesses hire workers to provide supporting goods and services. For instance, FirstNet contractors and their subcontractors and vendors would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and less than significant. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across California. The average unemployment rate in 2014 was 7.5 percent, higher than the national rate of 6.2 percent. The great majority of counties had unemployment rates above the national average. Only a small number of counties, around the San Francisco bay area, the counties including and north of Santa Barbara, and in a portion of the greater Los Angeles urbanized area, had unemployment rates below the national average (that is, better employment performance).

Large companies that win major contracts for deploying and operating the NPSBN may have concentrations of employees in some specific locations; for instance, engineers and other system designers may be located in one or a few specific offices. While such employment concentrations could be important to specific communities, these and other employment impacts would still not be significant based on the criteria in Table 8.2.9-1 because they would not constitute a "high level of job creation *at the state or territory level*."

Changes in Population Number or Composition

In general, changes in population numbers occur when employment increases or decreases to a degree that affects the decisions of workers on where they can find employment; that is, when workers and their families move to or leave an area because of employment opportunities or the lack thereof. As noted above, deployment and operation of the NPSBN is likely to generate new employment opportunities (directly and indirectly), but employment changes would not be large enough in any state to be considered significant. Therefore, it is highly unlikely that the NPSBN would lead to significant changes in population numbers according to the significance criteria table above. Further, it is unlikely that the NPSBN would lead to any measurable changes in population numbers in any geographic areas, with the possible exception of cities where companies that win major NPSBN contracts establish centers for NPSBN deployment and operation activities. Smaller numbers of employees in any area would not produce measurable population changes because population is always in flux due to births, deaths, and in-migration and out-migration for other reasons.

Population composition refers to age, gender, race, ethnicity, and other characteristics of the individuals making up a population. Given the low potential for changes to population numbers, it is highly unlikely that the NPSBN would lead to any changes in population composition.

4.2.9.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 4.2.9-1. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

- Satellites and Other Technologies
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact socioeconomics, it is anticipated that this activity would have no impact on socioeconomic resources.

Activities with the Potential to Have Impacts

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below summarizes how the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate;
- Changes to Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
    - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be

small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment through existing or new boxes or huts would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- New Build – Aerial Fiber Optic Plant: Pole/structure installation would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus the impacts would be less than significant.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:

  - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant.
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

In general, the abovementioned activities would have less than significant beneficial socioeconomic impacts. The discussion above characterized the impacts of each type of activity. The socioeconomic impacts of all activities considered together would also be less than significant. Even when considered together, the impacts would be very small relative to the total economic activity and property value of any region or the state. In addition, with the possible exception of property values, all deployment impacts would be limited to the construction phase. To the extent that certain activities could have adverse impacts to property values, those impacts are also expected to be less than significant, as described above. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. As with deployment activities, all operational activities would have

socioeconomic impacts, because all represent economic activity. Public or private sector employees would conduct all operational activities, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity and not significant across the entire state, they are measurable socioeconomic impacts.

Potential socioeconomic impacts would primarily be beneficial, and generally of these types:

- Changes to Spending, Income, Industries, and Public Revenues – Operational activities would require expenditures, which then generate business income and employee wages, and may result in new public sector revenues such as taxes on sales and income. All such effects would be small in scale relative to the regional and state economy; their impacts would be less than significant.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would be less than significant as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.9.5 Alternatives Impact Assessment

The following section assesses potential impacts to socioeconomics associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to socioeconomics resulting from implementation of this alternative could be as described below.

Deployment Impacts

As explained above, all deployment activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, such as generation of business income and employee wages, and creation or sustainment of jobs. The impacts would be small for each activity and therefore, less than significant.

Deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, would require storage, staging, and launch/landing areas. Development or enlargement of these facilities could have adverse impacts on nearby property values. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be implemented in greater numbers and over a larger geographic extent. These potential impacts are anticipated to be less than significant as described above. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be less than significant at the programmatic level.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be less than significant as they would be limited to a relatively small number of sites within the region and state. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated deployment or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on socioeconomics from deployment and operation of the No Action Alternative. Socioeconomic conditions would therefore be the same as those described in Section 4.1.9, Socioeconomics.

4.2.10 Environmental Justice

4.2.10.1 Introduction

This section describes potential impacts to environmental justice in California associated with construction/deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.10.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 4.2.10-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to environmental justice addressed in this section are presented as a range of possible impacts.

Table 4.2.10-1: Impact Significance Rating Criteria for Environmental Justice

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Effects associated with other resource areas (e. g., human health and safety, cultural resources, socioeconomics) that have a disproportionately high and adverse impact on low-income populations and minority populations	Magnitude or Intensity	Direct and disproportionately high and adverse effects on environmental justice communities (as defined by EO 12898) that cannot be fully mitigated.	Effect that is potentially significant, but with mitigation is less than significant.	Direct effects on environmental justice communities (as defined by EO 12898) that are not disproportionately high and adverse, and therefore do not require mitigation.	No direct effects on environmental justice communities, as defined by EO 12898.
	Geographic Extent	Effects realized within counties at the Census Block Group level.		Effects realized within counties at the Census Block Group level.	Effects realized within counties at the Census Block Group level.
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

4.2.10.3 Description of Environmental Concerns

Effects Associated with Other Resource Areas That Have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment." (CEQ, 1997b). Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. American Indian tribes are considered environmental justice populations (CEQ, 1997b); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both* "adverse" and "disproportionately high" in their incidence on environmental justice populations relative to the general population (CEQ, 1997b). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences (Section 4.2.9).

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deploys projects, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this PEIS. The areas shown in the environmental justice screening map of Affected Environment (Section 4.1.10) as having Moderate Potential or High Potential for environmental justice populations would

particularly warrant further screening. As discussed in Section 4.1.10, the percentages of individuals in California who identify as Asian or Some Other Race were somewhat higher than those of the region and considerably higher than those of the nation. The percentage of the population in California that identifies as Hispanic is considerably higher than in the region and the nation. Likewise, the state's percentage of All Minorities was considerably higher than the percentages for the region or nation. The poverty rate of California was similar to the rate for the region and above the rate for the nation. A large proportion of California has High Potential for environmental justice populations. The areas with High Potential and Moderate Potential for environmental justice populations are fairly evenly distributed across California. They occur within the largest population concentrations and in the sparsely populated regions of the state. Further analysis using the data developed for the screening analysis in Section 4.1.10.4, Environmental Justice Screening Results, may be useful. In addition, USEPA's EJSCREEN tool and USEPA's lists of environmental justice grant and cooperative agreement recipients may help identify local environmental justice populations (USEPA, 2015j; USEPA, 2014c).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts could use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

4.2.10.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to environmental justice communities and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to environmental justice under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand holes, pulling vaults, junction boxes, huts, and point of presence structures. Activities at these small entry points would be limited and temporary and thus are not likely to produce perceptible changes affecting any surrounding communities. Therefore, they would not affect environmental justice communities.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and therefore would have no impacts to environmental justice. If physical access is required to light dark fiber, it would likely be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts on environmental justice communities.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance and impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice, it is anticipated that this activity would have no impact on environmental justice.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and point of presence structures. These activities could temporarily generate noise and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Aerial Fiber Optic Plant: Pole/structure installation could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore or the banks of waterbodies that accept submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise, and dust could be generated, and traffic could be temporarily disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than significant, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. It is anticipated that such activities would not result in environmental justice impacts, as the intensity of these activities would be low (low potential for objectionable effects such as noise and dust) and their duration would be very short. Routine maintenance and inspection would not adversely affect property values, for the same reasons. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment activities that involve construction.

Impacts are expected to be less than significant, given the short-term nature and limited geographic scope for individual activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.10.5 Alternatives Impact Assessment

The following section assesses potential impacts to environmental justice associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to

environmental justice communities resulting from implementation of this alternative could be as described below.

Deployment Impacts

As explained above, deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise, and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant because they would be temporary in nature. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) that could negatively affect the value of surrounding properties. In addition, equipment maintenance activities at such facilities may temporarily generate noise, and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant because they would be temporary in nature. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on environmental justice as a result of deployment and operation of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 4.1.10, Environmental Justice.

4.2.11 Cultural Resources

4.2.11.1 Introduction

This section describes potential impacts to cultural resources in California associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.11.2 Impact Assessment Methodology and Significant Criteria

The potential impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 4.2.11-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to cultural resources addressed in this section are presented as a range of possible impacts.

Table 4.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse effect	Mitigated adverse effect[a]	Effect, but not adverse	No effect
Physical damage to and/or destruction of historic properties[b]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
	Geographic Extent	Direct effects Area of Potential Effect (APE).		Direct effects APE.	Direct effects APE.
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties.		Permanent direct effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
Indirect effects to historic properties (i.e., visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a contributing or non-contributing portion of a single or many historic properties.	No indirect effects to historic properties.
	Geographic Extent	Indirect effects APE.		Indirect effects APE.	Indirect effects APE.
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties.		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties.	No indirect effects to historic properties.
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties	No direct or indirect effects to historic properties.
	Geographic Extent	Direct and/or indirect effects APE.		Direct and/or indirect effects APE.	Direct and/or indirect effects APE.

Type of Effect	Effect Characteristics	Impact Level			
		Adverse effect	**Mitigated adverse effect[a]**	**Effect, but not adverse**	**No effect**
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties.		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties.	No direct or indirect effects to historic properties.
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No segregation or loss of access to historic properties.
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties.		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties.	No segregation or loss of access to historic properties.
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties.		Infrequent, temporary, or short-term changes in access to a single or many historic properties.	No segregation or loss of access to historic properties.

[a] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/THPO and other consulting parties, including American Indian Tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[b] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to American Indian Tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

4.2.11.3 Description of Environmental Concerns

Physical Damage to and/or Destruction of Historic Properties

One of the primary environmental concerns during deployment activities is damage to or destruction of historic and cultural resources. Deployment involving ground disturbance has the potential to damage or destroy archaeological sites, and the attachment of communications equipment to historic building and structures has the potential to cause damage to features that are historically significant.

Based on the impact significance criteria presented in Table 4.2.11-1, direct deployment impacts could be potentially significant if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given archaeological sites and historic properties are present throughout California, some deployment activities may be in these areas, in which case BMPs (see Chapter 9) would help avoid or minimize the potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of potentially significant impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alter historic architectural features. Significant impacts such as these could be avoided or minimized through BMPs (see Chapter 9).

Loss of Access to Historic Properties

The deployment of equipment requiring a secure area has the potential to cause the loss of access to historic properties. The highest potential for this type of significant impact would be from the deployment of equipment in secure areas that impact the access to sites of cultural importance to American Indians. It is anticipated that FirstNet would identify potential impacts to such areas through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

4.2.11.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to cultural resources, while others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to cultural resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts on cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to cultural. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could impact cultural resources, as coastal areas, shorelines and creekbanks in California have the potential to contain prehistoric archaeological sites, as well as sites associated with the state's significant maritime history since European colonization, such as shipwrecks. Impacts to cultural resources could also potentially occur as a result of the construction of landings and/or facilities on or the banks of waterbodies that accept submarine cable, which could result in the disturbance of archaeological and historical sites (archaeological deposits are frequently associated with bodies of water, and California has numerous maritime and riverine archaeological sites associated with its 18th and 19th century commercial expansion), and the associated network structures could have visual effects on historic properties.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts on cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
  - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in the disturbance of archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas, that have larger numbers of historic buildings.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment site. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the

surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties; however, due to the small scale of expected activities, these actions could affect but would not likely adversely affect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.11.5 Alternatives Impact Assessment

The following section assesses potential impacts to cultural resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to cultural resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment

impacts, it is anticipated that there would be effects, but no adverse effects to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be no effects to cultural resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur; however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts on cultural resources as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.11, Cultural Resources.

4.2.12 Air Quality

4.2.12.1 Introduction

This section describes potential impacts to California's air quality from deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.12.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on California's air quality were evaluated using the significance criteria presented in Table 4.2.12-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to California's air quality addressed in this section are presented as a range of possible impacts.

Table 4.2.12-1: Impact Significance Rating Criteria for California

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased air emissions	Magnitude or Intensity	Pollutant concentrations would exceed one or more NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would cause an area to be out of attainment for any NAAQS. Projects do not conform to the SIP covering nonattainment and maintenance areas.	Effect that is potentially significant, but with mitigation is less than significant.	Negligible emissions would occur for any criteria pollutants within an attainment area but would not cause a NAAQS exceedance.	Action would not cause pollutant concentrations to exceed the NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would not cause air quality to go out of attainment for any NAAQS. Projects are *de minimis* or conform to the SIP covering nonattainment and maintenance areas.
	Geographic Extent/Context	NA		NA	NA
	Duration or Frequency	Permanent or long-term.		Short term.	Temporary.

NA = Not Applicable

4.2.12.3 Description of Environmental Concerns

Increased Air Emissions

The Proposed Action has the potential to generate air pollutant emissions. These emissions could be above and beyond what is typically generated in a given area and may alter ambient air quality. Deployment activities may involve the use of vehicles, heavy equipment, and other equipment that could emit exhaust and create fugitive dust in localized areas. During operations, routine maintenance and other use of generators at tower facilities may emit exhaust for specific durations (maintenance) or unpredictable timeframes (if power is lost to a site, for example). Impacts are likely to be less than significant due to the mobile nature of the sources and the temporary and short-term duration of deployment activities. Although unlikely, the emissions of criteria pollutants could impair the air quality of the region and potentially affect human health. Potential impacts to air quality from emissions may occur in areas where the current air quality exceeds, or has a history of exceeding, one or more NAAQS. Areas exist in California that are in maintenance or nonattainment for one or more criteria pollutants, particularly, ozone is an issue in many parts of the state (see Section 4.1.12, Air Quality and Figure 4.1.12-1). The majority of the counties in California are designated as maintenance areas for one or both of the main pollutants of concern, PM and ozone (Table 4.1.12-31); counties with major metropolitan areas, such as San Francisco, Sacramento, Los Angeles, and San Diego, are designated nonattainment or maintenance for two NAAQS pollutants (Figure 4.1.12-2).

Based on the significance criteria presented in Table 4.2.12-1, air emission impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of emission sources be deployed/operated long-term in the same area from fixed or mobile sources or construction activities. Less than significant emissions could occur for any of the criteria pollutants within attainment areas in California; however, NAAQS exceedances are not anticipated, due to the small-scale and temporary duration of expected FirstNet deployment activities in any one location. Given that nonattainment areas are present throughout California (Figure 4.1.12-2), FirstNet would try to minimize potential emissions where possible and would recommend the implementation of BMPs, where feasible and practicable, to avoid or minimize potential impacts.

4.2.12.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction, deployment, and operation activities.

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would

not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to air quality under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points; however, this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create no new sources of emissions.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to no impact on ambient air quality concentrations.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Impact Air Quality

Construction, deployment, and operation activities related to the Preferred Alternative could impact air quality by generating various quantities of criteria and air pollutant emissions. It is expected that such impacts would be less than significant due to the shorter duration and localized nature of the activities. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in fugitive dust and products of combustion from the use of vehicles and heavy equipment.
  - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment could result in products of combustion from the use of vehicles and machinery, as well as fugitive dust emissions from site preparation.
  - Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in products of combustion from the use of vehicles and heavy equipment, as well as fugitive dust from site preparation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could generate products of combustion from vessels used to lay the cable. In addition, the construction of landings and/or facilities on shores or the banks of waterbodies that accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.
- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If additional power units, structural hardening, and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
  - Deployable Technologies: The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy

trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be less than significant due to the small-scale and temporary duration of expected FirstNet deployment activities in any one location. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be less than significant impacts to air quality associated with routine inspections of the Preferred Alternative due to the limited nature of the activity and the small-scale and temporary duration of expected FirstNet deployment activities in any one location. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors additional air quality impacts may occur; however, they would be less than significant as they would still be limited and small-scale in nature. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.12.5 Alternatives Impact Assessment

The following section assesses potential impacts to air quality associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial

deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows:

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations, would dictate the concentrations and associated impacts. It is anticipated that there would be less than significant impacts to air quality associated with the deployment and operation of aerial technology due to the limited nature of the activity and the small-scale and temporary duration of expected FirstNet deployment activities in any one location. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact on ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

4.2.13 Noise

4.2.13.1 Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and Alternatives in California. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.13.2 Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 4.2.13-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential noise impacts to California addressed in this section are presented as a range of possible impacts.

Table 4.2.13-1: Impact Significance Rating Criteria for Noise

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased noise levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific state noise limits. Noise levels plus baseline noise levels would exceeds 10 dBA increase from baseline noise levels (i.e., louder). Project noise levels near noise receptors at National Parks would exceed 65 dBA.	Effect that is potentially significant, but with mitigation is less than significant.	Noise levels resulting from project activities would exceed natural sounds, but would not exceed typical noise levels from construction equipment or generators.	Natural sounds would prevail. Noise generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.
	Geographic Extent/Context	County or local.		County or local.	County or local.
	Duration or Frequency	Permanent or long-term.		Short term.	Temporary.

4.2.13.3 Description of Environmental Concerns

Increased Noise Levels

The Proposed Action has the potential to generate noise during construction and operation of various equipment used for deployment. These noise levels could be above what is typically generated in a given area and may alter the ambient acoustical environment. If significant, the noise could cause impacts on residential areas, or other facilities that are sensitive to noise, such as churches, hospitals, or schools. The construction activities for deploying some of the various equipment evaluated under the Proposed Action could cause short-term impacts to nearby populations. However, it is likely that there would be less long-term effects from operational use of the proposed equipment (see Section 4.1.13, Noise).

Based on the significance criteria presented in Table 4.2.13-1, noise impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of noise sources be deployed/operated long-term in the same area. Noise levels from deployment activities are not expected to exceed typical noise levels for short-term/temporary construction equipment or generators.

To the extent practicable, FirstNet would attempt to mitigate or minimize noise effects during construction or operation. BMPs and mitigation measures could help to limit impacts on nearby noise-sensitive receptors. However, given that much of the concentration and setup of equipment would often occur in populated areas, FirstNet operations would not be able to completely avoid noise impacts due to construction and operations at various receptors.

4.2.13.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction, deployment, and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise impacts and while others would not. In addition, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no noise impacts under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in high noise levels from the use of heavy equipment and machinery.
  - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP

huts, or other associated facilities to house plant equipment would be short-term and could result in increased noise levels from the use of vehicles and machinery.

- Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in noise levels from the use of heavy equipment and machinery.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise levels if the activity required the use of heavy equipment for grading or other purposes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could generate noise if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. Aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. These impacts are expected to be less than significant

due to the temporary duration of deployment activities. Additionally, pre-existing noise levels would be achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be less than significant and similar to several of the deployment activities related to routine maintenance and inspection of the facilities because of the temporary nature of the activities, which would not create new permanent sources of noise. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be similar to or less than those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections or onsite generator use occurs, potential noise impacts could result as explained above. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.13.5 Alternatives Impact Assessment

The following section assesses potential noise impacts associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations and the duration of deployment. The potential noise impacts are as follows:

Deployment Impacts

Implementing deployable technologies could result in noise from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise levels. Several vehicles

traveling together could also create short-term noise impacts on residences or other noise-sensitive receptors as they pass by. With the exception of ballons, the deployment of aerial technology is anticipated to generate noise during all phases of flight. Aerial technologies would have the highest level of noise impact if they are required to fly above residential areas, areas with a high concentration of noise-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Deployable Technologies Alternative would be similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Operation of generators could also generate noise in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise impacts could be minimal in those areas. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise impacts could result as explained above.

Operational impacts from aerial technologies would include repeated flyovers by UAS vehicles while they are needed in the area. This could generate less than significant short-term impacts on any residential areas or other noise-sensitive receptors under the flight path of these vehicles. However, once these operations cease, noise levels would quickly return to baseline levels. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact on ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

4.2.14 Climate Change

4.2.14.1 Introduction

This section describes potential impacts to climate and climate change-vulnerable FirstNet installations and infrastructure in California associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.14.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on climate and potential climate change impacts on the Proposed Action's installations and infrastructure were evaluated using the significance criteria presented in Table 4.2.14-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to climate and climate change-vulnerable resources addressed in this section are presented as a range of possible impacts.

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or alternatives. The second is related to the implications and possible effects of climate change on the environmental consequences of the Proposed Action or alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or alternatives (CEQ, 2014).

CEQ has established the significance criteria for GHG emissions at 25,000 MT CO_2e on an annual basis, with the requirement that if projected emissions exceed this threshold, a GHG emissions quantitative analysis is warranted (CEQ, 2014). Although 25,000 MT is a very small fraction (one 266,920th) of the total U.S. emissions of 6,673 million metric tons (MMT) CO_2e in 2013 (USEPA, 2015u), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the Proposed Action is more general. In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2014). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process could provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 4.2.14-1: Impact Significance Rating Criteria for Climate Change

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Contribution to climate change through GHG emissions	Magnitude or Intensity	Exceedance of 25,000 metric tons of CO_2e/year, and global level effects observed.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No increase in greenhouse gas emissions or related changes to the climate as a result of project activities.
	Geographic Extent	Global impacts observed.		Global impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No measurable impact of climate change on FirstNet installations or infrastructure.
	Geographic Extent	Local and regional impacts observed.		Local and regional impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA

NA = Not Applicable

4.2.14.3 Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. The Southwest is the hottest and driest region in the United States, and the region is already experiencing impacts of climate change. The decade 2001-2010 was the warmest in the 110-year instrumental historical record keeping, with temperatures almost 2 °F higher than historic averages, which included fewer cold air outbreaks and more heat waves. Summertime heat waves are projected to become longer and hotter, whereas the trend of decreasing wintertime cold air outbreaks is projected to continue. These changes will directly affect urban public health and will also have direct impacts on crop yields. (USGCRP, 2014a)

Air Temperature

Figure 4.2.14-1 and Figure 4.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Texas from a 1969 to 1971 baseline.

Bsk – Figure 4.2.14-1 shows that by mid-century (2040 to 2059), temperatures in Bsk region of California under a low emissions scenario would increase by approximately 4 °F, and by the end of the century (2080 to 2099) under a low emissions scenario temperatures in this region would increase by approximately 5 °F. (USGCRP, 2009)

Figure 4.2.14-2 shows that under a high emissions scenario for the period (2040 to 2059), temperatures would increase by approximately 5 °F. Under a high emissions scenario for the period (2080 to 2099) in the Bsk region of California, temperatures would increase by approximately 8 °F. (USGCRP, 2009)

BWk – Temperatures in the BWk region are expected to increase by mid-century (2040 to 2059) by 4 °F under a low emissions scenario. By the end of the century under a low emissions scenario temperatures are expected to increase 5 °F in the majority of the region and by 6 °F in the eastern portion of the region. (USGCRP, 2009)

Under a high emissions scenario, temperatures will increase by 5 °F by mid-century in the BWk region, and by 8 °F or 9 °F depending on the portion of the region. (USGCRP, 2009)

BWh – By mid-century, temperatures in the BWh region are expected to increase by 4 °F under a low emissions scenario, and by the end of the century temperatures are expected to increase 5 °F or 6 °F depending on the portion of the region. (USGCRP, 2009)

Under a high emissions scenario temperatures are projected to increase by 4 °F in much of the region and by 5 °F in the eastern portion of the state by mid-century. By the end of the century temperatures are projected to increase by 8 °F or 9 °F depending on the portion of the region. (USGCRP, 2009)

Csa – Temperatures in the Csa region under a low emissions scenario are expected to increase by 3 °F or 4 °F by mid-century depending on the portion of the region. By the end of the century, temperatures are projected to increase 5 °F. (USGCRP, 2009)

Under a high emissions scenario, temperatures in the Csa region are expected to increase 4 °F in the eastern portion of the region and 5 °F in the majority of the region by mid-century. In this scenario by the end of the century, temperatures are expected to increase 7 °F, 8 °F, or 9°F depending on the portion of the region. (USGCRP, 2009)

Csb – Under a low emissions scenario temperatures in the Csb region of California are projected to increase 3 °F on the western coast and 4 °F in the remainder of the region by mid-century. By the end of the century, temperatures are projected to increase 4 °F on the western coast and 5 °F in the remainder of the region. (USGCRP, 2009)

Under a high emissions scenario temperatures in the Csb region are projected to increase 4 °F or 5 °F depending on the portion of the region. By the end of the century, temperatures will increase 6 °F, 7 °F, 8 °F, or 9 °F depending on the area of the region. (USGCRP, 2009)

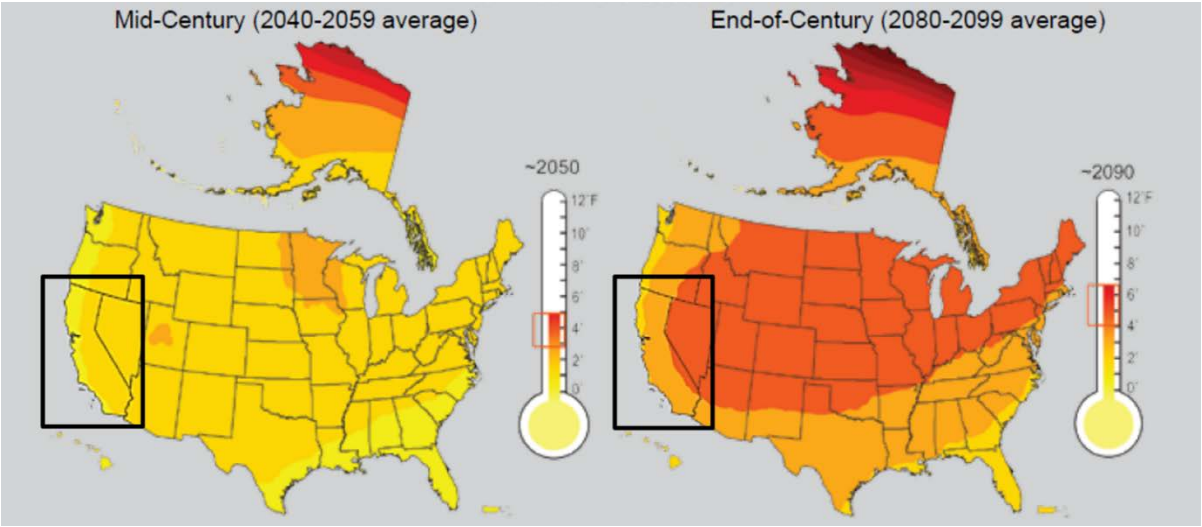


Figure 4.2.14-1: California Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

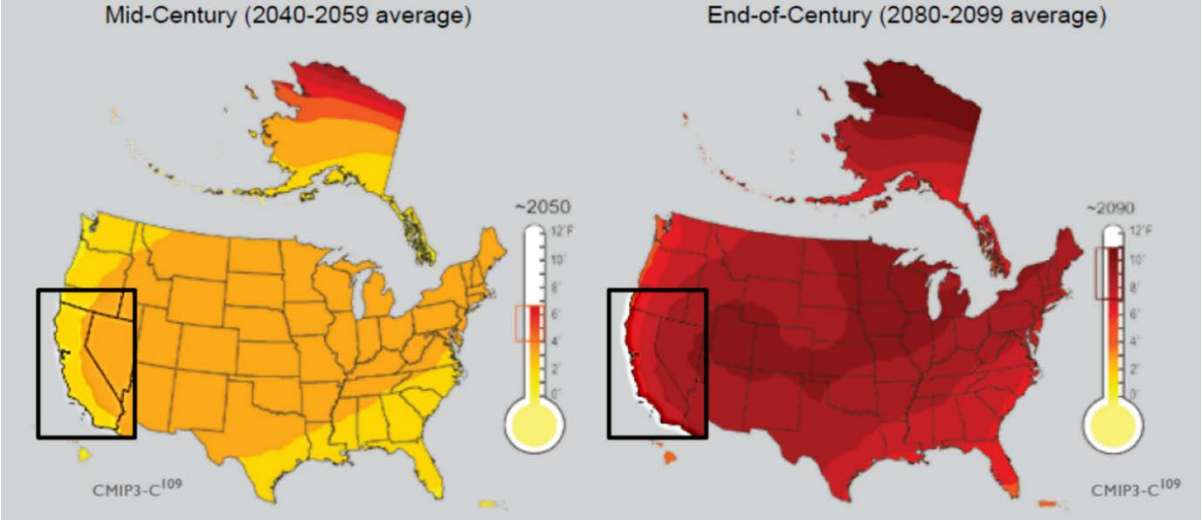


Figure 4.2.14-2: California High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

Precipitation

Projections of precipitation changes are less certain than those for temperature. Under a high emissions scenario, reduced winter and spring precipitation is consistently projected for the southern part of the Southwest by 2100. In the northern part of the region, projected winter, spring, summer and fall precipitation changes are smaller than natural variations. The Southwest is prone to drought, and future droughts are projected to be substantially hotter, and for major river basins such as the Colorado River Basin, drought is projected to become more frequent, intense, and longer lasting. These drought conditions present a huge challenge for water resource management and natural hazards such as wildfire. (USGCRP, 2014a)

Total seasonal snowfall has generally decreased in southern and some western areas although snow is melting earlier in the year and more precipitation is falling as rain versus snow. Overall snow cover has decreased in the Northern Hemisphere, due in part to higher temperatures that shorten the time snow spends on the ground. (USGCRP, 2014c)

In the majority of California under a high emissions scenario, there is an expected 10 percent increase in the number of consecutive dry days by mid-century (2041 to 2070) as compared to the period (1971 – 2000). An increase in consecutive dry days could lead to drought. (USGCRP, 2014b)

Figure 4.2.14-3 and Figure 4.2.14-4 show predicted seasonal precipitation change for an approximate 30-year period of 2071 to 2099 compared to a 1970 to 1999 approximate 30-year baseline. Figure 4.2.14-3 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050. (USGCRP, 2014b)

Figure 4.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. (Note:

white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability.) (USGCRP, 2014b)

Bsk – Figure 4.2.14-3 shows that in a low emissions scenario in the 30-year period for 2071 to 2099, precipitation is expected to remain constant in winter, spring, and summer and fall in the Bsk region of California. (USGCRP, 2014b)

Figure 4.2.14-4 shows that if emissions continue to increase, winter precipitation in the Bsk region could remain constant or increase 20 percent over the period 2071 to 2099 depending on the portion of the region. In spring, precipitation in this scenario will decrease 20 or 30 percent depending on the portion of the region. Summer precipitation will remain constant or increase 10 percent depending on the portion of the region. Fall precipitation is expected to decrease 20 percent. (USGCRP, 2014b)

BWk – Under a low emissions scenario, precipitation in winter, spring, summer and fall is expected to remain constant in the BWk region. (USGCRP, 2014b)

Winter precipitation is expected to remain constant, or increase 10 or 20 percent depending on the portion of the BWk region under a high emissions scenario. Spring precipitation is expected to decrease 20 percent. There are no expected changes in summer precipitation in some areas of the region while other areas are expected to have a 10 percent increase under a high emissions scenario. Fall precipitation is expected to remain constant, or decrease 10 or 20 percent depending on the portion of the region. (USGCRP, 2014b)

BWh – Under a low emissions scenario, precipitation in winter, spring, summer and fall is expected to remain constant in the BWh region of California. (USGCRP, 2014b)

In winter under a high emissions scenario, there are no anticipated changes to precipitation other than natural variability. Spring precipitation is expected to decrease 30 percent. In summer, precipitation is expected to remain constant or increase 10 or 20 percent. Fall precipitation will remain constant or decrease 10 percent depending on the portion of the BWh region. (USGCRP, 2014b)

Csa – Under a low emissions scenario, precipitation is expected to remain constant in spring, summer, and fall. In winter precipitation, may remain constant or may increase 10 percent depending on the portion of the region. (USGCRP, 2014b)

Under a high emissions scenario, winter precipitation is expected to remain constant or increase 20 percent. Spring precipitation will decrease 10, 20, or 30 percent depending on the portion of the region. Summer precipitation is not expected to change other than natural variability. Fall precipitation is expected to remain constant or decrease 10 or 20 percent depending on the portion of the region. (USGCRP, 2014b)

Csb – Precipitation in the Csb region will change at the same rate as the Csa region under a low emissions scenario. (USGCRP, 2014b)

Winter precipitation under a high emissions scenario in the Csb region is expected to remain constant, or increase 10 or 20 percent depending on the portion of the region. In spring, precipitation will decrease 10, 20, or 30 percent. In the Csb region summer precipitation will

vary drastically and is projected to remain constant, increase 10 or 20 percent, or decrease 10 or 20 percent depending on the portion of the region. Fall precipitation will decrease 10 or 20 percent depending on the portion of the region. (USGCRP, 2014b)

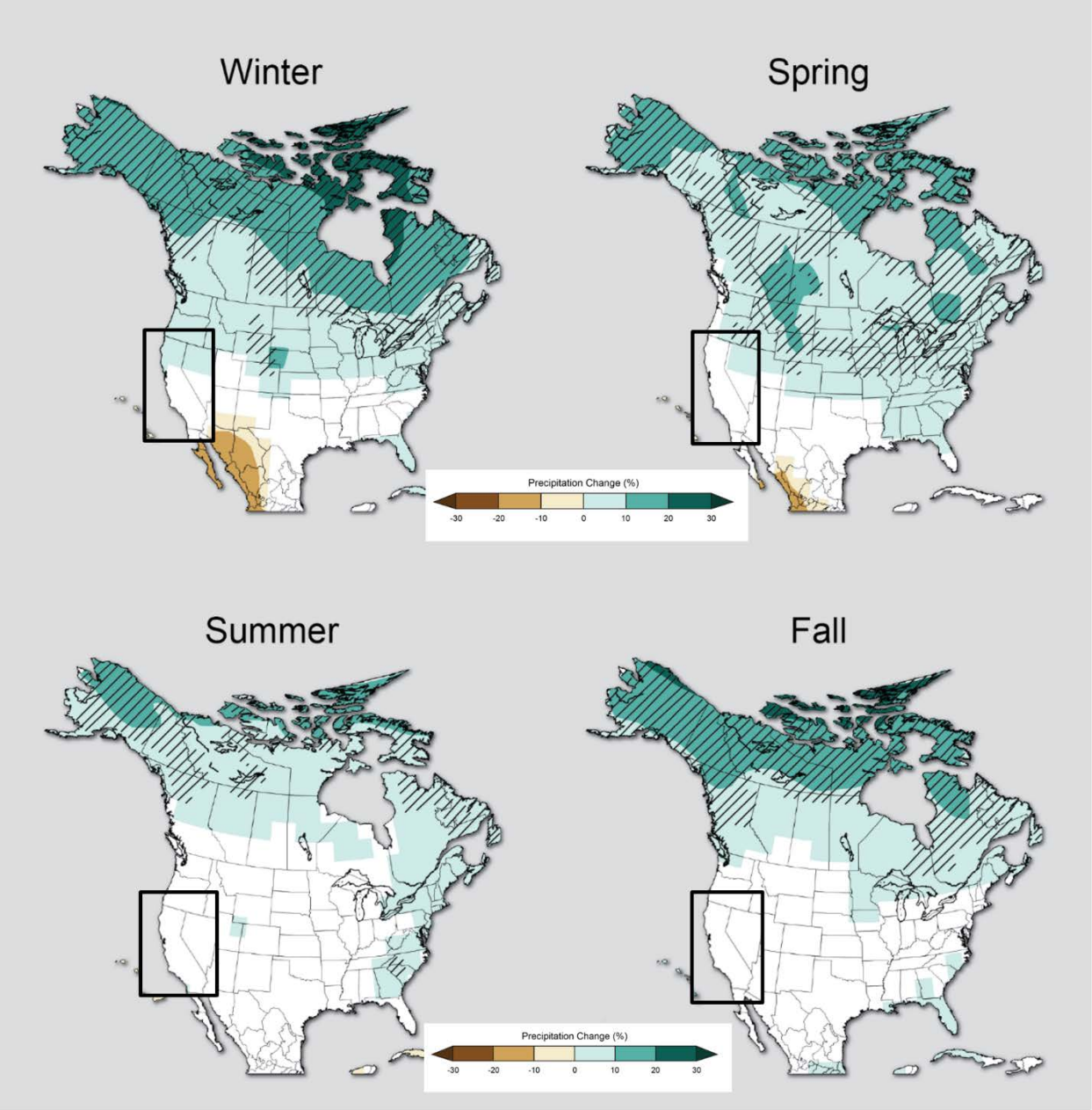


Figure 4.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

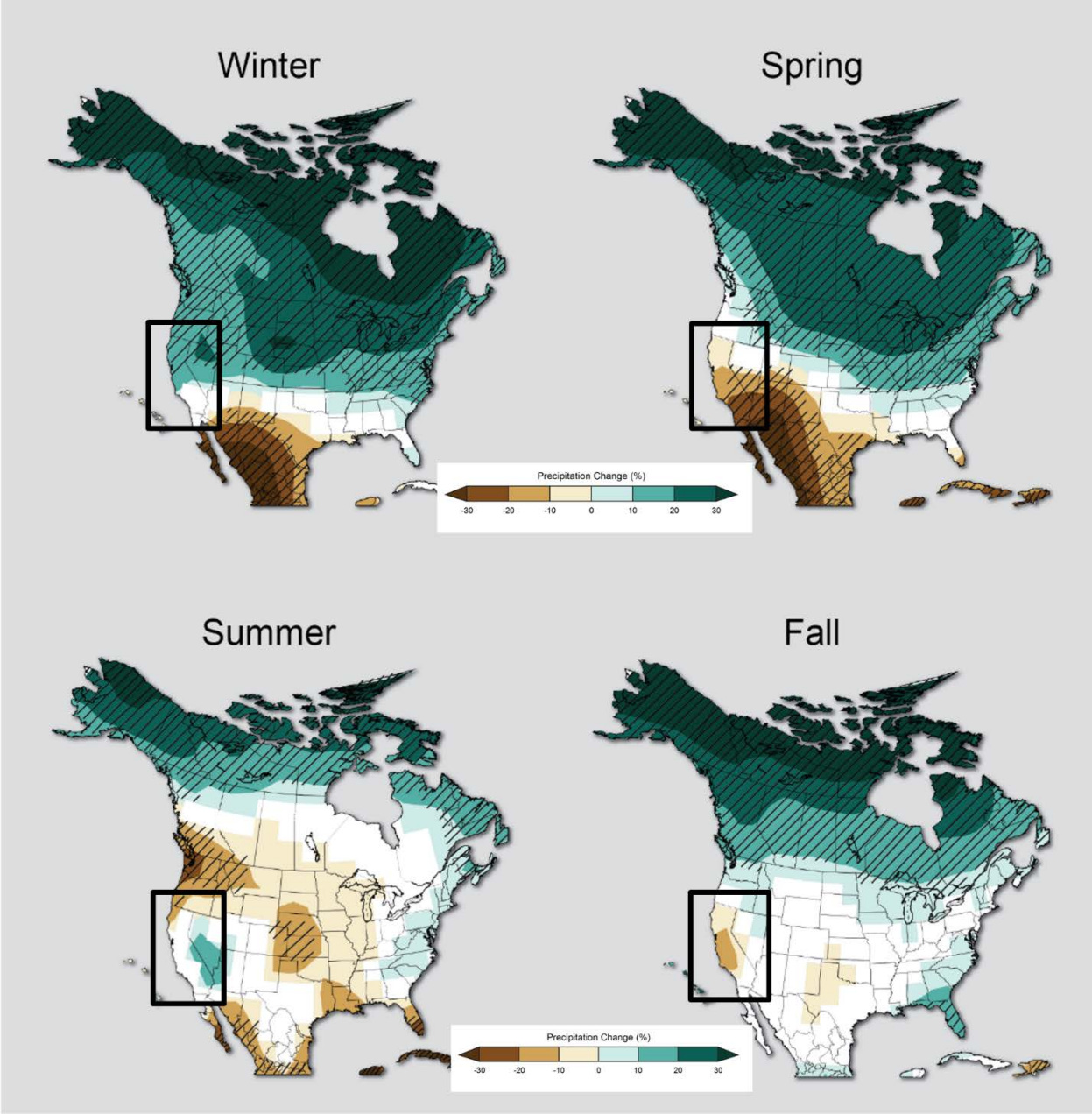


Figure 4.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2014b)

Sea Level

Several factors would continue to affect sea level rise in the future. Glacier melt adds water to the ocean, and increasing ocean temperatures result in thermal expansion. Worldwide, "glaciers have generally shrunk since the 1960s, and the rate at which glaciers are melting has accelerated over the last decade. The loss of ice from glaciers has contributed to the observed rise in sea level" (USEPA, 2012e). When water warms, it also expands, which contributes to sea level rise in the world's oceans. "Several studies have shown that the amount of heat stored in the ocean

has increased substantially since the 1950s." (USEPA, 2012e). Sea level and currents could be influenced by the amount of heat stored in the ocean. (USEPA, 2012e).

The amount of sea level rise would vary in the future along different stretches of the U.S. coastline and under different absolute global sea lever rise scenarios. Variation in sea level rise along different stretches of coast is mostly due to varying rates of land subsidence (also known as relative sea level rise). In the National Climate Assessment (NCA) potential sea level rise scenarios were reported. These scenarios were developed based on varying degrees of ocean warming and ice sheet loss as estimated by organizations like IPCC (NOAA, USGS, SERPD, and USACE, 2012). Figures 4.2.14-5 and 4.2.14-6 show feet of sea level above 1992 levels at different tide gauge stations. Figure 4.2.14-5 shows an 8 inch global sea level rise above 1992 levels by 2050 and Figure 4.2.14-6 shows a 1.24 foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014d).

Csa – Figure 4.2.14-5 presents an 8-inch global average sea level rise above 1992 levels which would result in a 0.7 to 1.0 foot sea level rise in 2050 along the coast of California. Figure 4.2.14-6 indicates that a 1.24-foot sea level rise above 1992 level would result in 1.0 to 1.3 foot sea level rise in 2050 along the Csa region on the coast of Texas. (USGCRP, 2014d)

Csb – An 8-inch global average sea level rise above 1992 levels would result in a 0.3 to 1.0 foot sea level rise in 2050 along the Csb region of California. A 1.24-foot sea level rise above 1992 level would result in a 0.7 to 1.3 foot sea level rise in 2050 along the Csb region on the coast of California. (USGCRP, 2014d)

Bsk, BWh, BWk – These regions of California are not affected by sea level rise.

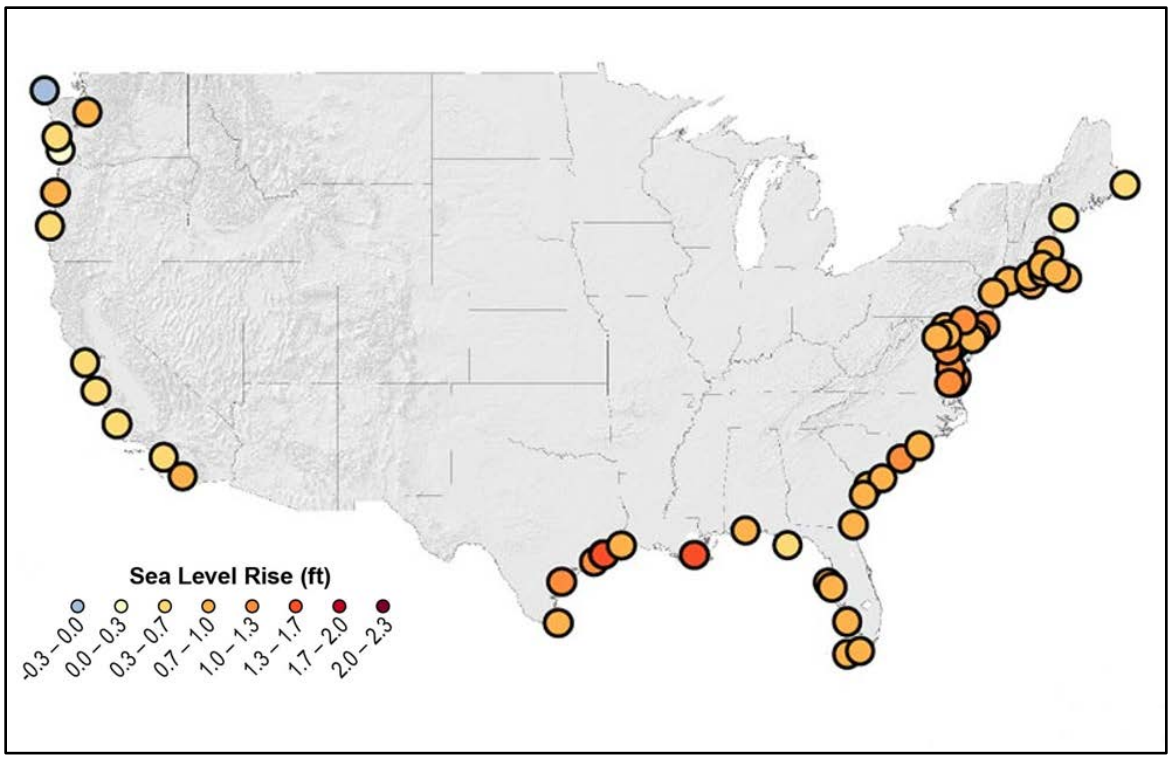


Figure 4.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014d)

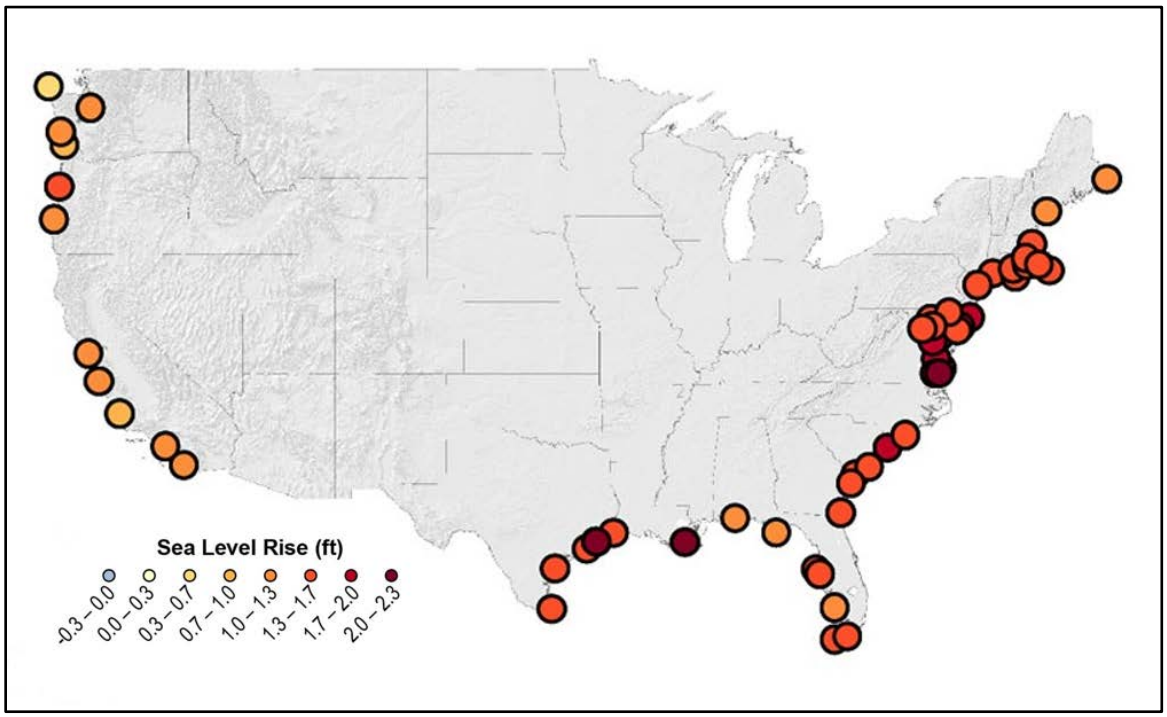


Figure 4.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014d)

Severe Weather Events

It is difficult to forecast the impact of climate change on severe weather events such as thunderstorms and hurricanes. Trends in thunderstorms and hurricanes are subject to greater uncertainties than trends in temperature and associated variables directly related to temperature such as sea level rise. Climate scientists are studying the influences of climate change on severe storms such as hurricanes. Recent research has yielded insights into the connections between warming and factors that cause severe storms. For example, atmospheric instability and increases in wind speed with altitude link warming with tornadoes and thunderstorms. Additionally, research has found a link between warming and conditions favorable for severe thunderstorms. However, more research is required to make definitive links between severe weather events and climate change. (USGCRP, 2014c)

United States coastal waters are expected to experience more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of storms that make landfall) (USGCRP, 2014c). Changes in hurricane intensity are difficult to project because there are contradictory effects at work. Warmer oceans increase storm strength with higher winds and increased precipitation. However, changes in wind speed and direction with height are also projected to increase in some regions; this tends inhibit storm formation and growth. Current research suggests stronger, more rain-producing tropical storms and hurricanes are generally more likely, though such storms may form less frequently; ultimately, more research would provide greater certainty (USGCRP, 2009).

4.2.14.4 Description of Environmental Concerns

Greenhouse Gas Emissions

Increases in GHG emissions have altered the global climate, leading to generalized temperature increases, weather disruption, increased droughts, and heatwaves, and may have potentially catastrophic long-term consequences for the environment. Although GHGs are not yet regulated by the federal government, many states have set various objectives related to reducing GHG emissions, particularly CO_2 emissions from fossil fuels.

Based on the impact significance criteria presented in Table 4.2.14-1, climate change impacts as a result of GHG emissions could be significant and require a quantitative analysis if FirstNet's deployment of technology was responsible for increased emissions of 25,000 MT/year or more. The GHG emissions resulting from FirstNet activities fall into two categories: short-term and long-term. Short-term emissions could be associated with deployment activities (vehicles and other motorized construction equipment) and would have no long-term or permanent impact on GHG emissions or climate change. Long-term (both temporary and permanent) emission increases could result from operations, including the use of grid-provided electricity by FirstNet equipment such as transmitters and optical fiber, and from the temporary use of portable or on-site electric generators (a less efficient, more carbon-intensive source of electricity), during emergency situations when the electric grid was down, for example after a hurricane.

A single large cell tower would typically require 20-60kW of power to operate (Balshe, 2011). The CO_2 emissions associated with the operation of the tower would depend on whether it was supplied by a stand-alone power source, such as a generator, or from the grid, and whether it was operating at full power on a continuous basis. A standard 60kW 3-phase diesel generator consumes approximately 5.0 gallons of diesel per hour (Diesel Service & Supply, 2016). Diesel fuel combustion emits 22.38 lbs of CO_2 per gallon (EIA, 2015d). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity would result in less CO_2 emissions than on-site provided energy. Using the average carbon intensity of grid-provided electricity of 1,136.53 lbs/MWh (USEPA, 2015v), the same transmitter would be responsible for approximately 271 MT of CO_2 per year running continuously. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Vereecken, et al., 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Effects of Climate Change on Project-Related Impacts

Climate change may increase project-related effects by magnifying or otherwise altering impacts in other resources areas. For example climate change may impact air quality, water resource availability, and recreation. These effects would vary from state to state depending on the resources in question and their relationship to climate change. In California, sea level is expected rise approximately 17-66 inches over the next century. The range of uncertainty is reflective of the role played by such factors such as coastal morphology, land subsidence, and uplift as a result of ongoing seismic activity (California Department of Fish and Wildlife, 2015c). Overall, sea level rise is expected to magnify the impacts of coastal storms, including coastal inundation and erosion. It is also anticipated to have ecological effects such as wetlands loss, and saltwater intrusion into freshwater aquifers (California Department of Fish and Wildlife, 2015c).

The severity and length of droughts is expected to increase in California as temperatures rise, mountain snowpack is reduced, and soil moisture decreases. These effects are expected to increase pressure on water resources state-wide (California Department of Water Resources, 2015b) (USGCRP, 2014g), stressing both natural and cultivated ecosystems. This in turn may contribute to more frequent and larger wildland fires as well as increased fuel load in the form of dead trees caused by invasive bark beetles that thrive in stressed forest environments (USGCRP, 2014f) (USFS, 2015c). In addition to threatening or even transforming California's forest ecosystems, wildland fires may present a risk to both permanent and mobile installations as well as to first responders themselves. FirstNet will assess permanent sites on a case-by-case basis for

wildland fire risk, and consider the risk to mobile sites during the deployment of FirstNet installations during emergency events.

Climate change may expose areas of California to longer and more intense heat waves (USGCRP, 2014e). Projections show numbers of days over 95° F doubling in some locations across the state between 2050 and 2099 under a high emissions scenario, with negative consequences for public health and the environment (State of California, 2013).

Impact of Climate Change on FirstNet Installations and Infrastructure

Climate change impacts on FirstNet installations and infrastructure will vary from state to state, depending on the placement and vulnerability of the installations and infrastructure, and the impacts that climate change is anticipated to have in that particular location. For areas of California at risk for flooding, climate change is projected to increase the frequency and severity of torrential downpours which in turn may increase the potential for flash floods (USGCRP, 2014e) including an extended and more intense flood hazard season in California (Dettinger, 2011). Extended periods of extreme heat may increase general demand on the electric grid, impeding its operation. In addition, with reduced winter snowpack contributing to reservoirs, the ability of California's extensive hydropower operations to meet demand may be reduced, placing stress on California's overall electrical infrastructure (DOE, 2015). FirstNet will ensure that installations and infrastructure has the necessary stand-by generators and cooling capacity to continue operations independent of the grid.

Based on the impact significance criteria presented in Table 4.2.14-1, climate change effects on FirstNet installations and infrastructure would be significant if they negatively affected the operation of these facilities.

4.2.14.5 Potential Impacts of the Preferred Alternative

Greenhouse Gas Emissions

The following section assesses potential GHG emission impacts associated with implementation of the Preferred Alternative in California, including deployment and operation activities.

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment and operation of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to GHG emissions, climate impacts in other resource areas, and FirstNet infrastructure and operations, and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to climate change under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions. This would create no perceptible change in GHG emissions.
- Satellites and Other Technologies
  - Distribution of Satellite Enabled Devices and Equipment: The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create any perceptible changes in GHG emissions because they would not create any new emissions sources.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

Activities with the Potential to Have Impacts

The deployment and use of energy-consuming equipment as a result of the implementation of the Preferred Alternative would result in GHG emissions whose significance would vary depending on their power requirements, duration, and intensity of use, and number. The types of infrastructure deployment scenarios that could be part of the Preferred Alternative and result in potential impacts to GHG emissions and climate change include the following:

- Wired Projects
  - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
  - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
  - Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with

these projects would arise from use of machinery and vehicles to complete these activities.

- New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small marine sources would contribute to GHGs.
- Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.

- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with construction, as it would not occur. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
- Deployable Technologies
  - COWs, COLTs, or SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However, this would be highly dependent on their size, number, and the frequency and duration of their use.
  - Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of piloted or unmanned aircraft were used for a sustained period of time (i.e., months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementing the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be less than significant due to the limited and localized nature of deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could be potentially significant to less than significant with BMPs and mitigation measures incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. FirstNet installations should be evaluated in the design and planning phase through tiering to this analysis, in the context of their local geography and anticipated climate hazards to ensure they are properly hardened or there is sufficient redundancy to continue operations in a climate-affected environment. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would likely prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

4.2.14.6 Alternatives Impact Assessment

The following section assesses potential impacts to climate associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operations Impacts

Implementing land-based deployable technologies (COW, COLT, and SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant due to the temporary nature of the operation of deployables. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. These activities are expected to be less than significant due the limited duration of deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

Climate change effects have the most noticeable impacts over a long period. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to GHG emissions or climate as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.14, Climate Change.

4.2.15 Human Health and Safety

4.2.15.1 Introduction

This section describes potential impacts to human health and safety in California associated with deployment of the Proposed Action and Alternatives. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.15.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on human health and safety were evaluated using the significance criteria presented in Table 4.2.15-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to human health and safety addressed in this section are presented as a range of possible impacts.

Table 4.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And Man-Made Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

NA = Not Applicable

4.2.15.3 Description of Environmental Concerns

Worksite Physical Hazards, Hazardous Materials, and Hazardous Waste

The human health and safety concern having the greatest likelihood to occur during FirstNet deployment activities is occupational injury to telecommunication workers. The nature of telecommunication work requires workers to execute job responsibilities that are inherently dangerous. Telecommunication work activities present physical and chemical hazards to workers. The physical hazards have the potential to cause acute injury, long-term disabilities, or in the most extreme incidents, death. Other occupational activities such as handling hazardous materials and hazardous waste often do not result in acute injuries, but may compound over multiple exposures, resulting in increased morbidity. Based on the impact significance criteria presented in Table 4.2.15-1, occupational injury impacts could be potentially significant if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites

To protect occupational workers, OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2016c).

1.) Engineering controls;

2.) Work practice controls;

3.) Administrative controls; and then

4.) Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes,[218] chain locks, bollards, storage containers (for storing equipment and chemicals), or signage and caution tape. Other forms of engineering controls could include machinery designed to manipulate the quality of the work environment, such as ventilation blowers. Whenever practical, engineering controls may result in the complete removal of the hazard from the work site, an example of which would be the transport and offsite disposal of hazardous waste or asbestos containing materials.

[218] Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents. (OSHA, 2016c)

Work practice controls could be implemented as abiding by specific OSHA industry standards, such as the Confined Space Entry standard (29 CFR 1910.146) or thru the development of employer specific workplace rules and operational practices (OSHA, 2016c). To the extent practicable, FirstNet partner(s) would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets (SDS) describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all FirstNet project sites. In addition to HASPs and SDSs, standard operating procedures (SOP) would be developed and implemented by FirstNet partner(s) for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear step-wise directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (OSHA, 2016c). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks, and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE is the common term used to refer to the equipment worn by employees to minimize exposure to chemical and physical hazards. Examples of PPE include gloves, protective footwear, eye protection, protective hearing devices (earplugs, muffs), hard hats, fall protection, respirators, and full body suits. PPE is the last line of defense to prevent occupational injuries and exposure. (OSHA, 2016c)

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination and mine lands at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed as a result of site activities. Mines may cause unstable surface and subsurface conditions because of underground shaft collapses or seismic shifting. Based on the impact significance criteria presented in Table 4.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties or abandoned or active mine lands. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination and/or mining activities using federal resources such as the USEPA Cleanups in My Community database and U.S. Department of Interior's Abandoned Mine Lands inventory, through the California Department of Conservation, or through an equivalent commercial resource.

By screening sites for environmental contamination, mining activities, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination or mining activities, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination (or mine lands) are selected for FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, Superfund, and applicable California state laws in order to protect workers and the general public from direct exposure or fugitive contamination.

Exposure assessments identify relevant site characteristics, temporal exposure parameters, and toxicity data to determine the likelihood of adverse health effects. More formally known as a human health risk assessment (HHRA), these studies provide mathematical justification for implementing controls at the site to protect human health. If the HHRA determines the potential for adverse health effects is too great the California Department of Environmental Protection may require FirstNet to perform environmental clean-up actions at the site to lower the existing levels of contamination. HHRAs help determine which level of PPE (i.e., Level D, Level C, Level B, or Level A) is necessary for a work activity. HHRAs take into account all exposure pathways: absorption, ingestion, inhalation, and injection. Therefore, specific protective measures (e.g., controls and PPE) that disrupt the exposure pathways could be identified, prioritized, and implemented.

Natural and Manmade Disasters

The impacts of natural and manmade disasters are likely to present unique health and safety hazards, as well as exacerbate pre-existing hazards, such as degrading occupational work conditions and disturbing existing environmental contamination. The unique hazards presented by natural and manmade disasters may include, fire, weather incidents (e.g., floods, tornadoes, hurricanes, etc.), earthquakes, vandalism, large- or small-scale chemical releases, utility disruption, community evacuations, or any other event that abruptly and drastically denudes the availability or quality of transportation infrastructure, utility infrastructure, medical infrastructure, and sanitation infrastructure. Additionally, such natural and manmade disasters could directly impact public safety communication infrastructure assets through damage or destruction.

Based on the impact significance criteria presented in Table 4.2.15-1, human health impacts could be significant if FirstNet deployment sites are located in areas that are directly impacted by natural and manmade disasters that could lead to exposure to hazardous wastes, hazardous materials, and occupational hazards. FirstNet's emphasis on public safety-grade communications infrastructure may result in a less than significant beneficial impact, as new infrastructure could be deployed with additional structural hardening, and existing infrastructure may also be hardened as appropriate and feasible, in an effort to reduce the possibility of infrastructure damage or destruction to some degree.

Potential mitigation measures for natural disasters include an awareness of current weather forecasts, forest fire activities, seismic activities, and other news worthy events that may indicate upcoming disaster conditions. Awareness provides time and opportunity to plan evacuation routes, to relocate critical equipment and parts, and to schedule appropriate work activities preceding and after the natural disaster. These mitigation steps reduce the presence of workers and dangerous work activities to reduce the potential for injury or death. Manmade disasters could be more difficult to anticipate due to the unexpected or accidental nature of the disaster. Though some manmade disasters are due to malicious intentions, many manmade disasters result from human error or equipment failure. The incidence of manmade disasters affecting FirstNet deployment sites would be difficult to predict and diminish because the source of such disasters is most likely to originate from sources independent of FirstNet activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.15.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and maintenance activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to human health and safety and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant with mitigation, depending on the deployment scenario or site-specific activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to human health and safety under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: the pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to human health and safety because there would be no ground disturbance or heavy equipment used.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact human health and safety resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
  - New Build - Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in limited nearshore and inland bodies of water requires workers to operate over aquatic and/or marine environments, which presents opportunities for drowning. When working over water, exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shores or the banks of waterbodies that accept submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation

lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance in land-based deployables occur in unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, and environmental contamination), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure, and release of hazardous chemicals and hazardous waste, and release of historic contamination to the surrounding environment. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be less than significant impacts to human health and safety associated with routine inspections of the Preferred Alternative. Use of PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents, and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.15.5 Alternatives Impact Assessment

The following section assesses potential impacts to human health and safety associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable land-based infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to human health and safety as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source is an electrical generator, then there would also likely be a need to manage hazardous materials (fuel) onsite. These activities could result in less than significant impacts to human health and safety. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to human health and safety associated with routine inspections of the Preferred Alternative. Use of PPE or other mitigation measures may be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. These impacts would be less than significant because of the small-scale of likely FirstNet activities; activities associated would routine maintenance, inspection, and deployment of deployable technologies would be temporary and often of limited duration. Chapter 9, BMPs

and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to human health and safety as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.15, Human Health and Safety.

CA APPENDIX A – WATER RESOURCES

Table A-1: California Federal Wild, Scenic, and Recreational Rivers

River Name	River Description	Designation
Amargosa River	March 30, 2009. From the northern boundary of Section 7, Township 21 North, Range 7 East to 100 feet upstream of the Tecopa Hot Springs Road crossing. From 100 feet downstream of the Tecopa Hot Springs Road crossing to 100 feet upstream of the Old Spanish Trail Highway crossing near Tecopa. From the northern boundary of Section 16, Township 20 North, Range 7 East to 100 feet upstream of the Dumont Dunes Access Road crossing in Section 32, Township 19 North, Range 7 East. From 100 feet downstream of the Dumont Dunes Access Road for the next 1.4 miles.	Wild — 7.9 miles; Scenic — 12.1 miles; Recreational — 6.3 miles
American River (Lower)	January 19, 1981. From the confluence with the Sacramento River to the Nimbus Dam.	Recreational — 23.0 miles
American River (North Fork)	November 10, 1978. From a point 0.3 miles above Heath Springs downstream to a point 1,000 feet upstream of the Colfax-Iowa Hill Bridge.	Wild — 38.3 miles
Bautista Creek	March 30, 2009. From the San Bernardino National Forest boundary in Section 36, Township 6 South, Range 2 East to the San Bernardino National Forest boundary in Section 2, Township 6 South, Range 1 East.	Recreational — 9.8 miles
Big Sur River	June 19, 1992. From the confluence of the South and North Forks downstream to the boundary of the Ventana Wilderness. The South Fork and the North Fork from their headwaters to their confluence.	Wild — 19.5 miles
Black Butte River	October 17, 2006. The segment from the Mendocino County line to its confluence with the Middle Eel River and Cold Creek from the Mendocino County line to its confluence with the Black Butte River.	Wild — 17.5 miles; Scenic — 3.5 miles
Cottonwood Creek	March 30, 2009. From its headwaters at the spring in Section 27, Township 4 South, Range 34 East to the northern boundary of Sec. 5, Township 4 South, Range 34 East.	Wild — 17.4 miles; Recreational — 4.1 miles
Eel River	January 19, 1981. From the mouth of the river to 100 yards below Van Ardsdale Dam. The Middle Fork from its confluence with the main stem to the southern boundary of the Yolla Bolly Wilderness Area. The South Fork from its confluence with the main stem to the Section Four Creek confluence. The North Fork from its confluence with the main stem to Old Gilman Ranch. The Van Duzen River from the confluence with the Eel River to Dinsmure Bridge.	Wild — 97.0 miles; Scenic — 28.0 miles; Recreational — 273.0
Feather River	October 2, 1968. The entire Middle Fork downstream from the confluence of its tributary streams one kilometer south of Beckwourth, California.	Wild — 32.9 miles; Scenic — 9.7 miles; Recreational — 35.0 miles
Fuller Mill Creek	March 30, 2009. From the source of Fuller Mill Creek in the San Jacinto Wilderness to its confluence with the North Fork San Jacinto River.	Scenic — 2.6 miles; Recreational — 0.9 miles
Kern River	November 24, 1987. The North Fork from the Tulare-Kern County line to its headwaters in Sequoia National Park. The South Fork from its headwaters in the Inyo National Forest to the southern boundary of the Domelands Wilderness in the Sequoia National Forest.	Wild — 123.1 miles; Scenic — 7.0 miles;

River Name	River Description	Designation
		Recreational — 20.9 miles
Kings River	November 3, 1987. From the confluence of the Middle Fork and the South Fork to the point at elevation 1,595 feet above mean sea level. The Middle Fork from its headwaters at Lake Helen to its confluence with the main stem. The South Fork from its headwaters at Lake 11599 to its confluence with the main stem.	Wild — 65.5 miles; Recreational — 15.5 miles
Klamath River	January 19, 1981. From the mouth to 3,600 feet below Iron Gate Dam. The Salmon River from its confluence with the Klamath to the confluence of the North and South Forks of the Salmon River. The North Fork of the Salmon River from the Salmon River confluence to the southern boundary of the Marble Mountain Wilderness Area. The South Fork of the Salmon River from the Salmon River confluence to the Cecilville Bridge. The Scott River from its confluence with the Klamath to its confluence with Schackleford Creek. All of Wooley Creek.	Wild — 11.7 miles; Scenic — 23.5 miles; Recreational — 250.8
Merced River	November 2, 1987 and October 23, 1992. From its source (including Red Peak Fork, Merced Peak Fork, Triple Peak Fork, and Lyle Fork) in Yosemite National Park to a the normal maximum operating pool (water surface level) of Lake McClure (elevation 867 feet mean sea level). The South Fork from its source in Yosemite National Park to the confluence with the main stem.	Wild — 71.0 miles; Scenic — 16.0 miles; Recreational — 35.5 miles
Owens River Headwaters	March 30, 2009. Deadman Creek from the two-forked source east of San Joaquin Peak to 100 feet upstream of Big Springs. The upper Owens River from 100 feet upstream of Big Springs to the private property boundary in Section 19, Township 2 South, Range 28 East. Glass Creek from its two-forked source to its confluence with Deadman Creek.	Wild — 6.3 miles; Scenic — 6.6 miles; Recreational — 6.2 miles
Palm Canyon Creek	March 30, 2009. From the southern boundary of Section 6, Township 7 South, Range 5 East to the San Bernardino National Forest boundary in Section 1, Township 6 South, Range 4 East.	Wild — 8.1 miles
Piru Creek	March 30, 2009. From 0.5 miles downstream of Pyramid Dam at the first bridge crossing to the boundary between Los Angeles and Ventura Counties.	Wild — 4.3 miles; Recreational — 3.0 miles
San Jacinto River (North Fork)	March 30, 2009. From the source of the North Fork San Jacinto River at Deer Springs in Mt. San Jacinto State Park to the northern boundary of Section 17, Township 5 South, Range 2 East.	Wild — 7.2 miles; Scenic — 2.3 miles; Recreational — 0.7 miles
Sespe Creek	June 19, 1992. The main stem from its confluence with Rock Creek and Howard Creek downstream to where it leaves Section 26, Township 5 North, Range 20 West.	Wild — 27.5 miles; Scenic — 4.0 mile
Sisquoc River	June 19, 1992. From its origin downstream to the Los Padres National Forest boundary.	Wild — 33.0 miles;
Smith River	January 19, 1981 and November 16, 1990. The segment from the confluence of the Middle Fork Smith River and the North South Fork Smith River to its mouth at the Pacific Ocean, including Rowdy Creek, Mill Creek, West Branch Mill Creek, East Fork Mill Creek, Bummer Lake Creek, Dominie Creek, Savoy Creek and Little Mill Creek. The Middle Fork from its the headwaters to its confluence with the North Fork Smith River, including Myrtle Creek, Shelly Creek, Kelly Creek, Packsaddle Creek, the East Fork of Patrick Creek, the West Fork Patrick Creek, Little Jones Creek, Griffin Creek, Knopki Creek, Monkey Creek, Patrick Creek, and	Wild — 78.0 miles; Scenic — 31.0 miles; Recreational — 216.4 miles

River Name	River Description	Designation
	Hardscrabble Creek. The Siskiyou Fork from its headwaters to its confluence with the Middle Fork, including the South Siskyou Fork of the Smith River. The South Fork from its headwaters to its confluence with the main stem, including Williams Creek, Eightmile Creek, Harrington Creek, Prescott Fork, Quartz Creek, Jones Creek, Hurdygurdy Creek, Gordon Creek, Coon Creek, Craigs Creek, Goose Creek, the East Fork of Goose Creek, Buck Creek, Muzzleloader Creek, Canthook Creek, Rock Creek, and Blackhawk Creek. The North Fork from the California-Oregon border to its confluence with the Middle Fork of the Smith River, including Diamond Creek, Bear Creek, Still Creek, the North Fork of Diamond Creek, High Plateau Creek, Stony Creek, and Peridotite Creek.	
Trinity River	January 19, 1981. From the confluence with the Klamath River to 100 yards below Lewiston Dam. The North Fork from the Trinity River confluence to the southern boundary of the Salmon-Trinity Primitive Area. The South Fork from the Trinity River confluence to the California State Highway 36 bridge crossing. The New River from the Trinity River confluence to the Salmon-Trinity Primitive Area.	Wild — 44.0 miles; Scenic — 39.0 miles; Recreational — 120.0 miles
Tuolumne River	September 28, 1984. The main stem from its source to the Don Pedro Reservoir.	Wild — 47.0 miles; Scenic — 23.0 miles; Recreational — 13.0 miles

Source: (National Wild and Scenic Rivers System, 2015c)

CA APPENDIX B – COMMUNITIES OF CONCERN

Table B-1: S1 Ranked Terrestrial Communities of Concern in California

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Pacific Silver Fir Forest	Klamath Mountains	This community is mainly found in the western Cascades and Olympic Mountains at middle elevations typically on moderate to steep slopes with south- to west-facing aspects and well-drained soils.	Pacific silver fir is commonly found in southeastern Alaska, in coastal British Columbia and Vancouver Island, and in the Cascade Range in Washington and Oregon. It also grows at a few locations in the Klamath Mountains of northwestern California.
Elephant Tree Stands	Sonoran Basin and Range/Southern California/Northern Baja Coast	Elephant trees grow as individuals or in small stands with shrubs. The canopy layer in this community is open and emergent. The trees grow in soils that are sandy or rocky.	Occurs in washes, gravelly plains, fans, steep south-facing slopes in the Sonoran Desert.
Santa Cruz Cypress Groves	Coast Range	Consists of granitic and sandstone ridges, and outcrops. The nutrient-deficient soils in this vegetative community are deep to shallow, well-drained gravels and sands.	Occurs in the mountain range south of San Francisco to Santa Cruz
Monterey Pygmy Cypress Stands	Coast Range/Central California Foothills and Coastal Mountains	Characterized by maritime terraces. The soils in this community are sandstone derived, acid, sterile, poorly drained with iron hardpans.	Occurs south of Santa Cruz to Salinas along the central coast.
Monterey Cypress Stands	Central California Foothills and Coastal Mountains	Distinguished by headlands and sheltered areas near the coast. Soils are granitic derived.	Occurs along the coastline south of Salinas.
Alaska Yellow-Cedar Stands	Klamath Mountains/California High North Coast Range/Eastern Cascades Slopes and Foothills/Cascades	Steep, north-facing slopes near ridgelines and lake borders characterize this community. Soils derived from granitic or serpentine substrates.	Occurs in Northern California near the Oregon border in the Klamath Mountains and southern portion of the Eastern Cascade region.

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Cuyamaca cypress stands	Southern California/Northern Baja Coast/Southern California Mountains/Sonoran Basin and Range	Characterized by uplands and riparian zones. The grabbro-derived soils are deep.	Occurs in Southern California east of the cities of Oceanside and San Diego.
Hind's Walnut and Related Stands	Central California Foothills and Coastal Mountains/Central California Valley	Intermittently flooded or saturated riparian corridors; floodplains, stream banks, and terraces. Soils are alluvial.	Occurs mainly in the Central California Valley from Chico to Bakersfield.
Monterey Pine Forest	Coast Range/Central California Foothills and Coastal Mountains	Consist of maritime terraces, headlands. Soils are well drained.	Extends from south of the Bay Area to San Luis Obispo.
Torrey Pine Stands	Central California Foothills and Coastal Mountains/Southern California Mountains/Southern California/Northern Baja Coast	Characterized by coastal bluffs, maritime terraces, slopes. Soils are sandstone or diatomaceous derived.	Occurs along the Central and Southern California coastline from Santa Maria/Lompoc to San Diego.
Burton Mesa Chaparral	Central California Foothills and Coastal Mountains/Southern California Mountains	The community consists of uplands, mesas, low hills, stabilized dunes. Soils are derived from Pleistocene sand deposits, occasionally marine siltstones overlain with a thin sand layer.	Occurs along Santa Barbara/Lompoc coastline.
Baker Manzanita Stands	Central California Foothills and Coastal Mountains/Coast Range	Occurs on upper slopes, flats, and ridges. Soils are usually shallow loams underlain by serpentine bedrock.	Occurs along the coastline north in Marin, Sonoma, and Mendocino Counties.
Monterey Manzanita Chaparral	Central California Foothills and Coastal Mountains	Sandstone outcrops, mesas, slopes. Soils are thin to deep, excessively drained, loams derived from old sand dunes and soft weathered sandstones.	Stands occur in the Central California Coast on Bureau of Land Management lands at Fort Ord Military Reservation, at Jacks Peak and Toro county parks, and at nearby areas.
Morro Manzanita Chaparral	Central California Foothills and Coastal Mountains	A shrub community consisting of uplands and stabilized sand dunes. Soils are deep, excessively drained, loams derived from old sand dunes.	Occurs along the Central California coast, including stands in Montaña de Oro State Park.

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Ione Manzanita Chaparral	Central California Valley/Central California Foothills and Coastal Mountains	Shrub community in low hills where soils are coarse, very acidic, and nutrient-poor with cement-like with yellow crusts of iron oxide	Stands occur over a 9500-hectare acre area in western Amador County and a very small portion of Calaveras County.
Pajaro Manzanita Chaparral	Central California Foothills and Coastal Mountains	Shrub layer that covers sandstone outcrops. Soils are deep, excessively drained, loams derived from old sand dunes and soft weathered sandstones.	Stands are restricted to the Pajaro Hills between the towns of Pajaro and Prunedale in northern Monterey County; stands also occur in an area owned by the Elkhorn Slough Land Conservancy.
Sandmat Manzanita Chaparral	Central California Foothills and Coastal Mountains	Shrub that is known to have stabilized sand dunes. Soils are thin to deep, excessively drained, loams derived from old sand dunes.	Stands occur in the Central California Coast, specifically at Fort Ord Military Reservation on Bureau of Land Management lands.
Silverleaf Manzanita Chaparral	Coast Range	A shrub that occupies sandstone outcrops and sands.	Stands occupy sandstone substrates and old marine sand deposits known as the Sandhills in the Santa Cruz Mountains. Stands also sampled at Bonny Doon Ecological Reserve and Quail Hollow County Park on west-facing upper slopes and ridgelines.
Crucifixion thorn stands	Sonoran Basin and Range/Southern California/Northern Baja Coast	Occupies plains, alluvial bottom lands, sand fields; rarely on rocky slopes. Soils are fine-textured silts and sands.	Occurs in Mojave, Sonoran, and Colorado deserts.

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Crown-of-thorn stands	Sonoran Basin and Range	Occurs in shrub canopies in washes and rocky slopes with desert pavement. Soils are coarse sands.	Occurs mainly in the Sonoran desert.
Foothill Palo Verde Desert Scrub	Sonoran Basin and Range	Shrub community that consists of metavolcanic and sedimentary outcrops, mesas, foothill slopes, and washes. Soils are thin, often with a caliche layer.	Stands reach their westernmost limit in the vicinity of the Whipple Mountains in the Parker Dam area, which is the easternmost part of California.
Sonoran Live Oak Scrub	Sonoran Basin and Range	This community occurs in intermittently flooded canyons and adjacent slopes. Soils are coarse to medium textured sands and loams derived from granitic substrates among boulders and bedrock surfaces.	Stands occur in the New York Mountains; the nearest stands to the east are in the Newberry Mountains at the California/Nevada line.
Hall's Shrubby Spurge Patches	Sonoran Basin and Range	Washes surrounded by uplands with desert pavement.	Stands occur on northerly slopes and washes in the Sonoran Desert and southernmost Mojave Desert.

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Indian Rice Grass Grassland	Central California Foothills and Coastal Mountains/Sierra Nevada/Central Basin and Range/Sonoran Basin and Range	An herbaceous shrub community that occurs in all topographic locations. Soils are sandy with many derived from aeolian deposits.	The community occurs across most topographic regions in California including: the Great Valley, where stands occur at the Monocline Ridge area of western Fresno County; the Mojave Desert, where stands occur in sandy areas such as the Devil's Playground; the Northwestern Basin and Range, where stands occur on the Madeline Plain north of Honey Lake and in Surprise Valley; the Sierra Nevada Mountains, where stands are found on rocky ridges at alpine elevations near Carson Pass; and the Southeastern Great Basin, where stands are found at the Eureka Dunes and adjacent areas in the Coso and Inyo mountains.

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Fountain Thistle Seeps	Coast Range/Central California Foothills and Coastal Mountains	Occupies habitats consisting of seeps, springs, or drainages along slopes influenced by runoff of adjacent seeps. Soils are derived from serpentine substrates.	Stands occur at Coyote Creek Golf Course, below Almaden Calero Canal, near Calero Reservoir, in western Santa Teresa Hills, and along Mount Umunhum Road. Stands also occur in the vicinity of Crystal Springs Reservoir in San Mateo and San Luis Obispo Counties. Multiple small colonies occur at Camp San Luis Obispo, Irish Hills Natural Reserve, Pennington Creek in the El Chorro Biological Reserve, Froom Ranch, Laguna Lake, and San Bernardo Creek. Within the Central California Coast Ranges, stands occur in Santa Clara County in serpentine seeps at the base of the Hamilton Range.

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Three-Way Sedge Meadows	Klamath Mountains/Sierra Nevada	A community that occupies wet meadows in basin fens, shallow depressions, margins of lakes, ponds, streams. Soils may be peaty.	Grows in the Klamath Mountains, Sierra Nevada, and Southern Cascades. Known stands occur in a basin fen in Lassen National Forest at Domingo Lake, and in fens on gabbroic substrate at Cedar Basin RNA in Shasta Trinity National Forest.
Pacific Bog Sedge Meadows	Central California Foothills and Coastal Mountains/Sierra Nevada	Community occurs in extreme rich fens from montane to alpine sites. Soils may peaty.	Known to occur at nutrient-rich fens in the Convict Creek drainage in the Sierra Nevada.
Desert Panic Grass Patches	Sierra Nevada/Sonoran Basin and Range/Central Basin and Range	This community occurs on active to partially stabilized dunes and sand fields.	Community occurs in the Colorado Desert at the Algodones Dunes, and they likely also occur in other sandy areas in the Coachella Valley; in the Mojave Desert in stands at Kelso Dunes and Devil's Playground; and in the Southeastern Great Basin in stands at the Eureka Dunes.

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Alkali Cordgrass Marsh	Sierra Nevada/Northern Basin and Range/Central Basin and Range	Moist, poorly drained, often alkaline areas along ephemeral, intermittent, or perennial streams, as well as swales, meadows, and margins of marshes and ponds.	Known to occur in the Mojave Desert at Owens Lake, in Mono County at stands along the Owens River at Fish Slough, in the Northwestern Basin and Range in stands at Middle Alkali Lake, and in the Southeastern Great Basin, where stands exist in Deep Springs Valley.
Patches of Eureka Valley Dune Grass	Central Basin and Range	This community occurs in sand dunes.	Known to occur in the Southeastern Great Basin.

Note: Natural community descriptions for "Lake – Deep, Soft, Drainage" and "Lake – Meromictic" were not available.
% = percent, in. = inches, ft. = feet

Sources: (CNPS 2015)

Table B-2: Essential Fish Habitat Offshore of California

Common Name	Eggs	Larvae/YOY[219]	Juveniles	Adults
Albacore Tuna	None	None	Oceanic, epipelagic waters beyond the 100fm isobath.	Oceanic, epipelagic waters beyond the 100fm isobath.
Bigeye Tuna	None	None	Beyond the 200 fm isobath out to the EEZ boundary from Mexico border to Monterey Bay.	Beyond the 200 fm isobath out to the EEZ boundary from Mexico border to Monterey Bay.
Northern Bluefin Tuna	None	None	Oceanic, epipelagic waters beyond the 100fm isobath.	None

[219] YOY (Young of the year): "All of the fish of a species that were born in the past year, from transformation to juvenile until January 1" (USEPA, 2015x).

Common Name	Eggs	Larvae/YOY[219]	Juveniles	Adults
Skipjack Tuna	None	None	None	Beyond the 400 fm isobaths out to the EEZ boundary; From the Mexico border north to Point conception CA.
Yellowfin Tuna	None	None	Between the 100fm isobaths out to EEZ boundary; from the Mexico border north to Monterey Bay.	None
Striped Marlin	None	None	None	Epipelagic waters of the Southern California Bight. From Mexico border to east of Santa-Rosa-Cortes Ridge.
Chinook Salmon	None	None	Marine populations for this life state are found in estuarine areas and from the mean higher tide line to the 200 nm-limit	Marine populations for this life state are found in estuarine areas and from the mean higher tide line to the 200 nm-limit
Coho Salmon	None	None	Marine populations for this life state are found in estuarine areas and from the mean higher tide line to the 200 nm limit.	Marine populations for this life state are found in estuarine areas and from the mean higher tide line to the 200 nm-limit
Krill (Euphausia pacifica, Thysanoessa spinifera, and other krill species)	None	Shoreline to 500 fm isobaths (E. pacifica) to 1000fm isobaths (all other krill); from the surface to 100 m deep (E. pacifica) to 400 m deep (all other krill)	Shoreline to 500 fm isobaths (E. pacifica) to 1000fm isobaths (all other krill); from the surface to 100 m deep (E. pacifica) to 400 m deep (all other krill)	Shoreline to 500 fm isobaths (E. pacifica) to 1000fm isobaths (all other krill); from the surface to 100 m deep (E. pacifica) to 400 m deep (all other krill)
Pelagic Species (northern anchovy, Pacific sardine, Pacific (chub) mackerel, and jack mackerel)	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10o and 26o centigrade			

Common Name	Eggs	Larvae/YOY[219]	Juveniles	Adults
Groundfish	Multiple species of groundfish with designated EFH occur in California offshore waters. The overall extent of groundfish EFH included wasters and substrates: With depths less than or equal to 3,500m to mean higher high water or the up-river extent of saltwater intrusion. Seamounts in depths greater than 3,5000 m as mapped Areas designated as HPACs			
Broadbill Swordfish	None	None	Epipelagic and mesopelagic waters U.S.-Mexico EEZ border north to 41° N latitude (near the Oregon border).	Epipelagic and mesopelagic waters U.S.-Mexico EEZ border north to 37° N latitude (near Monterey)
Dorado	None	None	Epipelagic oceanic waters offshore 6 fm isobaths along coastal CA from Mexico border to Point Conception CA.	Epipelagic oceanic waters offshore 6 fm isobaths along coastal CA from Mexico border to Point Conception CA.
Common Thresher Shark	Neonate: oceanic waters off beaches and in shallow bays from Mexico border north to Santa Cruz	NA	Late Juveniles-oceanic waters off beaches and in shallow bays from Mexico border north to Pigeon Point	Oceanic waters off beaches and in shallow bays
Pelagic Thresher Shark	NA	NA	Epipelagic and predominantly oceanic waters along coastal California from the Mexico border as far north as 34° N latitude (near Point Conception)	Epipelagic and predominantly oceanic waters along coastal California from the Mexico border as far north as 34° N latitude (near Point Conception)
Shortfin Mako Shark	Neonate/Early Juveniles: between 100fm-2000 fm isobaths from Mexico border to Point Pinos		Late Juveniles: 100fm beyond; from Mexico border north to San Francisco	400fm beyond; from Mexico border north to San Francisco
Bigeye Thresher Shark	NA	NA	Coastal and oceanic waters in epi- and mesopelagic zones from the U.S.-Mexico border north to 37° N latitude (Davenport)	Coastal and oceanic waters in epi- and mesopelagic zones along entire coast

Common Name	Eggs	Larvae/YOY[219]	Juveniles	Adults
Blue Shark	Neonate: oceanic waters beyond 1000 fm isobath	NA	Late Juveniles-Epipelagic oceanic waters from Mexico border north	Epipelagic, oceanic waters along entire coast. Extending inshore to the 200 fm isobath south of 37° N (Santa Cruz)

ACRONYMS

Acronym	Definition
AADT	Average Annual Daily Trips
AAQS	Ambient Air Quality Standards
AARC	Average Annual Rate of Change
ACE	Altamont Corridor Express
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ADAM	Air Quality Data Summaries
AFB	Air Force Base
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AIP	Agreement in Principle
AIRFA	American Indian Religious Freedom Act
AML	Abandoned Mine Lands
APCD	Air Pollution Control Districts
APCO	Air Pollution Control Officer
APE	Area of Potential Effect
API	American Petroleum Institute Gravity
AQCR	Air Quality Control Region
AQMD	Air Quality Management Division
AQR	Air Quality Regulations
ARPA	Archaeological Resources Protection Act
ASL	Above Sea Level
ASPM	Aviation System Performance Metrics
ASTM	American Society for Testing And Materials
ATC	Air Traffic Control
ATSDR	Agency for Toxic Substances and Disease Registry
ATO	Air Traffic Organization
AZ	Arizona
BART	Bay Area Rapid Transit
BAPC	Bureau of Air Pollution Control
BAQP	Bureau of Air Quality Planning
BCDC	San Francisco Bay Conservation and Development Commission
BGEPA	Bald and Golden Eagle Protection Act
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BNSF	Burlington Northern and Santa Fe Railway
BOR	Bureau of Reclamation
BTU	British Thermal Units
CA	California
CAA	Clean Air Act
CAAMLU	California Department of Conservation, Abandoned Mined Lands Unit
CAAQS	California Ambient Air Quality Standards
CADOSH	California Division of Occupational Safety and Health
CADOT	California Department of Transportation
CADPH	California Department of Public Health
CADTSC	California Department of Toxic Substances Control
CADWR	California Department of Water Resources
CAOEHHA	California Office of Environmental Health Hazard Assessment
CAPSNET	California Microwave Public Safety Network
CARB	California Air Resources Board

Acronym	Definition
CCC	California Coastal Commission
CCCS	Countywide coordinated Communications System
CCMP	Comprehensive Conservation and Management Plan
CCR	California Code of Regulations
CDC	Centers for Disease Control and Prevention
CDFA	California Department of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CDNPA	California Desert Native Plants Act
CDWR	California Department of Water Resources
CEC	California Energy Commission
CEHTP	California Environmental Health Tracking Program
CESA	California Endangered Species Act
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFA	Controlled Firing Area
CFR	Code of Federal Regulations
CGP	Construction General Permit
CGS	California Geological Survey
CHP	California Highway Patrol
CH_4	Methane
CIMC	Cleanups in My Community
CIO	Chief Information Officer
CIRN	Countywide Interoperable Radio Network
CISAC	Center for International Security and Cooperation
CLERS	California Law Enforcement Radio System
CNDDB	California Natural Diversity Database
CNEL	Community Noise Exposure Level
CNPS	California Native Plant Society
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COHP	California Office of Historic Preservation
COLT	Cell On Light Truck
COW	Cell On Wheels
CPUC	California Public Utilities Commission
CRS	Community Rating System
CSC	Connecticut Siting Council
CSU	California State University
CWA	Clean Water Act
CWIRS	Countywide Integrated radio System
DAQ	Department of Air Quality
DDT	Dichlorodiphenyltrichloroethane
DDW	Division of Drinking Water
DFG	Department of Fish and Game
DFW	Department of Fish and Wildlife
DISDI	Defense Installations Spatial Data Infrastructure
DoD	Department of Defense
DOE	Department of Energy
DPBH	Division of Public and Behavioral Health
DPS	Department of Public Safety
DPS	Distinct Population Segment

Acronym	Definition
DRECP	Desert Renewable Energy Conservation Plan
DWSAP	Drinking Water Source Assessment and Protection Program
EBRCS	East Bay Regional Communication System
ECOS	Environmental Conservation Online System
EDACS	Enhanced Digital Access System
EFH	Essential Fish Habitat
EIA	Energy Information Agency
EIS	Environmental Impact Statement
EMS	Emergency Medical Services
EPCRA	Emergency Planning and Community Right to Know Act
ERICA	Eastern Riverside County Interoperable Communications Authority
ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute
ESU	Evolutionarily Significant Unit
FAA	Federal Aviation Administration
FAC	Food and Agricultural Code
FCC	Federal Communications Commission
FDPTO	Fugitive Dust Permit to Operate
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FIPS	Federal Information Processing Standard
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act of 1976
FRA	Federal Railroad Administration
FSDO	Flight Standards District Offices
FSS	Flight Service Station
FTA	Federal Transit Administration
GAO	Government Accountability Office
GAP	Gap Analysis Program
GHG	Greenhouse Gas
GIS	Geographic Information System
GLOBE	Global Learning and Observations to Benefit the Environment
GPO	Government Printing Office
GWP	Global Warming Potential
HAP	Hazardous Air Pollutant
HAPC	Habitat Areas of Particular Concern
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IBA	Important Bird Area
ICE	Internal Combustion Engine
ICIS	Interagency Communications Interoperability System
ICIS	Integrated Compliance Information System
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Finance Corporation
IFR	Instrument Flight Rules
ILEC	Incumbent Local Exchange Carrier
IPCC	Intergovernmental Panel On Climate Change
IRS	Internal Revenue Service
ISO	International Organization for Standardization
ITU	International Telecommunications Union
IWVISP	Indian Wells Valley Internet Service Provider

Acronym	Definition
LAX	Los Angeles International Airport
LBS	Locations-Based Services
LCCS	Land Cover Classification System
LGB	Long Beach/Daugherty Field
LLC	Limited Liability Corporation
LMR	Land Mobile Radio
LPG	Liquefied Petroleum Gas
LRR	Land Resource Regions
LTBMU	Lake Tahoe Basin Management Unit
LTE	Long Term Evolution
MACT	Maximum Achievable Control Technology
MBTA	Migratory Bird Treaty Act
MCAS	Marine Corps Air Station
MDAB	Mojave Desert Air Basin
MERA	Marin Emergency Radio Authority
MHI	Median Household Income
MHz	Megahertz
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tons
MOA	Military Operations Areas
MPO	Metropolitan Planning Organization
MSFCMA	Magnuson-Stevens Fisheries Conservation and Management Act
MSL	Mean Sea Level
MSWLF	Municipal Solid Waste Landfill
MTS	Metropolitan Transit System
MYA	Million Years Ago
N_2O	Nitrous Oxide
NAAQ	National Ambient Air Quality
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NAWS	Naval Air Weapons Station
NCA	National Climate Assessment
NCCP	Natural Community Conservation Plan
NCCPA	Natural Community Conservation Planning Act
NCED	National Conservation Easement Database
NCRWQCB	North Coast Regional Water Quality Control Board
NCSL	National Conference of State Legislatures
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NHT	National Historic Trail
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology

Acronym	Definition
NM	Nautical Miles
NMFS	National Marine Fisheries Service
NNL	National Natural Landmarks
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notices To Airmen
NO_X	Oxides of Nitrogen
NOLF	Naval Outlying Field
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPPA	Native Plant Protection Act
NPR	National Petroleum Reserve
NPS	National Park Service
NPSBN	National Public Safety Broadband Network
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NSPS	New Source Performance Standards
NTIA	National Telecommunications and Information Administration
NTFI	National Task Force On Interoperability
NV	Nevada
NVCS	National Vegetation Classification System
NWF	National Wildlife Foundation
NWI	National Wetlands Inventory
NWP	Nationwide Permit
NWS	National Weather Service
NWR	National Wildlife Refuge
OAK	Oakland International Airport
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OEHHA	Office of Environmental Health Hazard Assessment
OHV	Off Highway Vehicle
ONT	Ontario International Airport
OPR	Office of Planning and Research
OR	Oregon
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OTR	Ozone Transport Region
PAB	Palustrine Aquatic Bed
PAR	Preliminary Appraisal and Ranking
PCN	Preconstruction Notice
PCT	Pacific Crest National Scenic Trail
PEIS	Programmatic Environmental Impact Statement
PEM	Palustrine Emergent Wetlands
PERP	Portable Equipment Registration Program
PFO	Palustrine Forested Wetland
PGA	Peak Ground Acceleration
POP	Points of Presence
POLB	Port of Long Beach
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Points
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration

Acronym	Definition
PSEC	Public Safety Enterprise Communication
PSRSPC	Public Safety Radio Strategic Planning Committee
PSS	Palustrine Scrub-Shrub Wetland
PTC	Permit to Construct
PTE	Potential-to-Emit
PTO	Permits to Operate
PUB	Palustrine Unconsolidated Bottom
PUC	California Public Utility
RCRA	Resource Conservation and Recovery Act
RCS	Regional Communications System
REACT	Radio Emergency Associated Communications Teams
RF	Radio Frequency
ROW	Right-of-Way
RWQCB	Regional Water Quality Control Board
SAA	Sense and Avoid
SAD	Surface Area Disturbance
SAIPE	Small Area Income and Poverty Estimates
SAN	San Diego International Airport
SASP	State Aviation System Plan
SCEC	State Climate Extremes Committee
SCRC	Student Climate Research Center
SCIP	Statewide Communications Interoperability Plan
SDGE	San Diego Gas and Electric Company
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SERDP	Strategic Environmental Research and Development Program
SFBCDC	San Francisco Bay Conservation & Development Commission
SFBRWQCB	San Francisco Basin Regional Water Quality Control Board
SF_6	Sulfur Hexafluoride
SFO	San Francisco International Airport
SCGN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SJC	San Jose International Airport
SMBNEP	Santa Monica Bay National Estuary Program
SMF	Sacramento International Airport
SNA	John Wayne Airport-Orange County
SO_2	Sulfur Dioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SOW	System On Wheels
SO_X	Oxides of Sulfur
SPL	Sound Pressure Level
SRRCS	Sacramento Regional Radio Communication System
SSA	Sole Source Aquifers
SSAB	Salton Sea Air Basin
STRS	Simulcast Trunked Radio System
SUA	Special Use Airspace
SVRCS	Silicon Valley Regional Communications System
SWAP	State Wildlife Action Plan
SWPPP	Storm Water Pollution Prevention Plan
TFR	Temporary Flight Restrictions

Acronym	Definition
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
TPY	Tons Per Year
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TSD	Technical Support Document
TWA	Time Weighted Average
U.S.C.	United States Code
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UHF	Ultra High Frequency
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
USNVC	U.S. National Vegetation Classification
UVA	University of Virginia
VCP	Voluntary Cleanup Program
VDE	Visible Dust Emission
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compounds
VTA	Santa Clara Valley Transportation Authority
WAP	Wildlife Action Plan
WCRCS	Washoe County Regional Communications System
WMA	Wildlife Management Areas
WMD	Wetland Management District
WONDER	Wide-Ranging Online Data For Epidemiologic Research
WPC	Water Pollution Control
WQC	Water Quality Certification
WWI	World War I
WWII	World War II

REFERENCES

The citations in this Draft PEIS reflect the most recent information on the referenced site at the time the document was being written. If the site was updated after that point, the more recent information will be incorporated, as feasible, into the final document.

40 CFR 230.3(t). (1993, August 25). *Clean Water Act-Guidelines for Specification of Disposal Sites for Dredged or Fill Material*. Retrieved April 6, 2015, from http://www.ecfr.gov/cgi-bin/text-idx?SID=7977290449ab243f2865159951305a77&node=40:25.0.1.3.24&rgn=div5

Adams, P., Grimes, C., Hightower, J., Lindley, S., & Moser, M. (2002). *Status review for North American green sturgeon.* Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/greensturgeon.pdf

Advisory Council on Historic Preservation. (2004). *36 CFR Part 800 - Protection of Historic Properties.* Retrieved July 21, 2015, from Advisory Council on Historic Preservation: http://www.achp.gov/regs-rev04.pdf

Al-Shehbaz, I. A. (2016a). *Physaria kingii subsp. bernardina (=Lesquerella kingii ssp. bernardina).* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=80340

Al-Shehbaz, I. A. (2016b). *Thelypodium stenopetalum*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=46370

Al-Shehbaz, Ihsan A.; Rosatti, Thomas J. (2016). Thysanocarpus conchuliferus. *Thysanocarpus conchuliferus*. Retrieved from http://herbaria4.herb.berkeley.edu/eflora_display.php?tid=46551

Amador APCD. (2000, May 16). Rule 218 - Fugitive Dust Emissions. Retrieved December 8, 2015, from http://www.arb.ca.gov/DRDB/AMA/CURHTML/R218.HTM

Amador APCD. (2001, March 27). Rule 500 - Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments Of 1990. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/AMA/CURHTML/R500.HTM

Amador APCD. (2009, April 28). Ruel 402 - Exempts to Rule 401. Retrieved December 4, 2015, from http://www.arb.ca.gov/DRDB/AMA/CURHTML/R402.PDF

American Trails. (2015, August 14). *National Trails Training Partnership*. Retrieved September 15, 2015, from http://www.americantrails.org/resources/feds/NatTrSysOverview.html

Amphibian Ark. (2016). *Chytrid Fungus*. Retrieved from http://www.amphibianark.org/the-crisis/chytrid-fungus/

Amtrak. (2015a, December). *California Train Routes*. Retrieved December 9, 2015, from Amtrak: http://www.amtrak.com/california-train-routes

Amtrak. (2015b, April 6). *Amtrak System Timetable.* Retrieved from Amtrak: https://www.amtrak.com/ccurl/194/703/System-Timetable-Spring-Fall-2015.pdf

Anderson, M. (2015). *California - A Little Bit of Everything.* Retrieved from California's Climate the Cocorah's State Climates Series: http://www.cocorahs.org/Media/docs/ClimateSum_CA.pdf

Antelope Valley AQMD. (1994, September 9). Regulation XIX - Rule 1901 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/AV/CURHTML/R1901.PDF

Antelope Valley AQMD. (1997, August 19). Rule 203 - Permit to Operate. Retrieved December 8, 2015, from http://www.avaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=899

Antelope Valley AQMD. (2005, April 19). Rule 3001 - Definitions. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/AV/CURHTML/R3001.PDF

Antelope Valley AQMD. (2010, April 20). Rule 403 - Fugitive Dust. Retrieved December 8, 2015, from http://www.avaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=867

Antelope Valley AQMD. (2011, Janaury 18). Rule 3000 - General. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/AV/CURHTML/R3000.PDF

Arkush, B. S. (1993). Yokuts Trade Networks and Native Culture Change in Central and Eastern California. *Ethnohistory*, 619-640.

Arnold, J. E. (1996, March). The Archaeology of Complex Hunter-Gatherers. *Journal of Archaeological Method and Theory, 3*(1), 77-126. Retrieved August 2016, from http://link.springer.com/article/10.1007/BF02228931

ATSDR. (2001, May 3). *Lava Cap Mine*. Retrieved December 10, 2015, from http://www.ehib.org/ehib/www.ehib.org/projects/LavaCapMine_PHA.pdf

Baldwin, B. G. (2016a). *Deinandra conjugens*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=77599

Baldwin, B. G. (2016b). *Holocarpha macradenia.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=3558

Baldwin, B. G., & Bainbridge, S. J. (2014). *Layia carnosa.* Retrieved from http://herbaria4.herb.berkeley.edu/eflora_display.php?tid=3744

Balshe, W. (2011). *Power System Considerations for Cell Tower Applications.* Cummins Power Generation. Retrieved from https://www.cumminspower.com/www/literature/technicalpapers/PT-9019-Cell-Tower-Applications-en.pdf

BART. (2015, December). *System Facts*. Retrieved December 2015, 9, from https://www.bart.gov/about/history/facts

Bay Area AQMD. (1993, November 3). Regulation 2, Rule 6 - Major Facility Review. Retrieved December 8, 2015, from http://hank.baaqmd.gov/dst/regulations/rg0206.pdf

Bay Area AQMD. (2012, April 18). Regulation 2, Rule 1 - General Requirements. Retrieved December 9, 2015, from http://www.baaqmd.gov/~/media/files/planning-and-research/rules-and-regs/rg0201.pdf?la=en

Bay Area AQMD. (2015). *Current Rules*. Retrieved August 10, 2016, from http://www.baaqmd.gov/rules-and-compliance/current-rules

Berven, K. A., & Grudzien, T. A. (1990). Dispersal in the Wood Frog (Rana sylvatica): Implications for Genetic Population Structure. *Evolution*, 2047-56. doi:http://doi.org/10.2307/2409614

BLM. (1976). *A Capsule Examination of the Legislative History of the Federal Land Policy and Management Act of 1976.* Retrieved from http://www.blm.gov/flpma/FLPMA.pdf

BLM. (1984, April 5). *Manual 8400 - Visual Resource Managment.* Washington: Department of the Interior, Bureau of Land Management. Retrieved from http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.34032.File.dat/8400.pdf

BLM. (2014, August). *DRECP Noise and Vibration*. Retrieved 07 22, 2015, from http://www.blm.gov/style/medialib/blm/ca/pdf/pa/energy/drecp/draft_drecp.Par.37401.File.dat/III.21%20Noise%20and%20Vibration.pdf

BLM. (2015a). *California Home Page*. Retrieved December 2015, from http://www.blm.gov/ca/st/en.html

BLM. (2015b). *National Monuments*. Retrieved August 10, 2016, from National Conservation Lands: http://www.blm.gov/publish/content/ca/en/prog/nlcs.html

BLM. (2015c). *National Conservation Areas*. Retrieved August 10, 2016, from National Conservation Lands: http://www.blm.gov/ca/st/en/prog/blm_special_areas/nca.html

BLM. (2015d). *National Scenic and Historic Trails*. Retrieved August 10, 2016, from National Conservation Lands: http://www.blm.gov/ca/st/en/prog/blm_special_areas/historictrails.html

BLM. (2016a, April 22). *Needles Field Office*. Retrieved April 22, 2016, from http://www.blm.gov/ca/st/en/fo/needles.html

BLM. (2016b, April 22). *Ridgecrest Field Office*. Retrieved April 22, 2016, from http://www.blm.gov/ca/st/en/fo/ridgecrest.html

BLM. (2016c, June 13). *U.S. Department of the Interior Bureau of Land Management*. Retrieved from http://www.blm.gov/ca/st/en.html

BLM. (2016d). *VRM*. Retrieved from http://www.blm.gov/wo/st/en/prog/Recreation/recreation_national/RMS/2.print.html

BLM. (2016e). *Wild and Scenic Rivers*. Retrieved August 10, 2016, from National Conservation Lands: http://www.blm.gov/ca/st/en/prog/blm_special_areas/wildrivers.html

BLM. (2016f). *Headwaters Forest Reserve*. Retrieved August 10, 2016, from National Conservation Lands: http://www.blm.gov/ca/st/en/prog/nlcs/Headwaters_ForestReserve.html

BLM. (2016g). *Wilderness*. Retrieved August 10, 2016, from National Conservation Lands: http://www.blm.gov/publish/content/ca/en/prog/wilderness.html

BLS. (2013a). *Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2013 (California).* Retrieved December 9, 2015, from http://www.bls.gov/iif/oshwc/osh/os/pr136ca.pdf

BLS. (2013b). *Incidence rate and number of nonfatal occupational injuries by industry and ownership, 2013 (U.S.).* Retrieved September 22, 2015, from http://www.bls.gov/iif/oshwc/osh/os/ostb3966.pdf

BLS. (2013c). *Fatal occupational injuries to private sector wage and salary workers, government workers, and self-employed workers by industry, all United States, 2013.* Retrieved September 22, 2015, from http://www.bls.gov/iif/oshwc/cfoi/cftb0279.pdf

BLS. (2014). *Table A-5. Fatal occupational injuries by occupation and event or exposure, all United States, 2014.* Retrieved September 29, 2015, from 2014 Census of Fatal Occupational Injuries (preliminary data): http://www.bls.gov/iif/oshwc/cfoi/cftb0290.pdf

BLS. (2015a). *Local Area Unemployment Statistics, Employment status of the civilian noninstitutional population, 1976 to 2014 annual averages.* State Data, Annual Average Series, Employment status of the civilian noninstitutional population, annual averages, file staadata.zip. Retrieved April 2015, from http://www.bls.gov/lau/rdscnp16.htm

BLS. (2015b, March 25). *Occupational Employment and Wages, May 2014: 49-9052 Telecommunications Line Installers and Repairers*. Retrieved September 25, 2015, from Occupational Employment Statistics: http://www.bls.gov/oes/current/oes499052.htm

BLS. (2015c, April 22). State Occupational Injuries, Illnesses, and Fatalities. Retrieved December 9, 2015, from Injuries, Illnesses, and Fatalities: http://www.bls.gov/iif/state_archive.htm#CA

BLS. (2015d, May). *U.S. Bureau of Labor Statistics*. Retrieved from May 2015 State Occupational Employment and Wage Estimates Oregon: http://www.bls.gov/oes/current/oes_or.htm

BLS. (2015e, September 21). Census of Fatal Occupational Injuries (CFOI) - Current and Revised Data. *Injuries, Illnesses, and Fatalities*. Retrieved September 18, 2015, from Census of FAtal Occupational Injuries (2011 forward): http://www.bls.gov/iif/oshcfoi1.htm

BLS. (2016, March 30). *Telecommunications: NAICS 517*. Retrieved from Industries at a Glance: http://www.bls.gov/iag/tgs/iag517.htm

Bond, S., Sims, S., & Dent, P. (Eds.). (2013). *Towers, Turbines, and Transmission Lines: Impacts on Property Value.* Chichester, West Sussex, United Kingdom: Wiley-Blackwell.

Brandoff, J., & Reeves, D. (2014). *SHELL BEAD PRODUCTION AT INTERIOR CHUMASH VILLAGES.* Retrieved from SCA Proceedings: https://scahome.org/wp-content/uploads/2014/10/Proceedings.28Brandoff.pdf

Bratcher, J. (2015). *Early Builders of FirstNet-Ready LTE Networks.* FirstNet.

Brouillet, L. (2014). Acmispon dendroideus var. traskiae. *Acmispon dendroideus var. traskiae*. Retrieved from http://ucjeps.berkleley.edu/cgi-bin/get_IJM.pl?tid=91804

Brummitt, R. (2016). Calystegia stebbinsii. *Calystegia stebbinsii*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=16878

Bureau of Reclamation. (2015). *Recreation*. Retrieved from http://www.usbr.gov/recreation/legislation.html

Butte AQMD. (2010, May 27). Regulation II Rule 205 - Fugitive Dust Emissions. Retrieved December 9, 2015, from http://www.arb.ca.gov/DRDB/BUT/CURHTML/R205.PDF

Butte AQMD. (2013, March 28). Rule 1101 - Title V - Federal Operating Permits. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/BUT/CURHTML/R1101.PDF

Butte AQMD. (2014a, April 24). Regulation IV, Rule 401 - Permit Exemptions. Retrieved December 9, 2015, from http://www.arb.ca.gov/DRDB/BUT/CURHTML/R401.PDF

Butte AQMD. (2014b, April 24). Rule 101 - Definitions. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/BUT/CURHTML/R101.PDF

CA RWQCB Central Coast Region. (2011, June). *Water Quality Control Plan for the Central Coastal Basin.* Retrieved December 7, 2015, from http://www.waterboards.ca.gov/centralcoast

CA RWQCB Central Valley Region. (2011, October). *Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins.* Retrieved December 7, 2015, from https://www.epa.gov/sites/production/files/2015-03/documents/ca5-plan-sacramento-sanjoaquin.pdf

CA RWQCB Colorado Region. (2014, March). *Water Quality Control Plan Colorado River Basin.* Retrieved December 7, 2015, from http://www.waterboards.ca.gov/coloradoriver/water_issues/programs/basin_planning/

CA RWQCB Santa Ana Region. (2008, February). *The Water Quality Control Plan (Basin Plan) for the Santa Ana River Basin.* Retrieved December 7, 2015, from http://www.waterboards.ca.gov/santaana/water_issues/programs/basin_plan/index.shtml

CA SWRCB. (2015a). *401 Water Quality Certification and Wetlands Program*. Retrieved December 7, 2015, from http://www.waterboards.ca.gov/water_issues/programs/cwa401/index.shtml

CA SWRCB. (2015b, October 8). *National Pollutant Discharge Elimination System (NPDES) - Wastewater*. Retrieved December 7, 2015, from http://www.waterboards.ca.gov/water_issues/programs/npdes/

Calaveras County APCD. (1997a, June 30). Rule 102 - Definitions. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/CAL/CURHTML/R102.HTM

Calaveras County APCD. (1997b, June 30). Rule 402 - Exemptions to Rule 401 (ATC, Permit Required). Retrieved December 9, 2015, from http://www.arb.ca.gov/DRDB/CAL/CURHTML/R402.HTM

Calaveras County APCD. (1997c, June 30). Regulation X - Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/CAL/CURHTML/REG-X.PDF

Calaveras County APCD. (1997d, June 30). Rule 502 - Exemptions to Rule 501. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/CAL/CURHTML/R502.HTM

CalEPA. (2009). *CA Water Plan Update 2009 Vol 4 Reference Guide.* Retrieved December 9, 2015, from http://www.waterplan.water.ca.gov/docs/cwpu2009/0310final/v4c01a06_cwp2009.pdf

CalEPA. (2015a, December 15). *Information for Public Drinking Water Systems*. Retrieved December 15, 2015, from California Environmental Protection Agency: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/publicwatersystems.shtml

CalEPA. (2015b, December 15). *Legal Definitions*. Retrieved December 15, 2015, from California Environmental Protection Agency: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/publicwatersystems.shtml

CalEPA. (2015c, December 15). *Drinking Water Source Assessment and Protection (DWSAP) Program*. Retrieved December 15, 2015, from California Environmental Protection Agency: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/DWSAP.shtml

CalEPA. (2015d, December 15). *Consumer Confidence Reports*. Retrieved December 15, 2015, from California Environmental Protection Agency: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/CCR.shtml

CalEPA. (2015e, December 15). *National Pollutant Discharge Elimination System (NPDES) - Wastewater*. Retrieved December 15, 2015, from California Environmental Protection Agency: http://www.swrcb.ca.gov/water_issues/programs/npdes/

CalEPA. (2015f, December 15). *Wastewater Operator Certification Program*. Retrieved December 15, 2015, from California Environmental Protection Agency: http://www.waterboards.ca.gov/water_issues/programs/operator_certification/cert.shtml

CalEPA. (2015g, December 15). *National Pollutant Discharge Elimination System (NPDES) - Individual Permits Information*. Retrieved December 15, 2015, from California Environmental Protection Agency: http://www.swrcb.ca.gov/water_issues/programs/npdes/individual_permits.shtml

CalEPA. (2015h, December 15). *National Pollutant Discharge Elimination System (NPDES) - General Permits*. Retrieved December 15, 2015, from California Environmental Protection Agency: http://www.swrcb.ca.gov/water_issues/programs/npdes/general_permits.shtml

CalEPA. (2015i). *California Greenhouse Gas Emissions for 2000 to 2013 – Trends of Emissions and Other Indicators.* Retrieved 12 16, 2015, from http://www.arb.ca.gov/cc/inventory/pubs/reports/ghg_inventory_trends_00-13%20_10sep2015.pdf

CalEPA. (2015j). *Santa Monica Bay Restoration Commission*. Retrieved Decembmer 14, 2015, from http://www.smbrc.ca.gov/

Calflora. (2016a). *Astragalus tener var. titi*. Retrieved from http://www.calflora.org/cgi-bin/county_taxon.cgi?where-calrecnum=941

Calflora. (2016b). *Trifolium trichocalyx*. Retrieved from http://www.calflora.org/cgi-bin/species_query.cgi?where-calrecnum=8107

Calflora. (2016c). *Potentilla hickmanii*. Retrieved from http://www.calflora.org/cgi-bin/species_query.cgi?where-calrecnum=6855

Calflora. (2016d). *Eriodictyon capitatum*. Retrieved from http://www.calflora.org/cgi-bin/species_query.cgi?where-taxon=Eriodictyon+capitatum

Calflora. (2016e). *Piperia yadonii*. Retrieved from http://www.calflora.org/cgi-bin/county_taxon.cgi?where-calrecnum=6537

Calflora. (2016f). *Erodium cicutarium.* Retrieved from https://www.calflora.org/cgi-bin/species_query.cgi?where-calrecnum=3448

Calhoun, A. J., & DeMaynadier, P. G. (2007). *Science and Conservation of Vernal Pools in Northeastern North America: Ecology and Conservation of Seasonal Wetlands in Northeastern North America.* CRC Press. Retrieved September 2015, from http://www.nae.usace.army.mil/Portals/74/docs/regulatory/VernalPools/Ch12_ScienceConservationofVernalPools.pdf

California Audubon. (2016). *Important Bird Areas*. Retrieved June 14, 2016, from USFS: http://ca.audubon.org/important-bird-areas-9

California Coastal Commission. (2014, April). *When Do I Need A Coastal Development Permit?* Retrieved December 7, 2015, from http://www.coastal.ca.gov/enforcement/cdp_pamphlet.pdf

California Department of Conservation. (2010, April). *California's Abandoned Mine Lands Program Fact Sheet.* Retrieved December 10, 2015, from Stay Out - Stay Alive!: http://www.conservation.ca.gov/omr/abandoned_mine_lands/Documents/AMLUFactSheet3%20April%2015%202010.pdf

California Department of Conservation. (2012a). *California Watersheds: Our Vital Link.* Retrieved August 9, 2016, from http://www.conservation.ca.gov/dlrp/wp/Documents/California%20Watersheds.pdf

California Department of Conservation. (2012b, January). *California's Abandoned Mine Lands Program Fact Sheet.* Retrieved December 10, 2015, from http://www.conservation.ca.gov/omr/abandoned_mine_lands/Documents/AMLUFactSheet1_2011-02.pdf

California Department of Conservation. (2015a). *CGS Note 13 Sabertoothed Cat: California State Fossil*. Retrieved December 2015, from http://www.conservation.ca.gov/cgs/information/publications/cgs_notes/note_13

California Department of Conservation. (2015b). *Abandoned Mined Land Reclamation*. Retrieved December 10, 2015, from http://www.conservation.ca.gov/omr/abandoned_mine_lands

California Department of Conservation. (2015c). *Geologic Hazards*. Retrieved December 2015, from http://www.conservation.ca.gov/cgs/hazards/Pages/index.aspx

California Department of Conservation, Office of Mine Reclamation. (2007, April 4). *Abandoned Mines Recognized as Physical Hazards.* Retrieved December 18, 2015, from http://www.conservation.ca.gov/omr/abandoned_mine_lands/Documents/2007_AMLPriorityListsFinal.pdf

California Department of Fish and Wildlife. (2015a). *California Department of Fish and Wildlife*. Retrieved December 2015, from https://www.wildlife.ca.gov/

California Department of Fish and Wildlife. (2015b, September 30). California State Wildlife Action Plan, 2015 Update: A Conservation Legacy for Californians. *2*. Sacramento. Retrieved December 8, 2015, from https://www.wildlife.ca.gov/SWAP/Final

California Department of Fish and Wildlife. (2015c, September 30). California State Wildlife Action Plan, 2015 Update: A Conservation Legacy for Californians. *2*. Sacramento. Retrieved December 8, 2015, from https://www.wildlife.ca.gov/SWAP/Final

California Department of Fish and Wildlife. (2016a). *Suisun Marsh Atlas.* Retrieved August 2016, 2016, from California Department of Fish and Wildlife: https://www.wildlife.ca.gov/Regions/3/Suisun-Marsh/Atlas

California Department of Fish and Wildlife. (2016b). *Ecological Reserves and Wildlife Areas of California*. Retrieved from https://www.wildlife.ca.gov/lands/places-to-visit

California Department of Fish and Wildlife. (2016c). *California Department of Fish and Wildlife- Golden Eagles in California*. Retrieved June 13, 2016, from https://www.wildlife.ca.gov/Conservation/Birds/Golden-Eagles

California Department of Forestry and Fire Protection. (2012). *Demonstration State Forests*. Retrieved December 2015, from http://calfire.ca.gov/resource_mgt/resource_mgt_stateforests

California Department of Parks and Recreation. (2009). *California State Capitol Museum Kids Zone*. Retrieved September 15, 2015, from http://capitolmuseum.ca.gov/kz-files/kids_home_flash.html

California Department of Parks and Recreation. (2015). *About Us*. Retrieved December 2015, from http://www.parks.ca.gov/?page_id=91

California Department of Parks and Recreation. (2016a). *About us*. Retrieved from http://www.parks.ca.gov/?page_id=91

California Department of Parks and Recreation. (2016b). *Mono Lake Tufa State Natural Reserve*. Retrieved from http://www.parks.ca.gov/?page_id=514

California Department of Public Health. (2015). CALIFORNIA ENVIRONMENTAL HEALTH TRACKING PROGRAM. Retrieved December 9, 2015, from http://www.cehtp.org/page/main

California Department of Toxic Substances Control. (2010). *2010 Annual Report to the California State Legislature, Report on Funds Allocated for National Priorities List (NPL) and State Orphan Sites.* Annual Report to the California State Legislature, California Environmental Protection Agency, Department of Toxic Substances Control. Retrieved December 10, 2015, from https://www.dtsc.ca.gov/PublicationsForms/upload/2010_NPL_Report.pdf

California Department of Toxic Substances Control. (2015a). *Overseeing Site Cleanup*. Retrieved December 9, 2015, from https://www.dtsc.ca.gov/SiteCleanup/

California Department of Toxic Substances Control. (2015b). *Brownfields Voluntary Program*. Retrieved December 9, 2015, from https://www.dtsc.ca.gov/SiteCleanup/Brownfields/BrownfieldsVoluntaryProgram.cfm

California Department of Toxic Substances Control. (2015c). *Creating a community asset: Turning a Brownfield into a sports park.* Retrieved December 10, 2015, from https://www.dtsc.ca.gov/Success/upload/Rumrill-Park_Success.pdf

California Department of Water Resources. (2015a). *California State Climatologist*. Retrieved from http://www.water.ca.gov/floodmgmt/hafoo/csc/

California Department of Water Resources. (2015b). *Climate Change*. Retrieved December 17, 2015, from http://www.water.ca.gov/climatechange/

California Emergency Management Agency. (2013). *State Hazard Mitigation Plan*. Retrieved December 2015, from http://hazardmitigation.calema.ca.gov/docs/SHMP_Final_2013.pdf

California Geological Survey. (2002a). *California Geomorphic Provinces*. Retrieved December 2015, from http://www.conservation.ca.gov/cgs/information/publications/cgs_notes/note_36/Documents/note_36.pdf

California Geological Survey. (2002b). *Generalized Geologic Map of California*. Retrieved December 2015, from http://www.conservation.ca.gov/cgs/information/publications/cgs_notes/note_17/Documents/note_17.pdf

California Governor's Office of Emergency Management. (2013). *California Multi-Hazard Mitigation Plan*. Retrieved from http://hazardmitigation.calema.ca.gov/docs/SHMP_Final_2013.pdf

California Health and Safety Code. (1975). *California Health and Safety Code 41700*. Retrieved June 17, 2016, from http://www.airquality.org/hboard/nuisance.pdf

California Legislative Information. (1967a). *Food and Agricultural Code - FAC*. Retrieved June 14, 2016, from http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=FAC&sectionNum=6305.

California Legislative Information. (1967b). *Food and Agricultural Code - FAC*. Retrieved June 14, 2016, from http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=FAC&sectionNum=52251.

California Office of Emergency Services. (2013). *California Statewide Communications Interoperability Plan (SCIP).* CAL OES. Retrieved from http://www.water.ca.gov/floodmgmt/funding/docs/CA_2013_SCIP.pdf

California Office of Health Hazard Assessment. (2013, February). *Proposition 65*. Retrieved December 11, 2015, from http://oehha.ca.gov/prop65/background/p65plain.html

California Office of Historic Preservation. (2005, September 7). *California State Law & Historic Preservation Statutes, Regulations & Administrative Ploicies.* Retrieved January 27, 2016, from http://ohp.parks.ca.gov/pages/1069/files/10%20comb.pdf

California Office of Planning and Research. (2003). *State of California General Plan Guidelines 2003*. Retrieved December 2015, from https://www.opr.ca.gov/docs/General_Plan_Guidelines_2003.pdf

California Sierra Nevada Conservancy. (2015a). *The Rim Fire.* Retrieved Decmber 10, 2015, from http://www.sierranevada.ca.gov/our-region/rim-fire

California Sierra Nevada Conservancy. (2015b). *The Rim Fire: Why investing in forest health equals investing in the health of California.* Retrieved December 10, 2015, from http://www.sierranevada.ca.gov/factsheets/10.31rimfirefactsheet.pdf

California State Parks. (2011). *Somana State Historic Park.* Retrieved July 5, 2016, from http://www.parks.ca.gov/pages/479/files/SonomaSHPbrochure2011.pdf

California State Parks: Office of Historic Preservation. (2013). *Sustainable Preservation: California's Statewide Historic Preservation Plan, 2013-2017.* Sacramento: California State Parks.

California Technology Agency. (2011). *California Public Safety Microwave Network Strategic Plan.* California Technology Agency. Retrieved from http://www.caloes.ca.gov/PublicSafetyCommunicationsSite/Documents/001CAPSNET_Strategic_Plan_03-03-2011.pdf

CalRecycle. (2015a, December). *About CalRecycle*. Retrieved December 2015, from Department of Resources Recycling and Recovery: http://www.calrecycle.ca.gov/SWFacilities/Directory/SearchList/List?OPSTATUS=Active&REGSTATUS=Permitted

CalRecycle. (2015b, December). *Facility/Site Listing*. Retrieved December 2015, from Department of Resources Recycling and Recovery: http://www.calrecycle.ca.gov/SWFacilities/Directory/SearchList/List?OPSTATUS=Active&REGSTATUS=Permitted

CalRecycle. (2015c, December). *2014 Disposal-Facility-Based Characterization of Solid Waste in California*. Retrieved December 2015, from Department of Resources Recycling and Recovery: http://www.calrecycle.ca.gov/Publications/Documents/1546/20151546.pdf

Caltrans. (2007). *Seaports*. Retrieved August 31, 2016, from http://www.dot.ca.gov/hq/tpp/offices/ogm/seaports.html

Caltrans. (2013a, May). *2013 California State Rail Plan.* Retrieved December 9, 2015, from http://californiastaterailplan.dot.ca.gov/docs/Final_Copy_2013_CSRP.pdf

Caltrans. (2013b). *CADOT State Rail Plan.* Retrieved 09 30, 2015, from http://www.dot.ca.gov/hq/tpp/offices/ogm/freight_rail.html

Caltrans. (2015a, December). *Mission, Vision, Goals, Values*. Retrieved December 9, 2015, from http://www.dot.ca.gov/hq/paffairs/about/mission.htm

Caltrans. (2015b, December). *Freight Rail*. Retrieved December 9, 2015, from http://www.dot.ca.gov/hq/tpp/offices/ogm/freight_rail.html

Caltrans. (2015c, May 5). *List of Offically Designated State Scenic Highways*. Retrieved December 9, 2015, from http://www.dot.ca.gov/hq/LandArch/16_livability/scenic_highways/scenic_hwy.htm

Caltrans. (2015d, December). *Aeronautics, The Office of Aviation Planning*. Retrieved December 2015, from http://www.dot.ca.gov/hq/planning/aeronaut/documents/planning/aviation_planning_office_functions.htm

Caltrans. (2015e, December). *Division of Aeronautics*. Retrieved December 2015, from http://www.dot.ca.gov/hq/planning/aeronaut/#

Caltrans. (2015f). *List of Officially Designated State Scenic Highways*. Retrieved from http://www.dot.ca.gov/hq/LandArch/16_livability/scenic_highways/scenic_hwy.htm

Caltrans. (2015g). *OFFICIALLY DESIGNATED COUNTY SCENIC HIGHWAYS*. Retrieved from http://www.dot.ca.gov/hq/LandArch/16_livability/scenic_highways/lists/OD_County_Scenic_Hwys_2015.pdf

Caltrans. (2016a). *Aviation in California: Fact Sheet (MAY 2016)*. Retrieved June 2016, from http://dot.ca.gov/hq/planning/aeronaut/documents/AeroFactSheet.pdf

Caltrans. (2016b). *The California Scenic Highway Program*. Retrieved from http://www.dot.ca.gov/dist3/departments/mtce/scenic.htm

CARB. (2006). *Lake County Air Quality Management District -- Rules and Regulations.* Retrieved August 10, 2016, from http://www.arb.ca.gov/DRDB/LAK/CURHTML/LCAQMDRULEBOOK2006.PDF

CARB. (2008a). *Colusa County APCD List of Current Rules*. Retrieved August 10, 2016, from http://www.arb.ca.gov/drdb/col/cur.htm

CARB. (2008b). *Mariposa County APCD List of Current Rules*. Retrieved August 10, 2016, from http://www.arb.ca.gov/drdb/mpa/cur.htm

CARB. (2009a). *Calaveras County APCD List of Current Rules*. Retrieved August 10, 2016, from http://www.arb.ca.gov/drdb/cal/cur.htm

CARB. (2009b). *Modoc County APCD List of Current Rules*. Retrieved August 10, 2016, from http://www.arb.ca.gov/drdb/mod/cur.htm

CARB. (2010a, April 20). *Air Districts (APCD OR AQMD) Operating Permits*. Retrieved December 7, 2015, from http://www.arb.ca.gov/permits/airdisop.htm

CARB. (2010b, April 20). *Local Air Districts (APCD or AQMD) Authority to Construct*. Retrieved December 7, 2015, from http://www.arb.ca.gov/permits/airdisac.htm

CARB. (2012). *Tuolumne County APCD List of Current Rules*. Retrieved August 11, 2016, from http://www.arb.ca.gov/drdb/tuo/cur.htm

CARB. (2013a). *Glenn County APCD List of Current Rules*. Retrieved August 10, 2016, from http://www.arb.ca.gov/drdb/gle/cur.htm

CARB. (2013b). *Mendocino County AQMD List of Current Rules*. Retrieved August 10, 2016, from http://www.arb.ca.gov/DRDB/MEN/CURHTML/REG1CHAPTER4.PDF

CARB. (2015a, October 1). Ambient Air Quality Standards. Retrieved December 5, 2015, from http://www.arb.ca.gov/research/aaqs/aaqs2.pdf

CARB. (2015b, April 16). Portable Equipment Frequently Asked Questions. Retrieved December 8, 2015, from http://www.arb.ca.gov/portable/perp/perpfaq_04-16-15.pdf

CARB. (2015c). *Monterey Bay Unified APCD List of Current Rules*. Retrieved August 11, 2016, from http://www.arb.ca.gov/drdb/mbu/cur.htm

CARB. (2015d). *Regulation I, Rule 104 -- Prohibitions.* Retrieved August 11, 2016, from http://www.arb.ca.gov/DRDB/NCU/CURHTML/R104.PDF

CARB. (2015e, December 11). *iADAM: Air Quality Data Statistics*. Retrieved December 11, 2015, from http://www.arb.ca.gov/adam/

CARB. (2016a). *Yolo-Solano AQMD List of Current Rules*. Retrieved August 11, 2016, from http://www.arb.ca.gov/drdb/ys/cur.htm

CARB. (2016b, June 17). Fugitive Dust Control Self-Inspection Handbook. Retrieved June 16, 2016, from http://www.arb.ca.gov/pm/fugitivedust_large.pdf

CARB. (2016c). *Siskiyou County APCD List of Current Rules*. Retrieved August 11, 2016, from http://www.arb.ca.gov/drdb/sis/cur.htm

CARB. (2016d, January 5). Chronology of State Visibility Reducing Particles Designations. Retrieved June 17, 2016, from http://www.arb.ca.gov/desig/changes/vrp.pdf

Cartier, R. (1988). The Middle Period in the Southern San Francisco Bay Area . In *Proceedings of the Society for California Archaeology.*

CCC. (2015). *California Coastal Commission*. Retrieved December 16, 2015, from http://www.coastal.ca.gov/whoweare.html

CDFA. (2005a). *California noxious weed plan.* Retrieved from https://www.cdfa.ca.gov/phpps/ipc/noxweedinfo/pdfs/noxious_weed_plan.pdf

CDFA. (2005b). *California noxious weed plan.* Retrieved from https://www.cdfa.ca.gov/phpps/ipc/noxweedinfo/pdfs/noxious_weed_plan.pdf

CDFA. (2015). *California noxious weed list*. Retrieved from https://www.cdfa.ca.gov/plant/IPC/encycloweedia/weedinfo/winfo_table-sciname.html

CDFW. (1993). *Introduced red fox in California*. Retrieved from https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=2939

CDFW. (1997). *Marine mammals of California*. Retrieved from https://www.wildlife.ca.gov/Conservation/Marine/Mammals

CDFW. (2008a). *California Bird Species of Special Concern*. Retrieved June 14, 2016, from CDFW: http://www.dfg.ca.gov/wildlife/nongame/ssc/birds.html

CDFW. (2008b). *California aquatic invasive species management plan*. Retrieved from https://www.wildlife.ca.gov/Conservation/Invasives/Plan

CDFW. (2013a). *California marine sportfish identification*. Retrieved from https://www.wildlife.ca.gov/Fishing/Ocean/Fish-ID/Sportfish

CDFW. (2013b). *Chorro Creek bog thistle.* Retrieved from https://www.wildlife.ca.gov/Conservation/Plants/Endangered/Cirsium-fontinale-var-obispoense

CDFW. (2014a). *Chinese Camp brodiaea*. Retrieved from https://www.wildlife.ca.gov/Conservation/Plants/Endangered/Brodiaea-pallida

CDFW. (2014b). *Santa Barbara Island liveforever*. Retrieved from https://www.wildlife.ca.gov/Conservation/Plants/Endangered/Dudleya-traskiae

CDFW. (2015a). *Natural communities*. Retrieved from http://www.dfg.ca.gov/biogeodata/vegcamp/natural_comm_background.asp

CDFW. (2015b). *CDFW SWAP Volume I.* Retrieved June 14, 2016, from https://www.wildlife.ca.gov/SWAP/Final

CDFW. (2015c). *CNDDB maps and data*. Retrieved from http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp

CDFW. (2015d). *Vegetation classification and mapping program*. Retrieved from http://www.dfg.ca.gov/biogeodata/vegcamp/

CDFW. (2015e, 2015). *CDFW SWAP Appendix C.* Retrieved June 14, 2016, from https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109224&inline

CDFW. (2015f). *California's invaders*. Retrieved from https://www.wildlife.ca.gov/Conservation/Invasives/Species

CDFW. (2015g). *Freshwater fishes*. Retrieved from https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83921

CDFW. (2015h). *California natural diversity database - Natural Communities List*. Retrieved June 21, 2016, from http://www.dfg.ca.gov/biogeodata/vegcamp/natural_comm_list.asp

CDFW. (2016a). *State and federally listed endangered and threatened animals of California*. Retrieved from https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109405&inline

CDFW. (2016b, May). *Complete List of Amphibians, Reptiles, Bird, and MAmmal Species in California.* Retrieved June 14, 2016, from CDFW: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=87155&inline

CDFW. (2016c, June). *Coho Salmon Range*. Retrieved June 22, 2016, from CDFW: http://www.dfg.ca.gov/fish/REsources/Coho/SAL_CohoRange.asp

CDFW. (2016d). *California's Invaders (Invasive Species List).* Retrieved June 15, 2016, from https://www.wildlife.ca.gov/Conservation/Invasives/Species

CDWR. (2013a). *California Water Plan Update 2013.* Retrieved December 9, 2015, from http://www.waterplan.water.ca.gov/technical/cwpu2013/index.cfm#general

CDWR. (2013b, November). *California's Flood Future: Recommendations for Managing the State's Flood Risk.* Retrieved December 9, 2015, from http://www.water.ca.gov/sfmp/resources/California_Flood_Future.pdf

CEC. (2011, April). *North American Terrestrial Ecoregions - Level III.* Retrieved from USEPA Ecoregions of North America: ftp://ftp.epa.gov/wed/ecoregions/pubs/NA_TerrestrialEcoregionsLevel3_Final-2june11_CEC.pdf

Centers for Disease Control and Prevention. (2015, December 9). CDC WONDER: Underlying Cause of Death, 1999-2013 Results. Retrieved December 9, 2015, from http://wonder.cdc.gov/

CEQ. (1997a, December). *Environmental Justice: Guidance Under the National Environmental Policy Act.* Retrieved April 2015, from http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-EJGuidance.pdf

CEQ. (1997b, December). *Environmental Justice: Guidance Under the National Environmental Policy Act.* Retrieved April 2015, from http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-EJGuidance.pdf

CEQ. (2014). *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*. Retrieved June 2014, from https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance

CIO Council. (2015). *Data Center Consolidation and Optimization*. Retrieved from https://cio.gov/drivingvalue/data-center-consolidation/

CISAC. (2010). *The California Invasive Species List.* Retrieved August 9, 2016, from http://www.iscc.ca.gov/docs/californiainvasivespecieslist.pdf

City of Lincoln. (2015). *What are Saline Wetlands?* Retrieved July 2015, from http://lincoln.ne.gov/city/parks/parksfacilities/wetlands/wetlandsinfo.htm

Climate Central. (2014, June). *California, Oregon, Washington and the Surging Seas.* Retrieved from A Vulnerability Assessment with Projections for Sea Level Rise and Coastal Flood Risk: http://sealevel.climatecentral.org/uploads/ssrf/Report-CA-OR-WA.pdf

COASTER. (2015, January). *COASTER Fact Sheet*. Retrieved December 9, 2015, from http://www.gonctd.com/wp-content/uploads/2013/08/COASTER-Fact-Sheet.pdf

Colusa County APCD. (1989, August 1). *Regulation III Rule 3.3 - Exemptions*. Retrieved December 10, 2015, from http://www.arb.ca.gov/DRDB/COL/CURHTML/R3-3.HTM

Colusa County APCD. (2001, October 2). Rule 3.17 - Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/COL/CURHTML/R3-17.PDF

Colusa County APCD. (2008, April 11). Regulation III - Permits; Rule 3.11 - State Ambient Air Quality Standards. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/COL/CURHTML/R3-11.HTM

Community Rating System. (2014, June). Retrieved from http://www.fema.gov/media-library-data/1398878892102-5cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf

Cowardin, L. M., Carter, V., Golet, F. C., & LaRoe, E. T. (1979). *Classification of wetlands and deepwater habitats of the United States, FWS/OBS-79/31*. Retrieved April 5, 2015, from http://www.fws.gov/wetlands/Documents/classwet/index.html

CPUC. (2015, December). *About Us*. Retrieved December 2015, from California Public Utilities Commission: http://www.cpuc.ca.gov/PUC/aboutus/

CPUC. (2016). *Summary of Annual Reports to the Legislature*. Retrieved December 2015, from California Public Utilities Commission: http://www.cpuc.ca.gov/AnnualReports/

CSC. (2007, March). Retrieved April 27, 2016, from Telecommunications Facilities: An Illustrated Primer on the Siting of Facilities within Connecticut and Throughout the Nation: http://www.ct.gov/csc/lib/csc/csc_tower_3_07.pdf

CSU Stanislaus, Endangered Species Recovery Program. (2015). *Fresno kangaroo rat (Dipodomys nitratoides exilis) species profile, endangered species recovery plan.* Retrieved from http://esrp.csustan.edu/publications/pubhtml.php?doc=sjvrp&file=chapter02I00.html#distribution

Davis, W.S. (2016a). Malacothrix squalida. *Malacothrix squalida*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=4086

Davis, W.S. (2016b). *Malacothrix indecora.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=4073

De Groot, S., Gowen, D., & Patterson, R. (2016). *Eriastrum densifolium subsp. sanctorum.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=50332

Department of Commerce. (2015). *Coastline of the United States*. Retrieved from http://www.infoplease.com/ipa/A0001801.html

Department of Defense. (2014). *Base Structure Report - Fiscal Year 2014 Baseline; A Summary of the Real Property Inventory.* Retrieved September 2015, from http://www.acq.osd.mil/ie/download/bsr/Base%20Structure%20Report%20FY14.pdf

Dettinger, M. (2011, Jone). Climate Change, Atmosperhic Rivers, and Floods in California: A Multimodal Analysis of Storm Frequency and Magnitude Changes. *Journal of the American Water Resources Association, 47*, 514-523.

Di Gregorio, A., & Jansen, L. J. (1998). *Land Cover Classification System (LCCS): Classification Concepts and User Manual.* Retrieved August 2016, from http://www.fao.org/docrep/003/x0596e/x0596e00.htm

Diesel Service & Supply. (2016, June). *Approximate Diesel Fuel Consumption Chart*. Retrieved from http://www.dieselserviceandsupply.com/Diesel_Fuel_Consumption.aspx

Dillon, B. D. (2002). California Paleoindians: lack of evidence, or evidence of lack. In W. J. Wallace, *Essays in California Archaeology: a Memorial to Franklin Fenenga* (pp. 110-128). Berkeley: University of California Berkeley.

DOE. (2015). *Climate Change and the U.S. Energy Sector: Regional Vulnerabilities and Resilience Solutions.* Washington, DC: Department of Energy. Retrieved December 15, 2015

Eastern Kern. (2011, January 13). *Regulation II Rule 202 - Permit Exemptions.* Retrieved December 10, 2015, from http://www.kernair.org/Rule%20Book/2%20Permits/202%20Permit%20Exemptions.pdf

Eastern Kern APCD. (1994, October 13). Rule 210.7 - Federal General Conformity Rule. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/KER/CURHTML/R210-7.HTM

Eastern Kern APCD. (2011, January 13). Rule 102 - Definitions. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/KER/CURHTML/R102.PDF

Eastern Kern APCD. (2012, January 12). Regulation II, Rule 201.1 - Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/KER/CURHTML/R201-1.PDF

Eastern Kern APCD. (2015, March 12). Regulation II, Rule 402 - Fugitive Dust. Retrieved December 19, 2015, from http://www.arb.ca.gov/DRDB/KER/CURHTML/R402.PDF

eBird. (2015a). *eBird range map--bald eagle*. Retrieved from http://ebird.org/ebird/map/baleag?bmo=1&emo=12&byr=2011&eyr=2015&__hstc=75100365.64b7254677ac8cc5c8f21aa17c0b9689.1442877327577.1442877327577.1442877327577.1&__hssc=75100365.4.1442877327577&__hsfp=3470679313#_ga=1.21938685.790432658.1442877326

eBird. (2015b). *eBird range map--golden eagle*. Retrieved from http://ebird.org/ebird/map/goleag?bmo=1&emo=12&byr=2011&eyr=2015#_ga=1.21938685.790432658.1442877326

Edinger, G. J., Evans, D. J., Gebauer, S., Howard, T. G., Hunt, D. M., & Olivero, A. M. (2014, March). *Ecological Communities of New York State.* Retrieved March 19, 2015, from A revised and expanded edition of Carol Reschke's Ecological Communities of New York State.: http://www.dec.ny.gov/animals/97703.html

EIA. (2011, July). *Greenhouse Gas Emissions Overview*. Retrieved July 28, 2015, from Emissions of Greenhouse Gases in the United States: http://www.eia.gov/environment/emissions/ghg_report/ghg_overview.cfm

EIA. (2015a, December). *Electricity, California*. Retrieved December 2015, from U.S. Energy Information Administration: http://www.eia.gov/electricity/data/state/

EIA. (2015b). *California State Energy Profile*. Retrieved December 2015, from U.S. Energy Information Administration: http://www.eia.gov/state/print.cfm?sid=CA

EIA. (2015c, December). *California Profile Overview*. Retrieved December 2015, from U.S. Energy Information Administration: http://www.eia.gov/state/?sid=ca

EIA. (2015d, July 7). *How much carbon dioxide is produced by burning gasoline and diesel fuel?* Retrieved September 21, 2015, from http://www.eia.gov/tools/faqs/faq.cfm?id=307&t=11

EIA. (2015e). *State CO2 Emissions - 1980 to 2012*. Retrieved July 22, 2015, from http://www.eia.gov/environment/emissions/state/

EIA. (2015f, October 26). *Energy-Related CO2 Emissions at the State Level, 2000-2013*. Retrieved February 11, 2016, from http://www.eia.gov/environment/emissions/state/analysis/

EIA. (2015g). Retrieved 12 16, 2015, from http://www.eia.gov/state/analysis.cfm?sid=CA

EIA. (2016a). *California Field Production of Crude Oil*. Retrieved from http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPCA1&f=M

EIA. (2016b). *Rankings: Natural Gas Marketed Production, 2014*. Retrieved from http://www.eia.gov/state/rankings/#/series/47

EIA. (2016c). *Glossary - Electricity*. Retrieved from U.S. Energy Information Administration: https://www.eia.gov/tools/glossary/?id=electricity

El Dorado AQMD. (2000, February 15). Rule 101 - General Provisions and Definitions. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/ED/CURHTML/R101.HTM

El Dorado AQMD. (2001, July 10). Regulation V, Rule 522 - Title V – Federal Operating Permit Program. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/ED/CURHTML/R522.PDF

El Dorado AQMD. (2005a, July 19). Regulation II Rule 223 - Fugitive Dust - General Requirements. Retrieved December 11, 2015, from http://www.arb.ca.gov/DRDB/ED/CURHTML/R223.PDF

El Dorado AQMD. (2005b, October 18). Regulation II, Rule 233-1 - Fugitive Dust - Construction, Bulk Material Handling, Blasting, Other Earthmoving Activities and Carryout and Trackout Prevention. Retrieved December 11, 2015, from http://www.arb.ca.gov/DRDB/ED/CURHTML/R223-1.PDF

El Dorado AQMD. (2006, June 6). Rule 501 - General Permit Requirements. Retrieved December 11, 2015, from http://www.arb.ca.gov/DRDB/ED/CURHTML/R501.PDF

Erlandson, J. M., Rick, T. C., Jones, T. L., & Porcasi, J. F. (2007). One if by land, two if by sea: who were the first Californians. In T. L. Jones, *California Prehistory: Colonization, Culture, and Complexity* (pp. 53-62). Lanham, Maryland: AltaMira Press.

Executive Office of the President. (1994, February). *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. Retrieved April 2015, from 59 Federal Register 7629: https://federalregister.gov/a/94-3685

Ezell, P. a. (1987). Cosoy, First Spanish Stop in Alta California. In E. Clifford M. Graves, *Brand Book Number Eight: San Diego Corral of the Westerners* (pp. 118-134). San Diego: Corral of the Westerners.

FAA. (2007, August 26). *Hearing and Noise in Aviation*. Retrieved 07 22, 2015, from https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/hearing_brochure.pdf

FAA. (2008). *Chapter 14 Airspace.* Retrieved June 2015, from Pilot's Handbook of Aeronautical Knowledge: http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/pilot_handbook/media/phak%20-%20chapter%2014.pdf

FAA. (2012, April 05). *Advisory Circular AC 36-3H*. Retrieved 07 22, 2015, from http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC36-3H%20Chg%201.pdf

FAA. (2013). *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap.* Retrieved from https://www.faa.gov/uas/media/uas_roadmap_2013.pdf

FAA. (2014a). *Calendar Year 2014 Passenger Boardings at Commercial Service Airports*. Retrieved from http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/media/cy14-commercial-service-enplanements.pdf

FAA. (2014b, January). *Federal Aviation Administration, Air Traffic Organization*. Retrieved June 2015, from http://www.faa.gov/about/office_org/headquarters_offices/ato/

FAA. (2015a). *Aeronautical Information Manual*. Retrieved August 2015, from http://www.faa.gov/air_traffic/publications/media/aim.pdf

FAA. (2015b, September 22). *CY14 Passenger Boardings at Commerical Service Airports*. Retrieved December 9, 2015, from http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/media/cy14-commercial-service-enplanements.pdf

FAA. (2015c, September 22). *All Cargo Data reported for CY14*. Retrieved December 9, 2015, from http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/media/cy14-cargo-airports.pdf

FAA. (2015d, March). *Flight Standards District Offices (FSDO)*. Retrieved June 2015, from http://www.faa.gov/about/office_org/field_offices/fsdo/

FAA. (2015e). *Obstruction Evaluation / Airport Airspace Analysis (OE/AAA)*. Retrieved July 2015, from Federal Aviation Administration: https://oeaaa.faa.gov/oeaaa/external/portal.jsp

FAA. (2015f, August 6). *FAA Air Traffic Organization Policy, JO 7400.9SZ, Airspace Designations and Reporting Points*. (F. A. U.S. Department of Transportation, Producer) Retrieved October 2015, from FAA, Regulations & Policies, Orders & Notices: http://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.list/parentTopicID/10

FAA. (2015g). *Air Traffic Organization Policy Order JO 7400.8X, Subject: Special Use Airspace.* Federal Aviation Administration, Airspace Policy and Regulations Group. Retrieved July 2015, from http://www.faa.gov/documentlibrary/media/order/7400_8x_2015.pdf

FAA. (2015h). *FAA TFR List*. Retrieved July 2015, from http://tfr.faa.gov/tfr2/list.html

FAA. (2015i, August 05). *FAA Pilot Safety Brochure - Hearing and Noise in Aviation.* Retrieved 08 05, 2015, from FAA.gov: https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/hearing_brochure.pdf

FAA. (2015j). *Aviation System Performance Metrics (ASPM) Database*. Retrieved July 22, 2015, from https://aspm.faa.gov/apm/sys/AnalysisAP.asp

Farmer, S. a. (2008). *The Shell Bead Assemblage at CA-SDI-39: Evidence for Interregional Exchange at a Major Coastal Site in La Jolla, California.*

FCC. (2000, August). *Deployment of Advanced Telecommunications Capability: Second Report.* Retrieved Nov 16, 2015, from https://transition.fcc.gov/Bureaus/Common_Carrier/Orders/2000/fcc00290.pdf

FCC. (2012, March 13). *Final Programmatic Environmental Assessement for the Antenna Structure Registration Program.* Retrieved from https://apps.fcc.gov/edocs_public/attachmatch/DOC-312921A1.pdf

FCC. (2013). *Universal Service Monitoring Report.* Retrieved from https://apps.fcc.gov/edocs_public/attachmatch/DOC-330829A1.pdf

FCC. (2014a). *Internet Access Servies: Status as of December 31, 2013.* Industry Analysis and Technology Division Wireline Competition Bureau. Federal Communications Commission. Retrieved from https://apps.fcc.gov/edocs_public/attachmatch/DOC-329973A1.pdf

FCC. (2014b). *Local Telephone Competition: Status as of December 31, 2013.* Industry Analysis and Technology Division Wireline Competition Bureau. Retrieved from https://apps.fcc.gov/edocs_public/attachmatch/DOC-329975A1.pdf

FCC. (2015a). *Master PSAP Registry, V 2.0.* PSAP Registry Data Report. Retrieved from https://www.fcc.gov/general/9-1-1-master-psap-registry

FCC. (2015b, June 17). *Antenna Structure Registration*. Retrieved June 17, 2015, from Federal Communications Commission: http://wireless2.fcc.gov/UlsApp/AsrSearch/asrRegistrationSearch.jsp

FCC. (2016a, March). *National Broadband Plan Chapter 16 Public Safety*. Retrieved March 29, 2016, from Broadband.gov: http://www.broadband.gov/plan/16-public-safety/

FCC. (2016b, February 1). *Tower and Antenna Siting*. Retrieved February 10, 2016, from https://www.fcc.gov/general/tower-and-antenna-siting

FCC. (2016c, June). *Detail - Microwave*. Retrieved from Application Search Help: http://wireless2.fcc.gov/helpfiles/applicationSearch/ad_microwave.html

Feather River AQMD. (1994a, April 11). Regulation II, Rule 3.16 - Fugitive Dust Emissions. Retrieved December 11, 2015, from http://www.arb.ca.gov/DRDB/FR/CURHTML/R3-16.HTM

Feather River AQMD. (1994b, December 12). Rule 10.4 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/FR/CURHTML/R10-4.HTM

Feather River AQMD. (2001, May 7). Regulation X, Rule 10.3 - Federal Operating Permits. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/FR/CURHTML/R10-3.PDF

Feather River AQMD. (2007, October 1). *Regulation IV, Rule 4.3 - Exemptions for Permit.* Retrieved December 11, 2015, from http://www.arb.ca.gov/DRDB/FR/CURHTML/R4-3.PDF

FedCenter.gov. (2016). *Permits*. Retrieved from https://www.fedcenter.gov/assistance/facilitytour/air/permits/index.cfm?&printable=1

FEMA. (2000). *44 CFR Section 59.1 of the National Flood Insurance Program (NFIP) Regulations: Definitions of NFIP Terms.* Retrieved May 2015, from http://www.fema.gov/media-library/assets/documents/12437?id=3064

FEMA. (2010, March). *Guidelines for Estimation of Percolation losses for NFIP Studies.* Retrieved August 6, 2015, from FEMA: http://www.fema.gov/media-library-data/20130726-1731-25045-9495/dl_perc.pdf

FEMA. (2013). *Unit 3: NFIP Flood Studies and Maps*. Retrieved May 2015, from http://www.fema.gov/media-library-data/20130726-1539-20490-0241/nfip_sg_unit_3.pdf

FEMA. (2014a, May). *Chapter 8: Floodplain Natural Resources and Functions*. Retrieved May 2015, from https://training.fema.gov/hiedu/docs/fmc/chapter%208%20-%20floodplain%20natural%20resources%20and%20functions.pdf

FEMA. (2014b, May). *The National Flood Insurance Program Community Status Book.* Retrieved May 2015, from http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book

FEMA. (2014c, May). *Community Rating System*. Retrieved May 2015, from http://www.fema.gov/media-library-data/1398878892102-5cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf

FEMA. (2014d, May). *Chapter 2: Types of Floods and Floodplains*. Retrieved May 2015, from http://training.fema.gov/hiedu/docs/fmc/chapter%202%20-%20types%20of%20floods%20and%20floodplains.pdf

FEMA. (2015, April). *Floodplain Management Fact Sheet*. Retrieved May 2015, from https://www.fema.gov/floodplain-management-fact-sheet

Fenneman, N. (1916). *Physiographic Subdivision of the United States.* Retrieved April 2015, from http://www.pnas.org/content/3/1/17.full.pdf?ck=nck

FGDC. (2013, August). *Classification of Wetlands and Deepwater Habitats of the United States.* Retrieved April 17, 2015, from FGDC Subcommittee on Wetlands Data: http://www.fgdc.gov/standards/projects/FGDC-standards-projects/wetlands/nvcs-2013

FHWA. (2009, October). *Advances in Wildlife Crossing Technologies*. Retrieved July 12, 2016, from Public Roads: http://www.fhwa.dot.gov/publications/publicroads/09septoct/03.cfm

FHWA. (2011, 7 14). *Highway Traffic and Construction Noise*. Retrieved 07 27, 2015, from fhwa.dot.gov: http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/probresp.cfm#appendix

FHWA. (2013, September 3). *National Scenic Byways Program - Intrinsic Qualities: Identification and Distinctions*. Retrieved May 2016, from http://www.fhwa.dot.gov/hep/scenic_byways/byway_quality/analysis/iq_identification.cfm

FHWA. (2014, October 21). *Public Road Length*. Retrieved December 9, 2015, from http://www.fhwa.dot.gov/policyinformation/statistics/2013/hm10.cfm

FHWA. (2015a, May 28). *Bridges by State and County 2014*. Retrieved December 9, 2015, from http://www.fhwa.dot.gov/bridge/nbi/no10/county14.cfm#ca

FHWA. (2015b, December). *Route Log and Finder List*. Retrieved December 9, 2015, from Federal Highway Administration: http://www.fhwa.dot.gov/reports/routefinder/#s09

FHWA. (2015c, December). *California*. Retrieved December 9, 2015, from http://www.fhwa.dot.gov/byways/states/CA

FHWA. (2015d, May 28). *Highway Traffic Noise*. Retrieved July 22, 2015, from http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/faq_nois.cfm

FHWA. (2016a). *California, U.S. Department of Transportation Fedreal Highway Administration*. Retrieved from http://www.fhwa.dot.gov/byways/states/CA

FHWA. (2016b). *National Scenic Byways Program*. Retrieved from http://www.fhwa.dot.gov/hep/scenic_byways/

FHWA. (2016c). *Arroyo Seco Historic Parkway - Route 110*. Retrieved from http://www.fhwa.dot.gov/byways/byways/10246

FHWA. (2016d). *Death Valley Scenic Byway*. Retrieved from http://www.fhwa.dot.gov/byways/byways/2176

FHWA. (2016e). *Ebbetts Pass Scenic Byway*. Retrieved from http://www.fhwa.dot.gov/byways/byways/2305

FHWA. (2016f). *Route 1 - Big Sur Coast Highway*. Retrieved from http://www.fhwa.dot.gov/byways/byways/2301

FHWA. (2016g). *Route 1 - San Luis Obispo North Coast Byway*. Retrieved from http://www.fhwa.dot.gov/byways/byways/2475

FHWA. (2016h). *Tioga Road/Big Oak Flat Road*. Retrieved from http://www.fhwa.dot.gov/byways/byways/2302

FHWA. (2016i). *Volcanic Legacy Scenic Byway*. Retrieved from http://www.fhwa.dot.gov/byways/byways/2587

FHWA. (2016j). *Route 1 - San Luis Obispo North Coast Byway Gallery*. Retrieved from http://www.fhwa.dot.gov/byways/byways/2475/photos

Fiber Optic Association. (2010). *Guide to Fiber Optics & Premises Cabling*. Retrieved September 21, 2015, from Safety in Fiber Optic Installations: http://www.thefoa.org/tech/safety.htm

FindLaw. (2016). *Guidelines for Drafting Municipal Noise Control Ordinances*. Retrieved from http://corporate.findlaw.com/law-library/guidelines-for-drafting-municipal-noise-control-ordinances.html

First Responder Network Authority. (2015, November 9). *California's Initial Consultation Highlights Strong Partnerships, Use Cases*. Retrieved December 18, 2015, from http://www.firstnet.gov/newsroom/blog/california%E2%80%99s-initial-consultation-highlights-strong-partnerships-use-cases

Fitzgerald, R. T. (1999). The Milling Stone Horizon revisited: new perspectives from northern and central California. *Journal of California and Great Basin Anthropology*, 67-93.

Foothill Conservancy. (2014, February). *Mokelumne State Wild and Scenic River Proposal Summary*. Retrieved from http://www.foothillconservancy.org/dl.cgi/1393017792_9011.f_page_pdf.pdf/Moke%20state%20summary.pdf

FRA. (2015). *Federal Railroad Administration Horn Noise FAQ*. Retrieved July 22, 2015, from https://www.fra.dot.gov/Page/P0599

Fredrickson, D. A. (1973). Early Cultures of the North Coast Ranges, California. Department of Anthropology, University of California, Davis. Retrieved August 2016, from https://www.sonoma.edu/asc/davefredrickson/history/DAF_1973_Dissertation.pdf

FTA. (2006). *Transit Noise and Vibration Impact Assessment.* FTA.

Galloway, D., & Riley, F. (2006). *San Joaquin Valley, California.* Retrieved December 2015, from http://pubs.usgs.gov/circ/circ1182/pdf/06SanJoaquinValley.pdf

GAO. (2013). *Data Center Consolidation: Strengthened Oversight Needed to Achieve Billions of Dollars in Savings*. Retrieved from http://www.gao.gov/products/GAO-13-627T

Gehring, J., Kerlinger, P., & Manville., A. M. (2011). The role of tower height and guy wires on avian collisions with communication towers. *The Journal of Wildlife Management, 75*, 848-855. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/jwmg.99/abstract

Glenn County APCD. (1999, May). Article III - Construction Authorization and Registration. Retrieved December 13, 2015, from http://www.arb.ca.gov/DRDB/GLE/CURHTML/ART-III.HTM

Glenn County APCD. (2001, June 19). Article VIII -- Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990. Retrieved July 18, 2016, from http://www.arb.ca.gov/DRDB/GLE/CURHTML/ART-VIII.PDF

GLOBE SCRC. (2015). *GLOBE Student Climate Research Center*. Retrieved from http://www.globe.gov/web/scrc/overview

Governor's Office of Planning and Research. (2003, October). *2003 Environmental Justice Report.* Retrieved 2015, from https://www.opr.ca.gov/docs/OPR_EJ_Report_Oct2003.pdf

GPO. (1998). *Government Publications*. Retrieved June 14, 2016, from https://www.gpo.gov/fdsys/search/pagedetails.action?browsePath=Title+7%2FChapter+61%2FSec.+2814&granuleId=USCODE-1998-title7-chap61-sec2814&packageId=USCODE-1998-title7&collapse=true&fromBrowse=true&collectionCode=USCODE

GPO. (2009, January 1). *Government Publications*. Retrieved June 14, 2016, from https://www.gpo.gov/fdsys/granule/CFR-2009-title7-vol3/CFR-2009-title7-vol3-sec201-2

GPO. (2010, April 5). Title 40 Code of Federal Regulations Part 93.153. Retrieved July 21, 2015, from http://www.ecfr.gov/cgi-bin/text-

idx?SID=2028b268447f0bf79b396678569dac85&mc=true&node=se40.20.93_1153&rgn=div8

GPO. (2011). *Title 7, Agriculture, Chapter 104 - Plant Protection*. Retrieved from https://www.gpo.gov/fdsys/pkg/USCODE-2011-title7/pdf/USCODE-2011-title7-chap104.pdf

GPO. (2014a). *Green Sea Turtle Listing.* Retrieved June 16, 2016, from Federal Register: https://www.gpo.gov/fdsys/pkg/FR-2016-04-06/pdf/2016-07587.pdf

GPO. (2014b). *Revised Designation of of Critical Habitat for Canada Lynx.* Retrieved June 16, 2016, from Federal Register: https://www.gpo.gov/fdsys/pkg/FR-2014-09-12/pdf/2014-21013.pdf

GPO. (2015, January 1). *Government Publications*. Retrieved June 14, 2016, from https://www.gpo.gov/fdsys/search/pagedetails.action?collectionCode=CFR&browsePath=Title+7%2FSubtitle+B%2FChapter+III%2FPart+360&granuleId=CFR-2015-title7-vol5-part360&packageId=CFR-2015-title7-vol5&collapse=true&fromBrowse=true

Great Basin Unified APCD. (2012, September 5). Regulation II - Permits. Retrieved December 13, 2015, from http://www.gbuapcd.org/rulesandregulations/GBUAPCD_Rules%20and%20Regulations.pdf

Great Basin Unified APCD. (2016). *Great Basin Unified Air Pollution Control District: Rules and Regulations*. Retrieved August 10, 2016, from http://gbuapcd.org/rulesandregulations/index.htm

Griffith, G., Omernick, J., Smith, D., Cook, T., Tallyn, E., Moseley, K., & Johnson, C. (2016). *Ecoregions of California (poster)*. Retrieved from https://pubs.er.usgs.gov/publication/ofr20161021

Herps, C. (2015). Identifying California sea turtles. *Identifying California sea turtles*. Retrieved from http://www.californiaherps.com/identification/turtlesid/seaturtles.id.html

Highland, L., & Schuster, R. (2013). *Significant Landslide Events in the United States.* Retrieved December 2015, from http://landslides.usgs.gov/docs/faq/significantls_508.pdf

Highsmith, Carol M. (2012a). Painted Ladies. *Library of Congress Prints and Photographs Online Catalog*. San Francisco, California: Library of Congress. Retrieved January 2016, from http://www.loc.gov/resource/highsm.20921/

Highsmith, Carol M. (2012b). Golden Gate Bridge, San Francisco, California. *Library of Congress Prints and Photographs Online Catalog*. San Francisco, California: Library of Congress. Retrieved January 2016, from http://www.loc.gov/resource/highsm.22576/

Hill, D., Hockin, D., Price, D., Tucker, G., Morris, R., & Treweek, J. (1997). Bird Disturbance: Improving the Quality and Utility of Disturbance Research. *Journal of Applied Ecology*, 34(2): 275-288.

Historic American Buildings Survey. (1933a). 1241 Martin Avenue, Southeast Front - Hanchett Residence Park, 1225-1257 Martin Avenue, San Jose, Santa Clara County, CA. *Library of Congress Prints and Photographs Online Catalog*. San Jose, California: Library of Congress. Retrieved January 2016, from http://www.loc.gov/resource/hhh.ca0969.photos/?sp=4

Historic American Buildings Survey. (1933b). South (main) and east elevations - Sacramento City Hall, 915 I Street, Sacramento, Sacramento County, CA. *Library of Congress Prints and Photographs Online Catalog*. Sacramento, California: Library of Congress. Retrieved January 2016, from http://www.loc.gov/resource/hhh.ca1298.photos/?sp=1

Hughes, R. E. (1994). *Toward a New Taxonomic Framework for Central California Archaeology: Essays by James A. Bennyhoff and David A. Frederickson.* Berkeley: University of California Archaeological Reserach Facility.

Idaho State University. (2000). *Environmental Geology*. Retrieved March 20, 2016, from http://geology.isu.edu/wapi/EnvGeo/EG4_mass_wasting/EG_module_4.htm

Imperial County APCD. (1994, November 29). Rule 925 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/IMP/CURHTML/R925.HTM

Imperial County APCD. (2016, January 1). Rules and Regulations. Retrieved December 14, 2015, from http://www.co.imperial.ca.us/AirPollution/Forms%20&%20Documents/RULEBOOK/13%20RULEBOOK%20JAN%202016.pdf

International Finance Corporation. (2007, April 30). *Environmental, Health, and Safety Guidelines for Telecommunications*. Retrieved from http://www.ifc.org/wps/wcm/connect/0985310048855454b254f26a6515bb18/Final+-+Telecommunications.pdf?MOD=AJPERES&id=1323152343828

IPCC. (2007). *Climate Change 2007: Synthesis Report.* Retrieved 2015, from Intergovernmental Panel on Climate Change: www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf

IPCC. (2013). *Climate Change 2013: The Physical Science Basis.* Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/report/ar5/wg1/

Israel, J. A., & May, B. (2007, January 29). *Mixed Stock Analysis of Green Sturgeon from Washington State Coastal Aggregations.* Retrieved from http://www.fishsciences.net/reports/2007/Israel_May_2007_Mixed_stock_analysis.pdf

ITU-T. (2012). *Series L: Construction, Installation and Protection of Cables and Other Elements of Outside Plant.* International Telecommunication Union, Telecommunication Standardization Sector of ITU, Geneva. Retrieved from https://www.itu.int/rec/T-REC-L/en

Johnson, Dale E. (2016a). *Pseudobahia bahiifolia.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=4491

Johnson, Dale E. (2016b). Pseudobahia peirsonii. *Pseudobahia peirsonii*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=4493

Johnson, M. J. (2009). *Understanding the Habitat Needs of the Declining Western Yellow-billed Cuckoo.* Retrieved from http://pubs.usgs.gov/fs/2009/3091/fs2009-3091.pdf

Jones, T. L. (2007). The Central Coast: A Midlatitude Milieu. In T. L. Jones, *California Prehistory: Colonialization, Culture, and Complexity* (pp. 126-146). Lanham, Maryland: AltaMira Press.

Jump, P., Longcore, T., & Rich, C. (2006). *Ecology and distribution of a newly discovered population of the federally threatened Euproserpinus euterpe (Sphingidae).* Retrieved from http://images.peabody.yale.edu/lepsoc/jls/2000s/2006/2006-60(1)41-Jump.pdf

Keil, D. J. (2014). Verbesina dissita. *Verbesina dissita*. Retrieved from http://herbaria4.herb.berkeley.edu/eflora_display.php?tid=5489

Kelley, R. B., & Ganders, F. R. (2016). *Amsinckia grandiflora.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=13130

Kottek, M. (2006). *World Map of the Köppen-Geiger Climate Classification.* Offenbach, Germany and Vienna, Austria: Gebrüder Borntraeger.

Lake County AQMD. (2006, August 9). Rules and Regulations. Retrieved December 14, 2015, from http://www.arb.ca.gov/DRDB/LAK/CURHTML/LCAQMDRULEBOOK2006.PDF

LA-RICS. (2015, August 6). *LARICS.org--Meeting Minutes*. Retrieved December 11, 2015, from http://www.la-rics.org/wp-content/uploads/2014/02/1.2.3Final-Regular-Meeting-Minutes-Dated-8.6.2015soc.tlm_.pm_.wst-3.pdf

LaRose, D. J. (2009). Political Geography and Colonialism in Mission Valley, San Diego: Spanish-Kumeyaay Interactions at Cosoy and the Presidio . *Proceedings of the Society for California Archaeology*.

Lassen County APCD. (2001, July 23). Regulation VII -- Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/LAS/CURHTML/RegVII.PDF

Lassen County APCD. (2011, January 11). *Regulation II, Rule 2-1 - Sources Not Requiring Permits.* Retrieved December 14, 2015, from http://www.arb.ca.gov/DRDB/LAS/CURHTML/R2-1.PDF

Lassen County APCD. (2014, January 15). Regulation IV, Rule 4:18 - Fugitive Dust. Retrieved December 14, 2015, from http://www.arb.ca.gov/DRDB/LAS/CURHTML/R4-18.HTM

LAX. (2015a, December). *Ten Year Summary of Passengers*. Retrieved December 9, 2015, from http://www.lawa.org/welcome_LAX.aspx?id=800

LAX. (2015b, December). *Ten Year Summary of FAA Aircraft Movements*. Retrieved December 9, 2015, from http://www.lawa.org/welcome_LAX.aspx?id=806

LAX. (2015c, December). *Ten Year Summary of Air Freight*. Retrieved December 9, 2015, from http://www.lawa.org/welcome_LAX.aspx?id=802

Legislative Counsel State of California. (2015a). *Public Utilities Code, Section 21001-21020, State Aeronautics Act*. Retrieved December 2015, from http://www.leginfo.ca.gov/cgi-bin/displaycode?section=puc&group=21001-22000&file=21001-21020

Legislative Counsel State of California. (2015b). *Calfornia Law, California Public Utilities Code, Division 9, Aviation*. Retrieved December 15, 2015, from Official California Legislative Information: http://www.leginfo.ca.gov/cgi-bin/calawquery?codesection=puc&codebody=&hits=20

Lew, A. (2004a). *Chapter 9 - The Mountain West and Southwest.* Retrieved April 2015, from Northern Arizona University: http://www.geog.nau.edu/courses/alew/gsp220/text/chapters/ch9.html

Lew, A. (2004b). *Chapter 10 - THE PACIFIC COAST*. Retrieved December 2015, from http://www.geog.nau.edu/courses/alew/gsp220/text/chapters/ch10.html

Manaster, A. K., & Selmi, D. P. (2016). *Controls on Noise.* California Environmental Law and Land Use Practice. Retrieved from https://litigation-essentials.lexisnexis.com/webcd/app?action=DocumentDisplay&crawlid=1&doctype=cite&docid=6-83+California+Environmental+Law+%26+Land+Use+Practice+83.syn&srctype=smi&srcid=2A04&key=d0cfc95abeaa331b682e1addb899bcd1

Marine Life Studies. (2012). *Marine mammals of California*. Retrieved from http://www.marinelifestudies.org/files/MMG_Sept_2012MarineLifeStudies.pdf

Mariposa County APCD. (2008a, April 11). Regulation X - Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990 - Rule 101. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/MPA/CURHTML/R1001.HTM

Mariposa County APCD. (2008b, April 11). Regulation IV, Rule 402 - Exemptions to Rule 401. Retrieved December 14, 2015, from http://www.arb.ca.gov/DRDB/MPA/CURHTML/R402.HTM

Mariposa County APCD. (2008c, April 11). Regulation X - Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990 - Rule 1002. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/MPA/CURHTML/R1002.HTM

McAlester, V. S. (2013). *A Field Guide to American Houses: The Definitive Guide to Identifying and Understanding America's Domestic Architecture.* New York: Knopf Doubleday Publishing Group.

McCabe, S. W. (2016a). Dudleya stolonifera. *Dudleya stolonifera*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=23674

McCabe, S. W. (2016b). Dudleya nesiotica. *Dudleya nesiotica*. Retrieved from http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=23667

McGuire, K. R. (1994). The possibilities of women and men: gender and the California milling stone horizon. *Journal of California and Great Basin Anthropology*, 41-59.

Mendocino County AQMD. (2000a, November 14). Regulation 5 - Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/MEN/CURHTML/reg5toc.pdf

Mendocino County AQMD. (2000b, November 14). Regulation 5, Chapter 2 - Definitions Used in Regulation 5. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/MEN/CURHTML/reg5chapter2.pdf

Mendocino County AQMD. (2006, December 5). *Regulation I, Chapter 2 - Permits.* Retrieved December 15, 2015, from http://www.arb.ca.gov/DRDB/MEN/CURHTML/REG1CHAPTER2.PDF

Mendocino County AQMD. (2011). *Regulation 1 -- Air Pollution Control Rules*. Retrieved August 10, 2016, from http://www.co.mendocino.ca.us/aqmd/district-regulation-1.html

Merriam Webster Dictionary. (2015a). *Sea Level*. Retrieved July 2015, from Merriam Webster Dictionary: http://www.merriam-webster.com/dictionary/sea%20level

Merriam Webster Dictionary. (2015b). *Airspace*. Retrieved June 2015, from Merriam Webster Dictionary: http://www.merriam-webster.com/dictionary/airspace

Merriam Webster Dictionary. (2016a). *Chaparral.* Retrieved from http://www.merriam-webster.com/dictionary/chaparral

Merriam Webster Dictionary. (2016b). *Bovid.* Retrieved from http://www.merriam-webster.com/dictionary/bovid?utm_campaign=sd&utm_medium=serp&utm_source=jsonld

Merriam Webster Dictionary. (2016c). *Parr mark.* Retrieved from http://www.merriam-webster.com/dictionary/Parr%20marks?utm_campaign=sd&utm_medium=serp&utm_source=jsonld

Merriam Webster Dictionary. (2016d). *Parotid Gland*. Retrieved from http://www.merriam-webster.com/dictionary/parotid%20gland?utm_campaign=sd&utm_medium=serp&utm_source=jsonld

Merriam Webster Dictionary. (2016e). *Definition of bract*. Retrieved from http://www.merriam-webster.com/dictionary/bract

Metro Rail. (2015, December). *Facts at a Glance*. Retrieved December 9, 2015, from https://www.metro.net/news/facts-glance/

MFWP; MNHP. (2015). *Montana field guide*. Retrieved from http://fieldguide.mt.gov/displayES_LCLU.aspx

Miller, J. M., & Jokerst, J. D. (2016). Acanthomintha ilicifolia. *Acanthomintha ilicifolia*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=11725

Milliken, R., Fitzgerald, R. T., Hylkema, M. G., Groza, R., Origer, T., Bieling, D. G., . . . Fredrickson, a. D. (2007). *Punctuated Culture Change in the San Francisco Bay Area, In California Prehistory: Colonization, Culture, and Complexity.* Altamira Press.

Modoc County APCD. (1989a, January 15). Regulation II, Rule 2.2 - Exemptions. Retrieved December 15, 2015, from http://www.arb.ca.gov/DRDB/MOD/CURHTML/R2-2.HTM

Modoc County APCD. (1989b, January 15). Regulation II, Rule 2:1 - Sources Not Requiring Permits. Retrieved December 15, 2015, from http://www.arb.ca.gov/DRDB/MOD/CURHTML/R2-1.HTM

Modoc County APCD. (2001, July 24). Rule 2.13 -- Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990. Retrieved 17 2016, June, from http://www.arb.ca.gov/DRDB/MOD/CURHTML/R2-13.PDF

Mojave Desert AQMD. (1977a, July 25). Regulation II, Rule 203 - Permit to Operate. Retrieved December 16, 2015, from http://www.mdaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=344

Mojave Desert AQMD. (1977b, July 25). Regulation II, Rule 202 - Permit to Operate. Retrieved December 16, 2015, from http://www.mdaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=1917

Mojave Desert AQMD. (1977c, July 25). Regulation II, Rule 201 - Permit to Construct. Retrieved December 16, 2015, from http://www.mdaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=345

Mojave Desert AQMD. (1977d, July 25). Regulation IV, Rule 403 - Fugitive Dust. Retrieved December 16, 2015, from http://www.mdaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=313

Mojave Desert AQMD. (2005, September 26). Regulation XII, Rule 1201 - Definitions. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/MOJ/CURHTML/R1201.PDF

Mojave Desert AQMD. (2011, February 28). Regulation XII, Rule 1200 - General. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/MOJ/CURHTML/R1200.PDF

Monterey Bay Unified APCD. (2010, November 17). Regulation II, Rule 218 - Title V: Federal Operating Permits. Retrieved December 16, 2015, from http://www.arb.ca.gov/DRDB/MBU/CURHTML/R218.PDF

Monterey Bay Unified APCD. (2014, October 15). *Regulation II, Rule 201 - Sources Not Requiring Permits.* Retrieved December 16, 2015, from http://www.arb.ca.gov/DRDB/MBU/CURHTML/R201.PDF

Moody, D. W., Carr, J., Chase, E. B., & Paulson, R. W. (1986). *National Water Summary 1986 -- Hydrologic Events and Ground-Water Quality.* Retrieved April 5, 2015, from http://pubs.er.usgs.gov/publication/wsp2325

Moser, M. L., & Lindley, S. T. (2007). Use of Washington estuaries by subadult and adult green sturgeon. *Environmental Biology of Fishes*(3), 243-253. doi:10.1007/s10641-006-9028-1

Moss, M. L. (2013). Waterfowl and lunate crescents in Western North America: The archaeology of the Pacific flyway. *Journal of world prehistory*, 173-211.

Moyle & Cech. (2004). *Fishes An Introduction to Ichthyology.* Retrieved from http://limnology.wisc.edu/courses/zoo510/2009/moyle_ch2.pdf

MTS. (2015, December). *MTS Trolley Map*. Retrieved December 9, 2015, from http://www.sdmts.com/schedules-real-time-maps-and-routes/trolley

Muni. (2015, December). *How to Ride*. Retrieved December 9, 2015, from https://www.sfmta.com/getting-around/transit/how-ride

NASA. (2013, August 24). *Rim Fire, California.* Retrieved December 18, 2015, from Earth Observatory: http://earthobservatory.nasa.gov/IOTD/view.php?id=81919

NASAO. (2010). *2010 California Aviation Systems Plan, 2010 General Aviation Systems Need Assessment (GASNA).* Retrieved July 15, 2015, from National Association of State Aviation Officials/Resources: http://www.activemerchandiser.com/JQCatalogView.aspx?CatalogOID=70106&SupplierID=404412&OpenPage=1&Format=0&SearchCriteria=&Ticket=&rand=1045000593

National Audubon Society - California. (2015). *Important bird areas - California.* Retrieved from http://ca.audubon.org/important-bird-areas-9

National Audubon Society. (2015). *Important bird areas - California*. Retrieved from http://netapp.audubon.org/iba/state/US-CA

National Conference of State Legislatures. (2015). *Federal and State Recognized Tribes.* Retrieved January 2016, from http://www.ncsl.org/research/state-tribal-institute/list-of-federal-and-state-recognized-tribes.aspx#State

National League of Cities. (2007). (Census of Goverments) Retrieved May 21, 2015, from Subcounty, General-Purpose Governments by Population-Size Group and State: http://www.nlc.org/build-skills-and-networks/resources/cities-101/city-structures/number-of-municipal-governments-and-population-distribution

National Recreation Trails. (2015). *National Recreation Trails Database*. Retrieved November 3, 2015, from http://www.americantrails.org/NRTDatabase/trailList.php?usrTrailName=&usrTrailState=MO&usrTrailCounty=&usrTrailUse=

National Recreation Trails. (2016). *National Recreation Trails Database*. Retrieved from http://www.americantrails.org/NRTDatabase/trailList.php?usrSortOrder=TrailName&maxRows_rsTrails=15000&usrTrailName=&usrTrailState=CA&usrTrailUse=&usrTrailCounty=&usrTrailUse2=&usrAgency=&usrYearDesignated=&usrTrailLength=0&usrTrailQuery=&usrTrailType=

National Register of Historic Places. (1985). *U.S. Post Offices in California, 1900-1941.* Sacramento: California State Parks: Office of Historic Preservation.

National Register of Historic Places. (1990). *California Carnegie Libraries.* Sacramento: California State Parks: Office of Historic Preservation.

National Register of Historic Places. (1991). *Light Stations of California.* Sacramento: California State Parks: Office of Historic Preservation.

National Wild and Scenic Rivers System. (2015a). *About the WSR Act*. Retrieved April 6, 2015, from New York: http://www.rivers.gov/wsr-act.php

National Wild and Scenic Rivers System. (2015b). *California*. Retrieved December 2015, from http://www.rivers.gov/california.php

National Wild and Scenic Rivers System. (2015c). *California*. Retrieved December 8, 2015, from http://www.rivers.gov/california.php

National Wild and Scenic Rivers System. (2016). *California*. Retrieved from https://www.rivers.gov/california.php

National Wildlife Federation. (2015). *Ecoregions.* Retrieved July 1, 2015, from http://www.nwf.org/Wildlife/Wildlife-Conservation/Ecoregions.aspx

Natural Resources Agency. (2010, June). *State of the State's Wetlands: 10 Years of Challenges and Progress.* Retrieved December 17, 2015, from State of California: http://resources.ca.gov/docs/SOSW_report_with_cover_memo_10182010.pdf

NCED. (2015). *State of California and All Easements*. Retrieved December 3, 2015, from http://conservationeasement.us/reports/easements

NCRWQCB. (2006, September 15). *North Coast Water Quality Basin Plan.* Retrieved December 7, 2015, from http://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/083105-bp/02_introduction.pdf

New England Coastal Wildlife Alliance. (2007). *The finback whale (Balaenoptera physalus).* Retrieved from http://www.necwa.org/finback.html

New Hampshire Department of Environmental Services. (2014). *Geologic Mapping Program.* Retrieved August 2015, from http://des.nh.gov/organization/commissioner/gsu/gmp/categories/overview.htm

NIH. (2015, June). *What is TOXMAP?* Retrieved from http://toxmap.nlm.nih.gov/toxmap/faq/2009/08/what-is-toxmap.html

NIST. (2015, March). *Nationwide Public Safety Broadband Network Deployment: Network Parameter Sensitivity Analysis.* Retrieved from http://nvlpubs.nist.gov/nistpubs/ir/2015/NIST.IR.8039.pdf

NMFS. (1970). *Guadalupe fur seal; 50 FR 294.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr910.pdf

NMFS. (1998). *Recovery plan for the blue whale (Balaenoptera musculus).* Retrieved from https://ecos.fws.gov/docs/recovery_plan/whale_blue.pdf

NMFS. (2010a). *Habitat areas of particular concern with essential fish habitat*. Retrieved from http://www.npfmc.org/wp-content/PDFdocuments/conservation_issues/HAPC/hapc_process092010.pdf

NMFS. (2010b). *Final recovery plan for the sperm whale.* Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/recovery/final_sperm_whale_recovery_plan_21dec.pdf

NMFS. (2012a). *Sei whale recovery plan.* Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/recovery/seiwhale.pdf

NMFS. (2012b). *Final rule to revise the critical habitat designation for the endangered Leatherback Sea Turtle*. Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/fr/fr77-4170.pdf

NOAA. (1998a). *A Species List for Elkhorn Slough and Adjacent Uplands*. Retrieved June 15, 2016, from http://montereybay.noaa.gov/research/techreports/trdevo1998c.html

NOAA. (1998b). *Green Sea Turtle Recovery Plan.* Retrieved June 20, 2016, from http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_green_pacific.pdf

NOAA. (1999). *Critical Habitat for Central California Coast and Southern Oregon - Northern California Coast ESU Coho Salmon.* Retrieved from http://www.fisheries.noaa.gov/pr/pdfs/fr/fr64-24049.pdf

NOAA. (2008). *White abalone recovery plan.* Retrieved from http://www.westcoast.fisheries.noaa.gov/publications/protected_species/other/abalone_species/white_abalone_recovery_plan_10-27-08_final_with_sig.pdf

NOAA. (2009, October 9). *74 FR 52300 - Critical Habitat Designation for Green Sturgeon.* Retrieved June 23, 2016, from http://www.nmfs.noaa.gov/pr/pdfs/fr/fr74-52300.pdf

NOAA. (2013). *Fin whale (Balaenoptera physalus).* Retrieved from http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/finwhale.htm

NOAA. (2014a, May). *Protected Resources Glossary*. Retrieved 10 2016, August, from http://www.nmfs.noaa.gov/pr/glossary.htm

NOAA. (2014b). *Olive ridley turtle (Lepidochelys olivacea).* Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/oliveridley.html

NOAA. (2014c, May). *Pacific Salmonids Major Threats and Impacts.* Retrieved June 22, 2016, from http://www.nmfs.noaa.gov/pr/species/fish/salmon.html

NOAA. (2015a). *San Francisco Bay National Estuarine Research Reserve*. Retrieved December 11, 2015, from http://nerrs.noaa.gov/reserves/san-francisco-bay.html

NOAA. (2015b). *Elkhorn Slough National Estuarine Research Reserve*. Retrieved December 14, 2015, from http://nerrs.noaa.gov/reserves/elkhorn-slough.html

NOAA. (2015c). *Tijuana River National Estuarine Research Reserve*. Retrieved December 14, 2015, from http://nerrs.noaa.gov/reserves/tijuana-river.html

NOAA. (2015d). *Chinook Salmon*. Retrieved from http://www.nmfs.noaa.gov/pr/species/fish/chinook-salmon.html

NOAA. (2015e). *Coho Salmon (Oncorhynchus kisutch).* Retrieved from http://www.fisheries.noaa.gov/pr/species/fish/coho-salmon.html

NOAA. (2015f). *Species Summary for the Steelhead Trout*. Retrieved from http://www.fisheries.noaa.gov/pr/species/fish/steelhead-trout.html

NOAA. (2015g). *Green Turtle - (Chelonia mydas).* Retrieved from NOAA: http://www.nmfs.noaa.gov/pr/species/turtles/green.htm

NOAA. (2015h). *National Oceanic and Atmospheric Administration*. Retrieved from Data Tools: 1981 - 2010 Normals: http://www.ncdc.noaa.gov/cdo-web/datatools/normals

NOAA. (2015i). *Leatherback turtle (Dermochelys coriacea).* Retrieved from www.nmfs.noaa.gov/pr/species/turtles/leatherback.html

NOAA. (2015j). *Threats to sea turtles*. Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/threats.htm

NOAA. (2015k). *Flood Related Hazards*. Retrieved July 2015, from http://www.floodsafety.noaa.gov/hazards.shtml

NOAA. (2015l). *Humpback whale (Megaotera novaeangliae).* Retrieved from http://www.nmfs.noaa.gov/pr/species/mammals/whales/humpback-whale.html

NOAA. (2015m). *Identification of 14 distinct population segments of the humpback whale and proposed revision of species wide listing*. Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2015-04-21/pdf/2015-09010.pdf

NOAA. (2016). *State Climate Extremes Committee (SCEC).* Retrieved August 31, 2016, from http://www.ncdc.noaa.gov/extremes/scec/records

NOAA, USGS, SERPD, and USACE. (2012). *Global Sea Level Rise Scenarios for the United States National Climate Assessment*.

NoiseMeters.Inc. (2016). *Ldn, Lden, CNEL - Community Noise Calculators*. Retrieved from https://www.noisemeters.com/apps/ldn-calculator.asp

North Coast Unified AQMD. (2015a, March 122015). Regulation V - Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990. Retrieved December 18, 2015, from http://www.ncuaqmd.org/files/rules/reg%205/Regulation%20V.pdf

North Coast Unified AQMD. (2015b, July 9). *Regulation I - General Provisions, Permits, and Prohibitions*. Retrieved December 18, 2015, from http://www.ncuaqmd.org/files/rules/reg%201/Regulation%20I%20-%20General%20Provisions.pdf

Northern Sierra AQMD. (1994, May 11). Regulation II, Rule 226 - Dust Control. Retrieved December 18, 2015, from http://www.arb.ca.gov/DRDB/NSI/CURHTML/R226.HTM

Northern Sierra AQMD. (2001, March 8). Regulation V, Rule 522, Title V Federal Operating Permits. Retrieved December 18, 2015, from http://myairdistrict.com/Reg_V_-_522.pdf

Northern Sierra AQMD. (2005, June 27). Regulation IV, Rule 402 - Exemptions to Rule 401. Retrieved December 18, 2015, from http://www.arb.ca.gov/DRDB/NSI/CURHTML/R402.PDF

Northern Sierra AQMD. (2016). *Air Quality Info*. Retrieved August 10, 2016, from http://myairdistrict.com/index.php/air-quality-info/

Northern Sonoma County APCD. (1985a, September 19). Regulation I, Chapter 1, Rule 103 - Definitions. Retrieved December 18, 2015, from http://www.arb.ca.gov/DRDB/NSC/CURHTML/r1-1-130.PDF

Northern Sonoma County APCD. (1985b, Septmber 19). Regulation I, Chapter 4, Rule 430 - Fugitive Dust Emissions.

Northern Sonoma County APCD. (2011, May 8). Regulation V, Chapter II - Definitions used in Regulation 5. Retrieved December 19, 2015, from http://www.arb.ca.gov/DRDB/NSC/CURHTML/R5-2.HTM

NPS. (1995, July 12). *The Secretary of the Interior's Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes.* Retrieved September 4, 2015, from National Park Service: http://www.nps.gov/tps/standards/four-treatments/landscape-guidelines/index.htm

NPS. (2000). *Geologic Glossary.* Retrieved August 2015, from https://www.nature.nps.gov/geology/usgsnps/misc/glossaryDtoI.html#G

NPS. (2012a, June 28). *California*. Retrieved December 3, 2015, from https://www.nature.nps.gov/nnl/state.cfm?State=CA

NPS. (2012b, July 17). *The National Trails System Act*. Retrieved April 12, 2015, from http://nature.nps.gov/nnl/index.cfm

NPS. (2013a, December 10). *Geologic Hazards*. Retrieved September 1, 2015, from Geologic, Energy, and Mineral Resources: http://www.nature.nps.gov/geology/hazards/

NPS. (2013b, December 10). *Geologic Hazards*. Retrieved September 1, 2015, from Geologic, Energy, and Mineral Resources: http://www.nature.nps.gov/geology/hazards/

NPS. (2014a). *Earth Science Concepts -- Geology by Region*. Retrieved October 2015, from https://www.nature.nps.gov/geology/education/concepts/concepts_regional_geology.cfm

NPS. (2014b). *Earth Science Concepts*. Retrieved November 2015, from https://www.nature.nps.gov/geology/education/concepts/concepts_cascadesierra.cfm
NPS. (2014c). *Earth Science Concepts*. Retrieved December 2015, from http://nature.nps.gov/geology/education/concepts/concepts_regional_geology.cfm
NPS. (2014d, June 20). *Prohibition of Unmanned Aircraft in National Parks*. Retrieved June 2015, from https://www.nps.gov/gaar/learn/news/prohibition-of-unmanned-aircraft-in-national-parks.htm
NPS. (2014e). *California*. Retrieved December 2015, from http://www.nps.gov/state/ca/index.htm
NPS. (2014f, June 16). *National Park Service Science of Sound*. Retrieved July 22, 2015, from http://www.nature.nps.gov/sound/science.cfm
NPS. (2015a). *Earth Science Concepts -- Geology by Region*. Retrieved December 2015, from https://www.nature.nps.gov/geology/education/concepts/concepts_regional_geology.cfm
NPS. (2015b). *Lassen Volcanic National Park California*. Retrieved December 2015, from http://www.nps.gov/lavo/learn/nature/eruption_lassen_peak.htm
NPS. (2015c). *California*. Retrieved December 2015, from http://www.nps.gov/state/ca/index.htm
NPS. (2015d). *National Park Service, Find A Park - California*. Retrieved December 2015, from http://www.nps.gov/state/ca/index.htm
NPS. (2015e, November 29). *Redwood National and State Parks*. Retrieved December 8, 2015, from http://www.nps.gov/redw/index.htm
NPS. (2015f, November 27). *California*. Retrieved December 8, 2015, from http://www.nps.gov/state/ca/index.htm
NPS. (2015g). *World Heritage Sites in the U.S.* Retrieved from https://www.nps.gov/nr/travel/worldheritagesites/list_of_sites.htm#CA
NPS. (2015h, April 27). *National Historic Landmarks Program*. Retrieved April 28, 2015, from http://www.nps.gov/nhl/INDEX.htm
NPS. (2015i, April 15). *National Historic Landmarks Survey: National Park Service: Listing of National Historic Landmarks By State.* Retrieved December 8, 2015, from National Historic Landmarks Program: National Historic Landmarks in California: http://www.nps.gov/nhl/find/statelists/ca/CA.pdf
NPS. (2015j, February 18). *National Historic Landmarks Program.* Retrieved May 2016, from https://www.nps.gov/nhl/
NPS. (2015k, December 9). *Redwood National and State Parks*. Retrieved December 9, 2015, from http://www.nps.gov/redw/index.htm
NPS. (2015l, December 8). *Riveter WWII Home Front National Historical Park: Plan Your Visit*. Retrieved December 8, 2015, from http://www.nps.gov/rori/planyourvisit/index.htm
NPS. (2015m, December 7). *San Francisco Maritime National Historical Park: Plan Your Visit*. Retrieved December 8, 2015, from http://www.nps.gov/safr/planyourvisit/index.htm
NPS. (2015n, December 9). *Old Spanish National Historic Trail: Photo Gallery*. Retrieved December 9, 2015, from http://www.nps.gov/media/photo/gallery.htm?id=BBC004DF-155D-451F-67EDA5444DD19555
NPS. (2015o). *National Park Service, Find a Park - California*. Retrieved from https://www.nps.gov/state/ca/index.htm

NPS. (2015p). *Wilderness*. Retrieved September 2015, from http://wilderness.nps.gov/faqnew.cfm

NPS. (2015q). *National Park Service*. Retrieved December 16, 2015, from http://www.nps.gov/sapu/learn/historyculture/abo.htm

NPS. (2015r). *National Heritage Areas: A Map of All the National Heritage Areas*. Retrieved May 2015, from National Park Service: http://www.nps.gov/maps/full.html?mapId=01a03739-ab0c-40eb-bc3d-6791d3bb67fa

NPS. (2015s). *World War II Shipbuilding Facilities in the San Francisco Bay Area*. Retrieved December 2015, from http://www.nps.gov/nr/travel/wwiibayarea/shipbuilding.HTM

NPS. (2015t, September 30). *California National Park Service*. Retrieved October 7, 2015, from http://www.nps.gov/state/ca/index.htm

NPS. (2016a). *Marin dwarf-flax*. Retrieved from http://www.nps.gov/prsf/learn/nature/marin-dwarf-flax.htm

NPS. (2016b). *Presidio clarkia*. Retrieved from http://www.nps.gov/prsf/learn/nature/presidio-clarkia.htm

NPS. (2016c). *Raven's manzanita*. Retrieved from http://www.nps.gov/prsf/learn/nature/ravens-manzanita.htm

NPS. (2016d). *National Natural Landmarks Program, California*. Retrieved from http://www.nature.nps.gov/nnl/state.cfm?State=CA

NPS. (2016e). *National Natural Landmarks Program, U.S. Department of the Interior*. Retrieved from https://www.nps.gov/orgs/1211/index.htm

NPS. (2016f). *National Register of Historic Places Program: Fundamentals*. Retrieved September 23, 2015, from http://www.nps.gov/nr/national_register_fundamentals.htm

NPS. (2016g). *Manzanar National Historic Site*. Retrieved January 2016, from http://www.nps.gov/manz/index.htm

NPS. (2016h). *Island Fox*. Retrieved August 10, 2016, from https://www.nps.gov/chis/learn/nature/island-fox.htm

NRC. (2003, July 1). *A Tapestry of Time and Terrain: The Union of Two Maps, Geology and Topography*. Retrieved July 1, 2016, from http://pbadupws.nrc.gov/docs/ML0933/ML093340269.pdf

NRCS. (1996a). *Soil Quality Resource Concerns: Soil Erosion*. Retrieved September 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051278.pdf

NRCS. (1996b). *Soil Quality Resource Concerns: Compaction*. Retrieved September 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051594.pdf

NRCS. (2000, March). *Soil Quality - Urban Technical Note No. 1*. Retrieved from Erosion and Sedimentation on Construction Sites: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053285.pdf

NRCS. (2003). *Soil Compaction: Detection, Prevention, and Alleviation*. Retrieved September 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053258.pdf

NRCS. (2006). *Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.* Retrieved May 2015, from Major Land Resource Area: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051845.pdf

NRCS. (2009). *Protecting pollinators*. Retrieved from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/newsroom/photos/?cid=nrcs144p2_057907

NRCS. (2015a). *STATSGO2 Database.* Retrieved June 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053629

NRCS. (2015b). *What is Soil?* Retrieved June 2015, from Soil Education: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054280

NRCS. (2015c). *Hydric Soils -- Introduction.* Retrieved June 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961

NRCS. (2015d). *Twelve Orders of Soil Taxonomy*. Retrieved August 2015, from Soils: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053588

NRCS. (2015e). *Using Soil Taxonomy to Identify Hydric Soils*. Retrieved July 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_010785.pdf

NRCS. (2015f). *Erosion*. Retrieved September 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/erosion/

NRCS. (2015g). *Using Soil Taxonomy to Identify Hydric Soils*. Retrieved Nov 16, 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_010785.pdf

NTFI. (2005). *Why Can't We Talk? Working Together to Bridge the Communications Gap to Save Lives: A Guide for Public Officials.* U.S. Department of Justice, Office of Justice Programs, National Institute of Justice. National Task Force on Interoperability (NTFI). Retrieved from https://www.ncjrs.gov/pdffiles1/nij/204348.pdf

NTIA. (2005, October). *Interference Protection Criteria Phase 1 - Compilation from Existing Sources.* Retrieved January 6, 2016, from NTIA Report 05-432: https://www.ntia.doc.gov/files/ntia/publications/ipc_phase_1_report.pdf

NTIA. (2014). *Download Data.* Retrieved from National Broadband Map: http://www.broadbandmap.gov/data-download

NWF. (2015). *Invertebrates*. Retrieved from http://www.nwf.org/Wildlife/Wildlife-Library/Invertebrates.aspx

NWS. (2011a, October 21). *National Weather Service: JetStream - Online School for Weather*. Retrieved from National Oceanic and Atmospheric Adminisration: http://www.srh.noaa.gov/jetstream//global/climate.htm#map

NWS. (2011b, October 21). *National Weather Service: JetStream - Online School for Weather*. Retrieved from National Oceanic and Atmospheric Administration: http://www.srh.noaa.gov/jetstream//global/climate_max.htm

NWS. (2015). *Flooding in California*. Retrieved from http://www.floodsafety.noaa.gov/states/ca-flood.shtml

Ocean Protection Council. (2015). *CA Ocean and coastal water quality*. Retrieved December 16, 2015, from http://www.opc.ca.gov/2010/06/ocean-and-coastal-water-quality/

Oregon Department of Agriculture. (2015). *Applegate's Milk-vetch (Astragalus applegatei).* Retrieved from http://www.oregon.gov/oda/shared/Documents/Publications/PlantConservation/AstragalusApplegateiProfile.pdf

Oregon Department of Geology. (2015). *Earthquake Hazards in the Pacific Northwest*. Retrieved March 2015, from http://www.oregongeology.org/sub/earthquakes/EQs.htm

OSHA. (2003). *Fact Sheets on Natural Disaster Recovery: Flood Cleanup.* Retrieved December 2013, from https://www.osha.gov/OshDoc/data_Hurricane_Facts/Bulletin2.pdf

OSHA. (2013). *OSHA Technical Manual - Noise.* Retrieved from https://www.osha.gov/dts/osta/otm/new_noise/index.pdf

OSHA. (2015a). *California State Plan*. Retrieved December 9, 2015, from https://www.osha.gov/dcsp/osp/stateprogs/california.html

OSHA. (2015b). *Communication Towers*. Retrieved from https://www.osha.gov/doc/topics/communicationtower/index.html

OSHA. (2016a). *OSHA Technical Manual: Noise.* Retrieved May 2016, from Section III: Chapter 5: https://www.osha.gov/dts/osta/otm/new_noise/

OSHA. (2016b, March 28). *Regulations (Standards - 29 CFR)*. Retrieved from Occupational Safety & Health Administration: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9867

OSHA. (2016c). *Occupational Safety & Health Administration We Can Help*. (S. L. OSHA Directorate of Technical Support and Emergency Management, & U. Salt Lake City, Editors) Retrieved September 22, 2015, from Safety & Health Managment System Tools: https://www.osha.gov/SLTC/etools/safetyhealth/comp3.html#Safe Work Practices

Page, S. D. (2012, October 15). Timely Processing of Prevention of Significant Deterioration (PSD) Permits when EPA or a PSD-Delegated Air Agency Issues the Permit. Retrieved April 21, 2015, from https://www.epa.gov/nsr/timely-processing-prevention-significant-deterioration-psd-permits-when-epa-or-psd-delegated-air

Paleontology Portal. (2015). *California, US*. Retrieved December 16, 2015, from http://paleoportal.org/index.php?globalnav=time_space&sectionnav=state&state_id=10&period_id=7

Parker, V. T., Vasey, M. C., & Keeley, J. E. (2016a). *Arctostaphylos franciscana*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=13931

Parker, V. T., Vasey, M. C., & Keeley, J. E. (2016b). Arctostaphylos confertiflora. *Jepson eFlora*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=13920

Peterson, R. R. (1984). Early/Middle Period Subsistence Changes at SBA-1, Rincon Point, Coastal California. *Journal of California and Great Basin Anthropolgy*, 207-216.

Photochrom Company. (1898). Mission San Antonio. *Library of Congress Prints and Photographs Online Catalog*. Jolon, California: Library of Congress. Retrieved January 2016, from http://www.loc.gov/resource/ppmsca.17978/

Placer County APCD. (1994, August 8). Rule 508 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/PLA/CURHTML/R508.PDF

Placer County APCD. (2001, April 17). Regulation V, Rule 507 - Federal Operating Permit Program. Retrieved December 18, 2015, from http://www.arb.ca.gov/DRDB/PLA/CURHTML/R507.PDF

Placer County APCD. (2003, April 10). Regulation II, Rule 228 - Fugitive Dust. Retrieved December 18, 2015, from http://www.placer.ca.gov/~/media/apc/documents/rules/reg%202/rule228fugitivedust.pdf?la=en

Placer County APCD. (2010, August 12). Regulation V, Rule 501 - General Permit Requirements. Retrieved December 18, 2015, from http://www.placer.ca.gov/~/media/apc/documents/rules/reg%205/rule501generalpermitrequirements.pdf?la=en

Planert, M., & Williams, J. S. (1995). *Carbonate-Rock Aquifers, HA 730-B*. Retrieved December 2015, from http://pubs.usgs.gov/ha/ha730/ch_b/index.html

POLB. (2015a, December). *Cargo Types*. Retrieved December 2015, from Port of Long Beach: http://www.polb.com/facilities/maps/cargo.asp

POLB. (2015b, December). *Trade/Commerce*. Retrieved December 2015, from Port of Long Beach: http://www.polb.com/economics/default.asp

POLB. (2015c, December). *Cargo*. Retrieved December 2015, from Port of Long Beach: http://www.polb.com/economics/cargotenant/default.asp

POLB. (2015d, December). *On Track for Tomorrow*. Retrieved December 2015, from Port of Long Beach: http://www.polb100.com/publications/railguide/index.html

Port of LA. (2015a, December). *Cargo Terminal Map*. Retrieved December 15, 2015, from Port of Los Angeles: https://www.portoflosangeles.org/pdf/POLA_Cargo_Terminals_2015.pdf

Port of LA. (2015b, December). *Facilities*. Retrieved December 2015, from Port of Los Angeles: https://www.portoflosangeles.org/idx_facilities.asp

Port of LA. (2015c, December). *Facts and Figures*. Retrieved December 2015, from Port of Los Angeles: https://www.portoflosangeles.org/about/facts.asp

Port of LA. (2015d, December). *Rail and Intermodal Yards*. Retrieved December 2015, from Port of Los Angeles: https://www.portoflosangeles.org/facilities/rail_intermodal_yards.asp

Port of Oakland. (2015a, December). *Terminal Specifications*. Retrieved December 2015, from Port of Oakland: http://www.portofoakland.com/maritime/terminal.aspx

Port of Oakland. (2015b, December). *Facts and Figures*. Retrieved December 2015, from Port of Oakland: http://www.portofoakland.com/maritime/factsfigures.aspx

Port of Oakland. (2015c, December). *Commodities*. Retrieved December 2015, from Port of Oakland: http://www.portofoakland.com/maritime/commodities.aspx

Port of Richmond. (2015a, December). *Port Facilities*. Retrieved December 2015, from Port of Richmond: http://www.ci.richmond.ca.us/324/Port-Facilities

Port of Richmond. (2015b, December). *Port Operations*. Retrieved December 2015, from Port of Richmond: http://www.ci.richmond.ca.us/102/Port-Operations

Port of Richmond. (2015c, December). *Overview*. Retrieved December 2015, from Port of Richmond: http://www.ci.richmond.ca.us/323/Overview

Port of Richmond. (2015d, December). *Port Operations*. Retrieved December 2015, from Port of Richmond: http://www.ci.richmond.ca.us/102/Port-Operations

Porter, M. J. (2016). Gilia tenuiflora subsp. hoffmannii. *Gilia tenuiflora subsp. hoffmannii*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=50824

Potter, B. A. (2011). *From the Yenisei to the Yukon: interpreting lithic assemblage variability in late Pleistocene/early Holocene Beringia.* College Station, Texas: Texas A&M Press.

Preston, R. E., Whetstone, R. D., & Atkinson, T. (2016a). *Fremontodendron mexicanum.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=26129

Preston, R. E., Whetstone, R. D., & Atkinson, T. (2016b). *Fremontodendron decumbens*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=26128

Project 25.org. (2015, August 28). *P25 Phase 1 TDMA System in Service June 2015*. Retrieved August 28, 2015, from http://www.project25.org/images/stories/ptig/docs/P25_Phase_2_TDMA_Systems_Updated_June_2015.pdf

ProximityOne. (2015). *State Population Projections, Outlook 2030*. Retrieved March 2015, from https://proximityone.wordpress.com/2013/12/19/state-population-projections-2030/

PSCR. (2015). *Location-Based Services R&D Roadmap.* Retrieved from http://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1883.pdf

Purdue University. (2015). *Hydrologic Soil Groups.* Retrieved June 2015, from https://engineering.purdue.edu/mapserve/LTHIA7/documentation/hsg.html

Purdue University Consumer Horticulture. (2006). *What is Loam?* Retrieved May 19, 2016, from https://hort.purdue.edu/ext/loam.html

Radbruch-Hall, D., Colton, R., Davies, W., Lucchitta, I., Skipp, B., & Varnes, D. (1982). *Landslide Overview Map of the Conterminous United States.* Retrieved December 2015, from http://pubs.usgs.gov/pp/p1183/pp1183.html#coastroc

Recreation.gov. (2014). *Bureau of Reclamation.* Retrieved from http://www.recreation.gov/campgroundDirectoryListByAgencyID.do

Regional Transit. (2015, December). *RT Fact Sheets and Information Page*. Retrieved December 9, 2015, from http://www.sacrt.com/rtfactsheets.stm

Reitze, A. W. (2001). *Air Pollution Control Law: Compliance and Enforecement.* Washington, D.C. : Environmental Law Institute. Retrieved from https://books.google.com/books?id=M8w5yJbNTD0C&pg=PA49&lpg=PA49&dq=The+California+Air+Resources+Board+(CARB)+oversees+permitting+completed+by+the+regional+air+pollution+control+districts+(APCD)+and+the+air+quality+management+districts+(AQMD).&source=bl&ot

Robinson Library. (2014). *Important Dates in California*. Retrieved December 2015, from http://www.robinsonlibrary.com/america/uslocal/pacific/california/history/dates.htm

Rogers, D. J., Olshansky, R., & Rogers, B. R. (2004). *Damage to Foundations From Expansive Soils*. Retrieved March 23, 2015, from http://web.mst.edu/~rogersda/expansive_soils/DAMAGE%20TO%20FOUNDATIONS%20FROM%20EXPANSIVE%20SOILS.pdf

Rondeau, M. F. (2007). Colonization technologies: fluted projectile points and the San Clemente Island woodworking/microblade complex. In T. L. Jones, *California Prehistory: Colonization, Culture, and Complexity* (pp. 63-70). Lanham, Maryland: AltaMira Press.

Rosenthal, J. S., White, G. G., & Sutton, M. Q. (2007). The Central Valley: A View from the Catbird's Seat. In T. L. Jones, & K. A. Klar (Eds.), *California Prehistory: Colonization, Culture, and Complexity* (pp. 147-163). Lanham, New York, Toronto, Plymouth: Rowman & Littlefield Publishers, Inc.

Sacramento County Airport System. (2015). *Sacramento County Airport System Noise Page.* Retrieved 6 10, 2015, from http://www.sacramento.aero/scas/environment/noise/noise_101/

Sacramento Metropolitan AQMD. (1977, August 3). *Regulation 4, Rule, 403 (Fugitive Dust.* Retrieved December 18, 2015, from http://www.airquality.org/rules/rule403.pdf

Sacramento Metropolitan AQMD. (1994, November 3). Rule 104 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/SAC/CURHTML/R104.HTM

Sacramento Metropolitan AQMD. (2006, August 24). Regulation II, Rule 201 - General Permit Requirements. Retrieved December 18, 2015, from http://www.airquality.org/rules/rule201.pdf

Sacramento Metropolitan AQMD. (2011, July 27). Regulation 2, Rule 207 Title V - Federal Operating Permit Program. Retrieved December 18, 2015, from http://www.airquality.org/rules/rule207.pdf

SAN. (2015, December). *Historical Data*. Retrieved December 9, 2015, from http://www.san.org/News/Air-Traffic-Reports?EntryId=7592&Command=Core_Download

San Diego County APCD. (1999, July 26). Regulation 1 - General Provisions. Retrieved December 20, 2015, from http://www.sdapcd.org/rules/Reg1pdf/R1-2.pdf

San Diego County APCD. (2001, May 23). *Regulation XIV - Title V Operating Permits.* Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/SD/CURHTML/R1401.HTM

San Diego County APCD. (2009). *Rule 55 -- Fugitive Dust Control.* Retrieved August 11, 2016, from http://www.sdapcd.org/content/dam/sdc/apcd/PDF/Rules_and_Regulations/Prohibitions/APCD_R55.pdf

San Diego County APCD. (2012, May 9). *Regulation II, Rule 11 - Exemptions from Rule 10 Permit Requirements.* Retrieved December 22, 2015, from http://www.arb.ca.gov/DRDB/SD/CURHTML/R11.pdf

San Francisco Estuary Institute. (2013a, January). *California Rapid Assessment Method for Wetlands Riverine Wetlands Field Book ver 6.1.* Retrieved December 7, 2015, from http://www.cramwetlands.org/sites/default/files/2013.03.19_CRAM%20Field%20Book%20Riverine%206.1_0.pdf

San Francisco Estuary Institute. (2013b, February). *California Rapid Assessment Method for Wetlands Depressional Wetlands Field Book Version 6.1.* Retrieved December 7, 2015, from http://www.cramwetlands.org/sites/default/files/2013.03.19_CRAM_Fieldbook_Depressional_final_0.pdf

San Francisco Estuary Institute. (2013c, January). *California Rapid Assessment Method for Wetlands Perrenial Wetlands Field Book Ver 6.1.* Retrieved December 7, 2015, from http://www.cramwetlands.org/sites/default/files/2013.03.19_CRAM%20Field%20Book%20Estuarine%206.1_0.pdf

San Francisco Estuary Institute. (2013d, April). *California Rapid Assessment Method Individual Vernal Pools Field Book Version 6.1.* Retrieved December 7, 2015, from http://www.cramwetlands.org/sites/default/files/Individual%20Vernal%20Pools%20CRAM%206.1%20Field%20Book%202013-4-24.pdf

San Joaquin Valley APCD. (1994, October 20). Rule 9110 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/SJU/CURHTML/R9110.HTM

San Joaquin Valley APCD. (2004a, August 19). Regulation VIII, Rule 8021 - Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities. Retrieved December 23, 2015, from http://www.valleyair.org/rules/currntrules/r8021.pdf

San Joaquin Valley APCD. (2004b, August 19). Regulation VIII, Rule 8041- Carryout and Trackout. Retrieved December 23, 2015, from http://www.valleyair.org/rules/1ruleslist.htm

San Joaquin Valley APCD. (2004c, August 19). Regulation VIII. Retrieved December 23, 2015, from http://www.valleyair.org/rules/currntrules/r8011.pdf

San Joaquin Valley APCD. (2004d, September 16). Regulation VIII, Rule 8071 - Unpaved Vehicle/Equipemnt Traffic Areas. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/SJU/CURHTML/R8071.PDF

San Joaquin Valley APCD. (2011, April 21). Regulations 2 - Ruel 2201 - New and Modified Stationary Source Review Rule. Retrieved December 23, 201, from http://www.valleyair.org/rules/currntrules/Rule22010411.pdf

San Joaquin Valley APCD. (2013, February 12). *Regulation 1 - Rule 1020 - Definitions.* Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/SJU/CURHTML/R1020.PDF

San Joaquin Valley APCD. (2014, December 18). Regulation II, Rule 2020 - Exemptions. Retrieved December 23, 2015, from http://www.valleyair.org/rules/currntrules/R2020Rule.pdf

San Luis Obispo County APCD. (2005, March 23). Regulation II, Rule 201 - Equipment Not Requiring a Permit. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/SLO/CURHTML/R201.pdf

San Luis Obispo County APCD. (2009, December 2). Regulation II, Rule 202 - Permits. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/SLO/CURHTML/R202.pdf

San Luis Obispo County APCD. (2011, March 23). *Regulation 2 - Rule 216 - Federal Part 70 Permits.* Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/SLO/CURHTML/R216.pdf

San Luis Obispo County APCD. (2016). *Regulation X -- Fugitive Dust Emission Standards, Limitations and Prohibitions.* Retrieved August 11, 2016, from http://www.arb.ca.gov/DRDB/SLO/CURHTML/r1001.pdf

Sanders, A. C., Elvin, M. A., & Brunell, M. S. (2016). *Monardella viminea.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=80959

Sandos, J. A. (2004). *Converting California: Indians and Franciscans in the Missions.* New Haven: Yale University Press.

Santa Barbara County APCD. (1994, October 20). Rule 702 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/drdb/sb/curhtml/r702.htm

Santa Barbara County APCD. (2010, January 21). Regulation III, Rule 345 - Control of Fugitive Dust from Construction and Demolition Activities. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/SB/CURHTML/R345.pdf

Santa Barbara County APCD. (2011, January 20). Regulation XIII - Rule 1301 - Part 70 Operating Permits - General Information. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/SB/CURHTML/R1301.PDF

Santa Barbara County APCD. (2012a, June 21). Regulation 2 - Rule 102 - Definitions. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/SB/CURHTML/R102.PDF

Santa Barbara County APCD. (2012b, June 21). Regulation II, Rule 202 - Exemptions to Rule 201. Retrieved December 23, 2015, from http://www.arb.ca.gov/DRDB/SB/CURHTML/r202.PDF

SCEC. (2015). *State Climate Extremes Committee* . (N. O. Administration, Producer) Retrieved 2015, from National Climatic Data Center: http://www.ncdc.noaa.gov/extremes/scec/records

SFBayRail. (2015, December). *Home*. Retrieved December 2015, from San Francisco Bay Rail: http://www.sfbayrail.com/

SFBCDC. (2007). *The San Francisco Bay Estuary*. Retrieved December 11, 2015, from http://www.bcdc.ca.gov/bay_estuary.shtml

SFBRWQCB. (2015). *San Francisco Bay Water Quality Basin Plan*. Retrieved December 8, 2015, from http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/planningtmdls/basinplan/web/bp_ch1.shtml

SFO. (2015, January 15). *Comparative Traffic Report*. Retrieved December 9, 2015, from http://media.flysfo.com/media/sfo/media/air-traffic/as201412.pdf

SFPort. (2015a, December). *Port of San Francisco*. Retrieved December 2015, from http://sfport.com/

SFPort. (2015b, December). *Cargo Services*. Retrieved December 2015, from Port of San Francisco: http://www.sfport.com/index.aspx?page=151

SFPort. (2015c, December). *Cargo Statistics*. Retrieved December 2015, from Port of San Francisco: http://www.sf-port.org/index.aspx?page=164

Shasta County APCD. (1984, January 3). *Rule II, Rule 2:5 - Exemptions*. Retrieved December 24, 2015, from http://www.arb.ca.gov/DRDB/SHA/CURHTML/R2-5.HTM

Shasta County AQMD. (2001, May 8). Rule 5 - Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act of 1990. Retrieved December 24, 2015, from http://www.arb.ca.gov/DRDB/SHA/CURHTML/R5.PDF

Shasta County AQMD. (2007, November 27). Rule 3:16 - Fugitive, Indirect, or Non-Traditional Sources. Retrieved December 24, 2015, from http://www.arb.ca.gov/DRDB/SHA/CURHTML/R3-16.pdf

Shasta County AQMD. (2009, March 30). Rule 5, Attachment 1 - List of Title V Insignificant Activities. Retrieved December 24, 2015, from http://www.arb.ca.gov/DRDB/SHA/CURHTML/R5Atch1.PDF

Sholars, T. (2014). *Lupinus tidestromii.* Retrieved from http://herbaria4.herb.berkeley.edu/eflora_display.php?tid=32099

Siskiyou County APCD. (2001a, April 23). Regulation I, Rule 1.2 - Definitions. Retrieved December 24, 2015, from http://www.arb.ca.gov/DRDB/SIS/CURHTML/R1-2.PDF

Siskiyou County APCD. (2001b, May 22). Regulation II - Rule 2.13 - Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the Federal Clean Air Act Amendments of 1990. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/SIS/CURHTML/R2-13.PDF

Siskiyou County APCD. (2014, May 13). *Regulation II, Rule 2.2 - Exemptions*. Retrieved December 24, 2015, from http://www.arb.ca.gov/DRDB/SIS/CURHTML/R2-2.HTM

Slotta, Tracey. (2014). *Malacothamnus clementinus.* Retrieved from http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32514

Slotta, Tracey. (2016). Malacothamnus fasciculatus var. nesioticus. *Malacothamnus fasciculatus var. nesioticus*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=61708

Smithsonian Institution. (2016). *Glossary -- Courtesy of the Department of Paleobiology, National Museum of Natural History, Washington, DC*. Retrieved May 2016, from http://paleobiology.si.edu/geotime/main/glossary.html#T

Society for California Archaeology. (2016). *Chronological and Cultural Units*. Retrieved January 27, 2016, from https://scahome.org/about-ca-archaeology/glossary-of-terms/chronological-and-cultural-units/

Sorrie, B. A., & Rosatti, T. J. (2014). *Crocanthemum greenei, revision 1.* Retrieved from http://ucjeps.berkleley.edu/cgi-bin/get_IJM.pl?tid=95269

South Coast AQMD. (1994, September 9). Rule 1901 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/SC/CURHTML/R1901.HTM

South Coast AQMD. (1997, November 14). Regulation XXX, Rule 3001 - Applicability. Retrieved January 21, 2016, from http://www.arb.ca.gov/DRDB/SC/CURHTML/R3001.HTM

South Coast AQMD. (2004a, December 3). Regulation II, Rule 203 - Permit to Operate. Retrieved December 28, 2015, from http://www.aqmd.gov/docs/default-source/rule-book/reg-ii/rule-203.pdf?sfvrsn=4

South Coast AQMD. (2004b, December 3). Regulation II, Rule 201 - Permit to Construct. Retrieved December 28, 2015, from http://www.aqmd.gov/docs/default-source/rule-book/reg-ii/rule-201.pdf?sfvrsn=4

South Coast AQMD. (2005, June 3). Regulation IV (Prohibitions) Rule 403 (Fugitive Dust.

South Coast AQMD. (2016, June 17). National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) Attainment Status for South Coast Air Basin. Retrieved June 17, 2016, from http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/naaqs-caaqs-feb2016.pdf?sfvrsn=2

Soza, Valeri. (2016a). *Galium californicum subsp. sierrae.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=50612

Soza, Valeri. (2016b). *Galium buxifolium.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=26322

SPRINTER. (2015, January). *SPRINTER Fact Sheet*. Retrieved December 9, 2015, from http://www.gonctd.com/wp-content/uploads/2013/08/SPRINTER-Fact-Sheet.pdf

State of California. (2013). *Preparing California for Extreme Heat: Guidance and Recommendations.* California Climate Action Team. Retrieved from http://www.climatechange.ca.gov/climate_action_team/reports/Preparing_California_for_Extreme_Heat.pdf

State of California. (2015a, December 8). *Facts*. Retrieved December 8, 2015, from http://www.ca.gov/About/Facts.html

State of California. (2015b, December 9). *California Department of Parks and Recreation: Historic Sites Visitor Information Guide*. Retrieved December 9, 2015, from http://www.parks.ca.gov/?page_id=25543

State of California. (2015c, December 8). *California Department of Parks and Recreation: Donner Memorial SP Image Gallery*. Retrieved December 8, 2015, from http://www.parks.ca.gov/ImageGallery/?page_id=503

State of California. (2015d). *California Department of Parks and Recreation*. Retrieved December 2015, from http://www.parks.ca.gov/

State of California Legislature. (1970). *California Legislative Information*. Retrieved December 8, 2015, from http://leginfo.legislature.ca.gov/faces/codes_displayexpandedbranch.xhtml?tocCode=PRC&division=13.&title=&part=&chapter=&article=

State of California Legislature. (2015, December 8). *California Legislative Information*. Retrieved December 8, 2015, from http://leginfo.legislature.ca.gov/faces/codedisplayexpand.xhtml?tocCode=PRC

SWRCB. (2003, August). *2002 California 305(b) Report on Water Quality.* Retrieved December 9, 2015, from http://www.waterboards.ca.gov/water_issues/programs/tmdl/305b.shtml

SWRCB. (2015, January 1). *Porter-Cologne Water Quality Control Act.* Retrieved December 7, 2015, from http://www.waterboards.ca.gov/laws_regulations/docs/portercologne.pdf

Symons, B. (2014). Project25 User's Perspective: WyoLink. *Project 25 User's Perspective (IWCE).* Las Vegas: IWCE. Retrieved May 27, 2016, from http://www.project25.org/images/stories/ptig/IWCE_2015/IWCE_2015_P25_User_Panel_Consolidated_Presentation_REV08_150309_.pdf

Tehama County APCD. (2008, February 5). *Regulation IV, Rule 4:24 - Fugitive Dust Emissions.* Retrieved December 30, 2015, from http://tehcoapcd.net/PDF/REGULATION%20IV.pdf

Tehama County APCD. (2011, March 1). Regulation VII - Title V. Retrieved December 30, 2015, from http://tehcoapcd.net/PDF/REGULATION%20VII.pdf

Tehama County APCD. (2015, March 3). Regulation II (Permit and Registration). Retrieved December 30, 2015, from http://tehcoapcd.net/PDF/REGULATION%20II.pdf

The Marine Mammal Center. (2015). *Arctocephalus townsendi*. Retrieved from http://www.marinemammalcenter.org/education/marine-mammal-information/pinnipeds/guadalupe-fur-seal/?referrer=https://www.google.com/

The National Academies Press. (2012). *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.* Retrieved from Committee on Sea Level Rise in California, Oregon, and Washington: http://www.nap.edu/read/13389/chapter/1#ii

The Union of Concerned Scientists. (2013, April). *Causes of Sea Level Rise.* Retrieved from http://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/Causes-of-Sea-Level-Rise.pdf

Thompson, W. (2015). *Surficial Geology Handbook for Southern Maine.* Retrieved July 2015, from http://www.maine.gov/dacf/mgs/explore/surficial/sghandbook/surficial_geology_handbook_for_southern_maine.pdf

Trock, D. K. (2016). Packera (=Senecio) layneae. *Packera (=Senecio) layneae*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=77389

Tuolumne County APCD. (2001, June 19). Regulation V, Rule 500 - Additional Procedures for Issuing Permits to Operate for Sources Subject to Title V of the 1990 Federal Clean Air Act Amendments. Retrieved December 30, 2015, from http://www.arb.ca.gov/DRDB/TUO/CURHTML/R500.PDF

Tuolumne County APCD. (2012, November 13). Rules 402 - Exemptions to Rule 401 (Permit Required).

U.S. Bureau of Justice Statistics. (2011, July 26). *Census of State and Local Law Enforcement Agencies*. Retrieved from http://www.bjs.gov/index.cfm?ty=pbdetail&iid=2216

U.S. Census Bureau. (2006). *Government Finance and Employment Classification Manual.* 2006_classification_manual. Retrieved July 2015, from http://www2.census.gov/govs/pubs/classification/2006_classification_manual.pdf

U.S. Census Bureau. (2010). *State Area Measurements and Internal Point Coordinates.* Retrieved September 14, 2015, from https://www.census.gov/geo/reference/state-area.html

U.S. Census Bureau. (2012). *2010 Census Urban and Rural Classification and Urban Area Criteria.* Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010 urbanized areas and urban clusters for the U.S., Puerto Rico, and Island Areas first sorted by state FIPS code, then sorted by UACE code. Retrieved June 2015, from http://www2.census.gov/geo/docs/reference/ua/ua_st_list_all.xls

U.S. Census Bureau. (2013, February). *Metropolitan Statistical Areas of California*. Retrieved December 9, 2015, from U.S. Census Bureau: http://www2.census.gov/geo/maps/metroarea/stcbsa_pg/Feb2013/cbsa2013_CA.pdf

U.S. Census Bureau. (2015a). *Population Estimates Program, 2010-2014 Data.* NST-EST2014-alldata. Retrieved March 2015, from http://www.census.gov/popest/data/national/totals/2014/files/NST-EST2014-alldata.pdf

U.S. Census Bureau. (2015b). 2010 Census Summary File 1, Table GCT-PH1, Population, Housing Units, Area, and Density. Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.US01PR&prodType=table

U.S. Census Bureau. (2015c). *Resident Population of the 50 States, the District of Columbia, and Puerto Rico: Census 2000.* File tab02.xls. Retrieved March 2015, from https://www.census.gov/population/www/cen2000/maps/respop.html

U.S. Census Bureau. (2015d). American Community Survey, 2009-2013 5-Year Summary File, Table B02001, Race. Retrieved April 2015, from http://dataferrett.census.gov/

U.S. Census Bureau. (2015e). *2010 Census Urban and Rural Classification and Urban Area Criteria.* Other Census Urban Area Information - Maps, Shapefiles & References. Retrieved June 2015, from http://www.census.gov/geo/reference/ua/urban-rural-2010.html

U.S. Census Bureau. (2015f). *Census 2000 Summary File 1 (SF 1), Table P001, Total Population*. (Obtained via Census Bureau online American FactFinder tool) Retrieved July 2015, from http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

U.S. Census Bureau. (2015g). *American Community Survey, 2009-2013 5-Year Estimates, Table DP05, Demographic and Housing Estimates*. (Obtained via Census Bureau online American FactFinder tool) Retrieved August 2015, from http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Census Bureau. (2015h). *American Community Survey and Puerto Rico Community Survey 2013 Subject Definitions.* 2013_ACSSubjectDefinitions. Retrieved April 2015, from http://www2.census.gov/programs-surveys/acs/tech_docs/subject_definitions/2013_ACSSubjectDefinitions.pdf

U.S. Census Bureau. (2015i). *Small Area Income and Poverty Estimates (SAIPE), 2013.* Retrieved March 2015, from http://www.census.gov/did/www/saipe/data/statecounty/data/2013.html

U.S. Census Bureau. (2015j). American Community Survey, 2013 1-Year Estimates, Table DP02, Selected social characteristics. Retrieved April 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP02&prodType=table

U.S. Census Bureau. (2015k). American Community Survey, 2013 1-Year Estimates, Table S1902, Mean Income in the Past 12 Months (in 2013 Inflation-Adjusted Dollars). Retrieved April 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_S1902&prodType=table

U.S. Census Bureau. (2015l). 2009-2013 American Community Survey 5-Year Estimates, Table DP03: Selected economic characteristics. Retrieved April, July 2015, from

http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_DP03&prodType=table

U.S. Census Bureau. (2015m). American Community Survey, 2013 1-year Estimates, Table DP03, Selected economic characteristics. Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP03&prodType=table

U.S. Census Bureau. (2015n). American Community Survey, 2013 1-Year Estimates, Table DP04, Selected housing characteristics. Retrieved April 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_1YR_DP04&prodType=table

U.S. Census Bureau. (2015o). American Community Survey, 2009-2013 5-year Estimates, Table DP04, Selected housing characteristics. Retrieved April, July 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_DP04&prodType=table

U.S. Census Bureau. (2015p). 2012 Census of Governments: Finance – Surveys of State and Local Government Finances, Table LGF001. Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=COG_2012_LGF001&prodType=table

U.S. Census Bureau. (2015q). American Community Survey, 2012 1-Year Estimates, Table B01003: Total Population. Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_1YR_B01003&prodType=table

U.S. Census Bureau. (2015r). American Community Survey, 2013 1-Year Estimates, Table DP05, Demographic and Housing Estimates. Retrieved August 31, 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP05&prodType=table

U.S. Census Bureau. (2015s). American Community Survey, 2013 1-Year Estimates, Table S1701: Poverty Status in the Past 12 Months. Retrieved August 31, 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_S1701&prodType=table

U.S. Census Bureau. (2015t). American Community Survey, 2009-2013 5-Year Summary File, Table B03002, Hispanic or Latino Origin by Race. Retrieved April 2015, from http://dataferrett.census.gov

U.S. Census Bureau. (2015u). American Community Survey, 2009-2013 5-Year Summary File, Table B17021, Poverty Status of Individuals in the Past 12 Months by Living Arrangement. Retrieved April 2015, from http://dataferrett.census.gov

U.S. Census Bureau. (2015v). American Community Survey, 2009-2013 5-Year Summary File, Table C17002, Ratio of Income to Poverty Level in the Past 12 Months. Retrieved May 2015, from http://dataferrett.census.gov

U.S. Census Bureau. (2015w). *Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2014.* Retrieved August 9, 2016, from https://www.census.gov/quickfacts/table/PST045215/06

U.S. Census Bureau. (2015x, March 11). *Foreign Trade*. Retrieved July 2015, from United States Census Bureau: http://www.census.gov/foreign-trade/Press-Release/2013pr/12/ft920/index.html

U.S. Census Bureau. (2016). *U.S. Census Bureau*. Retrieved May 21, 2015, from State and County Quickfacts: http://quickfacts.census.gov/qfd/states/06000.html

U.S. Coast Guard. (2015, December 18). *National Response Center (2015 Reports).* Retrieved December 18, 2015, from http://www.nrc.uscg.mil/FOIAFiles/Current.xlsx

U.S. Department of Agriculture. (2014a, May). *2012 Census of Agriculture, California.* Retrieved December 2015, from http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/California/

U.S. Department of Agriculture. (2014b). *2014 State Agriculture Overview, California*. Retrieved December 2015, from http://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=CALIFORNIA

U.S. Department of Commerce. (2013, February 21). *Department of Commerce Environmental Justice Strategy.* Retrieved July 2015, from http://open.commerce.gov/sites/default/files/DOC_Environmental_Justice_Strategy.pdf

U.S. Department of Interior. (2008). *Navajo Reservoir RMP/FEA Appendix E Noise*. Retrieved 07 22, 2015, from https://www.usbr.gov/uc/envdocs/ea/navajo/appdx-E.pdf

U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. (2015, May 26). *Mine Fires and Burning Refuse*. Retrieved from Mine Fires: http://www.osmre.gov/programs/tdt/minefires.shtm

U.S. Fire Administration. (2015, June 11). *National Fire Department Census*. Retrieved from http://apps.usfa.fema.gov/census-download/main/download

U.S. Harbors. (2015). *U.S. Harbors - California*. Retrieved Dec 7, 2015, from http://ca.usharbors.com/

UNESCO. (2015). *The Criteria for Selection*. Retrieved September 8, 2015, from http://whc.unesco.org/en/globalstrategy/

University of California at Davis. (2014). *California fish species*. Retrieved from http://calfish.ucdavis.edu/species/

University of California Museum of Paleontology. (2011, May). *Geologic Time Scale*. Retrieved June 2016, from http://www.ucmp.berkeley.edu/help/timeform.php

University of California, Hastings College of Law. (2010). *Environmental Justice for All: A Fifty State Survey of Legislation, Policies and Cases, Fourth Edition.* Retrieved August 2015, from http://gov.uchastings.edu/public-law/docs/ejreport-fourthedition1.pdf

University of Minnesota. (2001). *Soils and Landscapes of Minnesota*. Retrieved July 2015, from http://www.extension.umn.edu/agriculture/tillage/soils-and-landscapes-of-minnesota/

USACE. (2012, March 19). *Final Sacramento District Nationwide Permit Regional Conditions for California, excluding the Lake Tahoe Basin.* Retrieved December 7, 2015, from http://www.spk.usace.army.mil/Portals/12/documents/regulatory/nwp/2012_nwps/2012-NWP-RC-CA.pdf

USACE. (2015a). *California*. Retrieved from http://corpslakes.usace.army.mil/visitors/states.cfm?state=CA

USACE. (2015b). *Planner's Study Aid*. Retrieved from http://www.usace.army.mil/Missions/CivilWorks/ProjectPlanning/Products/StudyAid.aspx

USDA. (2014). Federal noxious weed list. *Federal noxious weed list*. Retrieved from https://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/weedlist.pdf

USDA. (2015a). *Ecoregions of the United States.* Retrieved July 1, 2015, from http://www.fs.fed.us/rm/ecoregions/products/map-ecoregions-united-states/#

USDA. (2015b). *Plant Pests and Diseases*. Retrieved from https://www.aphis.usda.gov/wps/portal/aphis/ourfocus/planthealth?1dmy&urile=wcm%3apath%3a%2FAPHIS_Content_Library%2FSA_Our_Focus%2FSA_Plant_Health%2FSA_Domestic_Pests_And_Diseases

USDA Farm Service Agency. (2006, February). *Programmatic Environmental Assessment California North Central Valley Conservation Reserve Enhancement Program*. Retrieved from https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/Environ-Cultural/ncvcrepfinal.pdf

USDOI, BLM. (2004, December 3). 8100-The Foundations for Managing Cultural Resources. Wahsington. Retrieved September 28, 2015, from http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.71969.File.dat/8100.pdf

USDOT. (2015). *National Transportation Atlas Database*. Retrieved July 2015, from Bureau of Transportation Statistics National Transportation Atlas Database: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_atlas_database/index.html

USEPA. (1973, July 27). *USEPA.gov.* Retrieved August 5, 2015, from National Service Center for Environmental Publications - Impact Characterization of Noise. (NTID 73.4): o http://nepis.epa.gov/Exe/ZyNET.exe/9101DPQN.TXT?ZyActionD=ZyDocument&Client=EPA&Index=Prior+to+1976&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=

USEPA. (1974). *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.* Washington, D.C.: EPA.

USEPA. (1979, March 19). Notification to Federal Land Manager Under Section 165(d) of the Clean Air Act. Retrieved April 21, 2015, from http://www.epa.gov/sites/production/files/2015-07/documents/fdlndmgr.pdf

USEPA. (1992, October 19). *Clarification of Prevention of Significant Deterioration (PSD) Guidance for Modeling Class I Area Impacts, U.S. Environmental Protection Agency.* (J. S. Seitz, Ed.) Retrieved April 21, 2015, from http://www.epa.gov/sites/production/files/2015-07/documents/class1.pdf

USEPA. (1995). *America's wetlands: Our vital link between land and water*. Retrieved April 21, 2015, from U.S. Environmental Protection Agency, EPA843-K-95-001: http://water.epa.gov/type/wetlands/fish.cfm

USEPA. (2000). *Level III ecoregions of California*. Retrieved from https://hort.purdue.edu/newcrop/cropmap/california/maps/CAeco3.html

USEPA. (2004, April 15). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: Glossary*. Retrieved July 16, 2015, from http://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do?details=&vocabName=Greenhouse%20Emissions%20Glossary&uid=1869718#formTop

USEPA. (2009). *National Lakes Assessment: A Collaborative Study of the Nation's Lakes.* Retrieved March 27, 2015, from http://www.epa.gov/owow/LAKES/lakessurvey/pdf/nla_report_low_res.pdf

USEPA. (2010, March 24). *Revisions to the General Conformity Regulations*. Retrieved April 20, 2015, from https://www.epa.gov/general-conformity/final-revisions-general-conformity-regulations

USEPA. (2011a, August 19). *Taking Toxics Out of the Air. Part 1 - Main Body of Brochure.* Retrieved April 20, 2015, from http://nepis.epa.gov/Exe/ZyNET.exe/00002RWT.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&

USEPA. (2011b, December 12). *CERCLA Overview*. Retrieved from EPA Superfund: http://www.epa.gov/superfund/policy/cercla.htm

USEPA. (2012a). *Water: Estuaries and Coastal Watersheds*. Retrieved April 5, 2015, from Basic Information about Estuaries: http://water.epa.gov/type/oceb/nep/about.cfm

USEPA. (2012b). *Watershed Assessment, Tracking & Environmental Results System*. Retrieved December 2015, from http://ofmpub.epa.gov/tmdl_waters10/attains_state.control?p_state=CA

USEPA. (2012c, May 2012). *List of 156 Mandatory Class I Federal Areas*. Retrieved April 20, 2015, from https://www.epa.gov/visibility/list-156-mandatory-class-i-federal-areas

USEPA. (2012d, July 16). *Noise Pollution*. Retrieved August 4, 2015, from http://www.epa.gov/air/noise.html

USEPA. (2012e). *Climate Change Indicators in the United States 2012*. Retrieved October 2013, from Environmental Protection Agency: http://www.epa.gov/climatechange/pdfs/climateindicators-full-2012.pdf

USEPA. (2012f, June). *Lava Cap Mine Superfund Site.* Retrieved December 10, 2015, from http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dc283e6c5d6056f88257426007417a2/9c7ce94a4798631e88257a1c0076bf38/$FILE/LavaCap6_12%20335kb.pdf

USEPA. (2013a, August 13). General Conformity. Retrieved April 20, 2015, from https://www3.epa.gov/airquality/genconform/

USEPA. (2013b, August 29). *Guidance for Indian Tribes Seeking Class I Redesignation of Indian Country Pursuant to Section 164(c) of the Clean Air Act*. Retrieved April 20, 2015, from http://www.epa.gov/air/tribal/pdfs/GuidanceTribesClassIRedesignationCAA.pdf

USEPA. (2013c, February 21). *EPA Terminology Services (TS)*. (U.S. Environmental Protection Agency) Retrieved July 28, 2015, from http://iaspub.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do

USEPA. (2013d). *Cleanups in my Community*. Retrieved from http://www2.epa.gov/cleanups/cleanups-my-community

USEPA. (2014a). *National Ambient Air Quality Standards (NAAQS)*. Retrieved from http://www.epa.gov/air/criteria.html

USEPA. (2014b, October 28). Who Has to Obtain a Title V Permit. Retrieved April 20, 2015, from https://www.epa.gov/title-v-operating-permits/who-has-obtain-title-v-permit

USEPA. (2014c). *Grants and Programs*. Retrieved July 2015, from http://www.epa.gov/compliance/environmentaljustice/grants/index.html

USEPA. (2015a, December). *NPDES Wastewater & Stormwater Permits*. Retrieved December 2015, from U.S. Environmental Protection Agency: http://www3.epa.gov/region9/water/npdes/index.html

USEPA. (2015aa). *Terms and Acronyms Search Page*. Retrieved from https://iaspub.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do

USEPA. (2015b, December). *NPDES State Program Information*. Retrieved December 2015, from U.S. Environmental Protection Agency: http://www.epa.gov/npdes/npdes-state-program-information

USEPA. (2015c). *Coastal Waters*. Retrieved December 16, 2015, from http://www3.epa.gov/region9/water/oce/coastalwaters.html

USEPA. (2015d). *Local National Estuary Programs*. Retrieved December 14, 2015, from http://www.epa.gov/nep

USEPA. (2015e). *National Estuary Program*. Retrieved December 16, 2015, from http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2

USEPA. (2015f, January). *Chesapeake Bay Glossary*. Retrieved July 15, 2015, from http://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do?details=&glossaryName=Chesapeake%20Bay%20Glossary

USEPA. (2015g, May). *Sole Source Aquifer Protection Program*. Retrieved July 2015, from http://water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/solesourceaquifer.cfm

USEPA. (2015h, September 1). *Lava Cap Mine.* Retrieved December 10, 2015, from http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/7f29f3b3740158ca88257007005e944f%21opendocument

USEPA. (2015h, October 22). *Pacific Southwest, Region 9, Ground Water Sole Source Aquifer*. Retrieved December 9, 2015, from http://www3.epa.gov/region9/water/groundwater/ssa.html

USEPA. (2015i). *Environmental Justice*. Retrieved July 2015, from http://www.epa.gov/compliance/environmentaljustice/index.html

USEPA. (2015j). *EJSCREEN: Environmental Justice Screening and Mapping Tool*. Retrieved July 2015, from http://www2.epa.gov/ejscreen

USEPA. (2015k, July 14). Retrieved July 14, 2015, from http://www.epa.gov/region9/air/permit/index.html

USEPA. (2015l, July 14). Retrieved July 14, 2015, from http://www.epa.gov/region9/air/permit/index.html

USEPA. (2015m, April 21). The Green Book Nonattainment Areas for Criteria Pollutants. Retrieved April 21, 2015, from http://www.epa.gov/airquality/greenbook/

USEPA. (2015n, October 27). *Title IV- Noise Pollution*. Retrieved November 2015, 2015, from http://www2.epa.gov/clean-air-act-overview/title-iv-noise-pollution

USEPA. (2015o, October 23). *Cleanups in my Community.* Retrieved December 10, 2015, from http://ofmpub.epa.gov/apex/cimc/f?p=cimc:73::::71:P71_WELSEARCH:CA|State|CA|||true|true|true|true|true|true||-1|sites|N|basic

USEPA. (2015p, October 23). Cleanups in My Community List Results. Retrieved December 10, 2015, from http://ofmpub.epa.gov/apex/cimc/f?p=108:35:3027521032201:::35:P35_State_code,P35_ADV_QUERY:CA,((SF_EI_HE_CODE=%27N%27))

USEPA. (2015q, October 23). Cleanups in My Community List Results. Retrieved December 10, 2015, from http://ofmpub.epa.gov/apex/cimc/f?p=108:35:3027521032201:::35:P35_State_code,P35_ADV_QUERY:CA,((RCRA_EI_HE_CODE=%27N%27))

USEPA. (2015r, March). *2013 TRI Analysis: State - California*. (U.S. Environmental Protection Agency) Retrieved December 10, 2015, from http://iaspub.epa.gov/triexplorer/tri_factsheet.factsheet_forstate?&pstate=CA&pyear=2013

USEPA. (2015s, November 12). Envirofacts - PCS-ICIS. Retrieved December 10, 2015, from http://www3.epa.gov/enviro/facts/pcs-icis/search.html

USEPA. (2015t, December 10). Envirofacts Search Results. Retrieved December 10, 2015, from http://www3.epa.gov/enviro/facts/multisystem.html

USEPA. (2015u, June). *U.S. Greenhouse Gas Emissions*. Retrieved September 22, 2015, from http://www3.epa.gov/climatechange/science/indicators/ghg/us-ghg-emissions.html

USEPA. (2015v, October 8). *Emissions & Generation Resource Integrated Database (eGRID) Summary Table 1*. Retrieved March 10, 2016, from http://www.epa.gov/energy/egrid-2012-summary-tables

USEPA. (2015w). *USEPA Terms Index*. Retrieved from https://iaspub.epa.gov/sor_internet/registry/termreg/

USEPA. (2015x, January). *Chesapeake Bay Glossary - YOY*. Retrieved August 10, 2016, from https://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do;jsessionid=uu51VEyaNP3_-ZmCnm1Q2DAoXKTB22bwdtSjp-_kkAzhmzGKsY-p!-2003163538?details=&vocabName=Chesapeake%20Bay%20Glossary&filterTerm=YOY&filterMatc

USEPA. (2015y). *Technology Transfer Network - Basic Information*. Retrieved from http://cfpub.epa.gov/oarweb/mkb/basic_information.cfm

USEPA. (2015z). *Designations*. Retrieved from http://www.epa.gov/airquality/greenbook/define.html

USEPA. (2016a, February 21). *Ecoregions of North America*. Retrieved from Western Ecology Division: https://archive.epa.gov/wed/ecoregions/web/html/na_eco.html

USEPA. (2016b, March). *NAAQS Table*. Retrieved from https://www.epa.gov/criteria-air-pollutants/naaqs-table

USEPA. (2016c, September). *Hazardous Air Pollutants*. Retrieved from https://www.epa.gov/haps

USEPA. (2016d, May 29). *Glossary of Climate Change Terms*. Retrieved from https://www3.epa.gov/climatechange/glossary.html

USEPA. (2016e, May 19). *De Minimis Levels*. Retrieved from https://www3.epa.gov/airquality/genconform/deminimis.html

USEPA. (2016f, June 17). *Nonattainment Area & OTR SIP Requirements*. Retrieved June 17, 2016, from https://www3.epa.gov/airquality/urbanair/sipstatus/nonattainment.html

USFS. (1995). *Landscape Aesthetics: A Handbook for Scenery Management*. Retrieved from http://www.fs.fed.us/cdt/carrying_capacity/landscape_aesthetics_handbook_701_no_append.pdf

USFS. (2008, November 15). *California's Forest Resources, 2001-2005; Five-Year Forest Inventory and Analysis Report.* Retrieved December 15, 2015, from http://www.fs.fed.us/pnw/rma/fia-topics/publications/

USFS. (2009). *Soil-Disturbance Field Guide.* USDA. Retrieved from http://www.fs.fed.us/t-d/pubs/pdf/08191815.pdf

USFS. (2010, November 29). *Sierra Nevada Red Fox fact sheet.* Retrieved June 14, 2016, from USFS: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5282562.pdf

USFS. (2013). *U.S. Forest Service, Find a Forest by State.* Retrieved from http://www.fs.fed.us/recreation/map/state_list.shtml

USFS. (2015a). *Invasive Species.* Retrieved August 11, 2016, from http://www.fs.fed.us/outernet/pnw/invasives/index.shtml

USFS. (2015b, November 9). *Invasive Species.* Retrieved December 4, 2015, from http://www.nrs.fs.fed.us/disturbance/invasive_species/

USFS. (2015c). *Insect Disturbance.* Retrieved October 6, 2015, from http://www.fs.usda.gov/ccrc/topics/insect-disturbance

USFS. (2016a). *Humboldt-Toiyabe National Forest's.* Retrieved from http://www.fs.usda.gov/htnf/

USFS. (2016b). *Pacific Crest National Scenic Trail.* Retrieved from http://www.fs.usda.gov/pct/

USFS. (2016c). *National Scenic, Historic, and Recreation Trails - Pacific Northwest Region.* Retrieved from http://www.fs.usda.gov/detail/r6/specialplaces/?cid=stelprd3829844

USFWS. (1967). *The following native fish and wildlife are threatened with extinction.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr18.pdf

USFWS. (1970). *Appendix D- United States list of endangered native fish and wildlife (Morro Bay kangaroo rat).* Retrieved from http://ecos.fws.gov/docs/federal_register/fr27.pdf

USFWS. (1976, May). *Determination of endangered status for six species of butterfly - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr99.pdf

USFWS. (1977). *Proposed determination of critical habitat for six butterflies and two plants.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr11.pdf

USFWS. (1978). *Final determination of endangered status for eleven plant taxa are endangered and two plant taxa are threatened species.* Retrieved from https://ecos.fws.gov/docs/federal_register/fr208.pdf

USFWS. (1979). *Determination of endangered status for the Arctostaphylos hookeri ssp. ravenii.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr343.pdf

USFWS. (1980a). *Listing the delta green ground beetle as a threatened species with critical habitat.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr450.pdf

USFWS. (1980b). *Determination of threatened status for the Kern primrose sphinx moth (Euproserpinus euterpe) - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr402.pdf

USFWS. (1980c). *Listing the valley elderberry longhorn beetle as a threatened species with critical habitat.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr449.pdf

USFWS. (1982a, June). *USFWS Desert Slender Salamander Recovery Plan.* Retrieved June 20, 2016, from http://ecos.fws.gov/docs/recovery_plan/820812.pdf

USFWS. (1982b). *Eureka Valley Dunes recovery plan.* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1ZM

USFWS. (1984a). *Critical habitat determination (final) for the Amargosa vole (Microtus californicus scirpensis).* Retrieved from http://ecos.fws.gov/docs/federal_register/fr897.pdf

USFWS. (1984b). *Recovery plan for Mohave Tui chub (Gila bicolor ssp.).* Retrieved from https://ecos.fws.gov/docs/recovery_plan/840912.pdf

USFWS. (1984c). *Kern primrose sphinx moth recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/840208.pdf

USFWS. (1984d). *Recovery plan for San Bruno elfin butterfly and mission blue butterflies.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/841010.pdf

USFWS. (1984e). *Smith's blue butterfly recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/841109.pdf

USFWS. (1984f). *McDonald's Rock-Cress Recovery Plan (Arabis mcdonaldiana).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/840228.pdf

USFWS. (1984g). *Determination of endangered status for Thelypodium stenopetalum (slender-petaled mustard) and Sidalcea pedata (pedal checker-mallow).* Retrieved from http://ecos.fws.gov/docs/federal_register/fr880.pdf

USFWS. (1985a). *Salt marsh bird's beak recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/851206.pdf

USFWS. (1985b). *Recovery plan, threespine unarmored stickleback - revised plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/851226.pdf

USFWS. (1985c). *Recovery plan for the San Francisco garter snake (Thamnophis sirtalis tetrataenia).* Retrieved from https://ecos.fws.gov/docs/recovery_plan/850911.pdf

USFWS. (1985d). *Lotis blue butterfly recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/851226b.pdf

USFWS. (1985e). Determination of endangered status and critical habitat for Amsinckia grandiflora. *Determination of endangered status and critical habitat for Amsinckia grandiflora*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1SU

USFWS. (1985f). *Determination of endangered status and critical habitat for the Fresno kangaroo rat - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr918.pdf

USFWS. (1987a). *Determination of endangered status for the giant kangaroo rat.* Retrieved from https://ecos.fws.gov/docs/federal_register/fr1208.pdf

USFWS. (1987b). *Proposed endangered status for Tipton kangaroo rat.* Retrieved from https://ecos.fws.gov/docs/federal_register/fr1295.pdf

USFWS. (1988). *Determination of endangered status for Stephen's kangaroo rat.* Retrieved from https://ecos.fws.gov/docs/federal_register/fr1489.pdf

USFWS. (1990). *Recovery plan for the endangered and threatened species of Ash Meadows, Nevada.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/900928d.pdf

USFWS. (1991). *Point Arena mountain beaver (Aplodontia rufa nigra) determined to be endangered.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr1984.pdf

USFWS. (1993a). *Desert pupfish draft recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/931208b.pdf

USFWS. (1993b). *Determination of endangered status for three vernal pool plants and the Riverside fairy shrimp - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr2358.pdf

USFWS. (1993c). *Determination of endangered status for two plants Arenaria paludicola (marsh sandwort) and Rorippa gambellii (Gambel's watercress).* Retrieved from https://ecos.fws.gov/docs/federal_register/fr2357.pdf

USFWS. (1994a). *Five plants from the San Bernardino Mountains in southern California determined to be threatened or endangered.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr2666.pdf

USFWS. (1994b). *Determination of endangered status for the tidewater goby - final rule.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1144.pdf

USFWS. (1994c). *Determination of endangered status for the Arroyo southwestern toad - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr2750.pdf

USFWS. (1994d). *Determination of endangered status for the Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, and the Vernal Pool Tadpole Shrimp; and Threatened Status for the Vernal Pool Fairy Shrimp*. Retrieved from http://ecos.fws.gov/docs/federal_register/fr2692.pdf

USFWS. (1994e). *Endangered or threatened status for five plants and the Morro shoulderband snail from western San Luis Obispo County, California.* Retrieved from https://ecos.fws.gov/docs/federal_register/fr2746.pdf

USFWS. (1994f, #sep#). *Determination of endangered status for the Pacific pocket mouse - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr2705.pdf

USFWS. (1995a). *Recovery Plan for the Lahontan Cutthroat Trout*. Retrieved from http://ecos.fws.gov/docs/recovery_plan/950130.pdf

USFWS. (1995b). *Determination of endangered status for ten plants and threatened status for two plants from serpentine habitats in the San Francisco Bay region of California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr2779.pdf

USFWS. (1996a). *Recovery plan for the Sacramento-San Joaquin Delta native fishes.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/961126.pdf

USFWS. (1996b). *Determination of threatened status for the California red-legged frog.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr2960.pdf

USFWS. (1996c). *Determination of endangered status for four plants and threatened status for one plant from the central Sierran Foothills of California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3018.pdf

USFWS. (1996d). *Water howellia (Howellia aquatilis) recovery plan*. Retrieved from http://ecos.fws.gov/docs/recovery_plan/960924.pdf

USFWS. (1997a). *Determination of endangered status for the Laguna Mountains skipper and Quino checkerspot butterfly - final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-1997-01-16/pdf/97-1111.pdf

USFWS. (1997b, January). *Determination of endangered status for two insects from the Santa Cruz Mountains of California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3039.pdf

USFWS. (1997c). *Determination of endangered status for the San Diego fairy shrimp.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3045.pdf

USFWS. (1997d). *Determination of endangered status for three plants from the Channel Islands of southern California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3120.pdf

USFWS. (1997e). *Determination of endangered status for Pseudobahia bahiifolia (Hartweg's golden sunburst) and threatened status for Pseudobahia peirsonii (San Joaquin adobe*

sunburst), two grassland plants from the Central Valley of California. Retrieved from http://ecos.fws.gov/docs/federal_register/fr3047.pdf

USFWS. (1997f). *Final rule for 13 plant taxa from the northern Channel Islands, California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3114.pdf

USFWS. (1997g). *Endangered status for the plant Lessingia germanorum (San Francisco lessingia) from California.* Retrieved from https://ecos.fws.gov/docs/federal_register/fr3093.pdf

USFWS. (1998a). *Recovery plan for upland species of the San Joaquin Valley, California.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/980930a.pdf

USFWS. (1998b). *Recovery plan for upland species of the San Joaquin Valley, California.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/980930a.pdf

USFWS. (1998c). *Point Arena mountain beaver (Aplodontia rufa nigra (Rafinesque)) recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/980602.pdf

USFWS. (1998d). *Final rule to list the San Bernardino kangaroo rat as endangered.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3315.pdf

USFWS. (1998e). *Recovery plan for Inyo California towhee (Pipilo erythrophthalmus eremophilus).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/980410c.pdf

USFWS. (1998f). *Draft recovery plan for the least Bell's vireo.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/980506.pdf

USFWS. (1998g). *Owens Basin wetland and aquatic species recovery plan.* Retrieved from http://inyo-monowater.org/wp-content/uploads/2011/09/OV_Wetland_Aquatic_spp_Recovery_Plan_1998.pdf

USFWS. (1998h). *Recovery Plan for the Threatened and Rare Native Fishes of the Warner Basin and Alkali Subbasin*. Retrieved from http://ecos.fws.gov/docs/recovery_plan/980427.pdf

USFWS. (1998i). *Recovery plan for the El Segundo blue butterfly (Euphilotes battoides allyni).* Retrieved from https://ecos.fws.gov/docs/recovery_plan/980928d.pdf

USFWS. (1998j). *Recovery plan for insect and plant taxa from the Santa Cruz Mountains in California.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/980928a.pdf

USFWS. (1998k). *Vernal pools of southern California recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/980903a.pdf

USFWS. (1998l). *Applegate's Milk-vetch (Astragalus applegatei) Recovery Plan.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/980410d.pdf

USFWS. (1998m). *Recovery plan for seven coastal plants and the Myrtle's silverspot butterfly.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/980930d.pdf

USFWS. (1998n). *Determination of threatened status for four plants from the foothills of the Sierra Nevada Mountains in California.* Retrieved from https://ecos.fws.gov/docs/federal_register/fr3303.pdf

USFWS. (1998o). *Determination of endangered or threatened status for five desert milk-vetch taxa from California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3320.pdf

USFWS. (1998p). *Determination of endangered or threatened status for four plants from southwestern California and Baja California, Mexico.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3325.pdf

USFWS. (1998q). *Endangered status for the peninsular ranges population segment of the desert bighorn sheep in southern California - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3225.pdf

USFWS. (1998r). *Determination of threatened status for one plant, Arctostaphylos pallida (Pallid manzanita), from the Northern Diablo Range of California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3252.pdf

USFWS. (1998s). *Recovery plan for Santa Cruz cypress (Cupressus abramsiana).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/980926.pdf

USFWS. (1998t). *Endangered or threatened status for three plants from the chaparral and scrub of southwestern California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3326.pdf

USFWS. (1999a). *Draft revised recovery plan for the Morro Bay kangaroo rat (Dipodomys heermanni morroensis).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/000125.pdf

USFWS. (1999b). *Recovery plan for the Arroyo southwestern toad.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/990724.pdf

USFWS. (1999c). *Recovery plan for six plants from the mountains surrounding the Los Angeles Basin.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/990930a.pdf

USFWS. (1999d). *Determination of endangered status for the plant Eriogonum apricum (inclusive of vars. apricum and prostratum) (Ione buckwheat) and threatened status for the plant Arctostaphylos myrtifolia (Ione manzanita).* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3399.pdf

USFWS. (2000a). *Recovery plan for bighorn sheep in the peninsular ranges, California.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/001025.pdf

USFWS. (2000b). *Final rule to list the riparian brush rabbit and the riparian, or San Joaquin Valley, woodrat as endangered.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3524.pdf

USFWS. (2000c). *Final rule to list the short-tailed albatross as endangered in the United States.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2000-07-31/pdf/00-19223.pdf#page=1

USFWS. (2000d). *Threatened status for the Santa Ana sucker.* Retrieved from https://www.federalregister.gov/articles/2000/04/12/00-8999/endangered-and-threatened-wildlife-and-plants-threatened-status-for-the-santa-ana-sucker

USFWS. (2000e). *Thirteen plant taxa from the northern Channel Islands recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/000926.pdf

USFWS. (2000f). *Determination of endangered status for Sidalcea keckii (Keck's checker-mallow) from Fresno and Tulare Counties, CA.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3523.pdf

USFWS. (2000g). *Determination of endangered status for the plant Thlaspi californicum (Kneeland prairie penny-cress) from coastal northern California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3522.pdf

USFWS. (2000h). *Determination of endangered or threatened status for four southwestern California plants from vernal wetlands and clay soils.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3328.pdf

USFWS. (2000i). *Final rule for endangered status for four plants from south central coastal California.* Retrieved from https://ecos.fws.gov/docs/federal_register/fr3546.pdf

USFWS. (2000j). *Determination of threatened status for Chlorogalum purpureum (purple amole), a plant from the South Coast ranges of California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3545.pdf

USFWS. (2000k). *Determination of endangered status for the plant Yreka phlox from Siskiyou County, CA.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3521.pdf
USFWS. (2001a). *Final determination of critical habitat for the Morro shoulderband snail.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3708.pdf
USFWS. (2001b). *Final determination of critical habitat for the Zayante band-winged grasshopper - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3710.pdf
USFWS. (2002a). *Endangered status for the Buena Vista Lake shrew (Sorex ornatus relictus) - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3844.pdf
USFWS. (2002b). *Recovery plan for the southwestern willow flycatcher.* Retrieved from http://ecos.fws.gov/docs/recovery_plans/2002/020830c.pdf
USFWS. (2002c). *Bonytail chub recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/060727a.pdf
USFWS. (2002d). *Colorado pikeminnow recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/020828b.pdf
USFWS. (2002e). *Razorback sucker recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/060727c.pdf
USFWS. (2002f). *Designation of critical habitat for the unarmored threespine stickleback - finding the the designation should not be made.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2002-09-17/pdf/02-23645.pdf
USFWS. (2002g). *Recovery plan for the California red-legged frog (Rana aurora draytonii).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/020528.pdf
USFWS. (2002h). *Recovery plan for gabbro soil plants of the central Sierra Nevada foothills.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/020830b.pdf
USFWS. (2002i). *Determination of critical habitat for Thlaspi californicum (Kneeland prairie penny-cress).* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3974.pdf
USFWS. (2002j). *Designation of critical habitat for Deinandra conjugens (Otay tarplant).* Retrieved from http://ecos.fws.gov/docs/federal_register/fr4006.pdf
USFWS. (2002k). *Final designation of critical habitat for Chlorogalum purpureum, a plant from the south coastal ranges of California; final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3976.pdf
USFWS. (2002l). *Determination of endangered status for Ambrosia pumila (San Diego ambrosia) from southern California.* Retrieved from https://www.fws.gov/carlsbad/SpeciesStatusList/List/20020702_fList_AMPU.pdf
USFWS. (2002m). *Final designation of critical habitat for Holocarpha macradenia (Santa Cruz tarplant), final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3972.pdf
USFWS. (2002n). *Proposed designation of critical habitat for Astragalus pycnostachyus var. lanosissimus, a plant from the coast of southern and central California.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr3969.pdf
USFWS. (2003a). *Recovery plan for the Quino checkerspot butterfly (Euphydryas editha quino).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/030917.pdf
USFWS. (2003b). *Final rule for designation of critical habitat for Keck's checker-mallow (Sidalcea keckii).* Retrieved from http://ecos.fws.gov/docs/federal_register/fr4077.pdf
USFWS. (2003c). *Recovery plan for coastal plants of the northern San Francisco Peninsula.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/031006.pdf

USFWS. (2004a). *Listing the San Miguel Island fox, Santa Rosa Island fox, Santa Cruz Island fox, and Santa Catalina Island fox as endangered - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr4228.pdf

USFWS. (2004b). *Revised recovery plan for the Paiute cutthroat trout (Oncorhynchus clarkii seleniris).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/040910.pdf

USFWS. (2004c). *Recovery plan for Chorizanthe robusta var. robusta (robust spineflower).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/041220b.pdf

USFWS. (2004d). *Recovery plan for five plants from Monterey County, California.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/050617a.pdf

USFWS. (2005a). *Final determination concerning critical habitat for the San Miguel Island fox, Santa Rosa Island fox, Santa Cruz Island fox, and Santa Catalina Island fox - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr4468.pdf

USFWS. (2005b). *Final designation of critical habitat for the Arroyo toad (Bufo californicus) - final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr4405.pdf

USFWS. (2005c). *Recovery plan for delta green ground beetle (Elaphrus viridis).* Retrieved from http://www.fws.gov/sacramento/es/Recovery-Planning/Vernal-Pool/Documents/delta_green_ground_beetle.pdf

USFWS. (2005d). *Designation of critical habitat for Astragalus lentiginosus var. piscinensis (Fish Slough milk-vetch).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2005-06-09/pdf/05-11315.pdf#page=2

USFWS. (2006a). *California least tern 5-year review.* Retrieved from http://www.fws.gov/cno/es/California%20least%20tern%205-year%20review.FINAL.pdf

USFWS. (2006b). *Least Bell's vireo 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc781.pdf

USFWS. (2006c). *San Francisco garter snake 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc774.pdf

USFWS. (2006d). *Recovery plan for vernal pool ecosystems of California and southern Oregon.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/060614.pdf

USFWS. (2006e). *Designation of critical habitat for the Laguna Mountains skipper (Pyrgus ruralis lagunea).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2006-12-12/pdf/06-9498.pdf#page=1

USFWS. (2006f). *Morro shoulderband snail 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc772.pdf

USFWS. (2006g, September). *Smith's blue butterfly 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc777.pdf

USFWS. (2006h). *Valley elderberry longhorn beetle (Desmocerus californicus dimorphus) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc779.pdf

USFWS. (2006i). *Designation of critical habitat for four vernal pool crustaceans and eleven vernal pool plants - final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2006-02-10/pdf/06-1080.pdf#page=2

USFWS. (2006j). *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/060614.pdf

USFWS. (2006k). *Recovery plan for Phlox hirsuta (Yreka phlox).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/060921.pdf

USFWS. (2007a). *Revised designation of critical habitat for the coastal California gnatcatcher (Polioptila californica californica).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2007-12-19/pdf/07-6003.pdf#page=1
USFWS. (2007b). *5 Year Review Lost River Sucker*. Retrieved from http://www.fws.gov/cno/es/LRS5YRCNO071707.pdf
USFWS. (2007c). *5 Year Review Shortnose Sucker*. Retrieved from http://www.fws.gov/cno/es/SNS5YR071007.pdf
USFWS. (2007d). *Tidewater goby final recovery plan working draft.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/051207.pdf
USFWS. (2007e). *Tidewater goby (Eucyclogobius newberryi) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1144.pdf
USFWS. (2007f). *Recovery plan for Carson wandering skipper.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/070913b.pdf
USFWS. (2007g). *Kern primrose sphinx moth (Euproserpinus euterpe) 5-year review - evaluation and summary.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1157.pdf
USFWS. (2007h). *Laguna Mountains skipper (Pyrgus ruralis lagunae) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1158.pdf
USFWS. (2007i). *Designation of critical habitat for the San Diego fairy shrimp (Branchinecta sandiegonensis).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2007-12-12/pdf/07-5972.pdf#page=1
USFWS. (2007j). *Vernal Pool Fairy Shrimp (Branchinecta lynchi) 5-Year Review: Summary and Evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1150.pdf
USFWS. (2007k). *Vernal pool tadpole shrimp (Lepidurus packardi) 5-year review summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1160.pdf
USFWS. (2007l). *Amargosa niterwort 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1864.pdf
USFWS. (2007m). *Cercocarpus traskiae (Catalina Island mountain-mahogany) five-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1146.pdf
USFWS. (2007n). *Pseudobahia bahiifolia (Hartweg's golden sunburst) and Pseudobahia peirsonii (San Joaquin adobe sunburst) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1869.pdf
USFWS. (2007o). *Designation of critical habitat for Ceanothus ophiochilus (Vail Lake ceanothus) and Fremontodendron mexicanum (Mexican flannelbush).* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q3AH
USFWS. (2007p). *Chorizanthe orcuttiana (Orcutt's spineflower) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1872.pdf
USFWS. (2007q). *5-year review Malacothamnus clementinus (San Clemente Island bush mallow).* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1141.pdf
USFWS. (2007r). *Lithophragma maximum (San Clemente Island woodland star) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1143.pdf
USFWS. (2007s). *Soft-leaved paintbrush (Castilleja mollis) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1877.pdf
USFWS. (2008a). *Designation of critical habitat for the San Bernardino kangaroo rat (Dipodomys merriami parvus).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2008-10-17/pdf/E8-23515.pdf#page=1

USFWS. (2008b). *Sierra Nevada bighorn sheep 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2000.pdf

USFWS. (2008c). *Designation of critical habitat for Acanthomintha ilicifolia (San Diego thornmint), final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2008-08-26/pdf/E8-19194.pdf#page=2

USFWS. (2008d). *Delhi Sands flower loving fly (Rhaphiomidas terminatus abdominalis) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1898.pdf

USFWS. (2008e). *Lange's metalmark butterfly, Antioch Dunes evening-primrose, and Contra Costa wallflower 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1928.pdf

USFWS. (2008f). *Riverside fairy shrimp 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1997.pdf

USFWS. (2008g). *Ben Lomond wallflower (Erysimum teretifolium) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1934.pdf

USFWS. (2008h). *Blennosperma bakeri (Sonoma sunshine, Lasthenia burkei (Burke's goldfields), Limnanthes vinculans (Sebastopol meadowfoam) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1992.pdf

USFWS. (2008i). *Limnanthes floccosa ssp. californica (Butte County meadowfoam) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1939.pdf

USFWS. (2008j). *Colusa grass (Neostapfia colusana) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1930.pdf

USFWS. (2008k). *Few-flowered Navarretia (Navarretia leucocephala ssp. pauciflora) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1935.pdf

USFWS. (2008l). *Island phacelia (Phacelia insularis var. insularis) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1936.pdf

USFWS. (2008m). *Lane Mountain milk-vetch (Astragalus jaegerianus) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1955.pdf

USFWS. (2008n). *Lyon's pentachaeta (Pentachaeta lyonii) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1994.pdf

USFWS. (2008o). *Menzies' wallflower (Erysimum menziesii) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1937.pdf

USFWS. (2008p). *Monterey gilia (Gilia tenuiflora ssp. arenaria) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1899.pdf

USFWS. (2008q). *Delphinium variegatum ssp. kinkiense (San Clemente Island larkspur) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1894.pdf

USFWS. (2008r). *Astragalus magdalenae var. peirsonii (Peirson's milk-vetch) 5-year review: short form summary.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1995.pdf

USFWS. (2008s). *Purple amole (Chlorogalum purpureum) five-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1996.pdf

USFWS. (2008t). *Orcuttia viscida (Sacramento orcutt grass) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1933.pdf

USFWS. (2008u). *San Bernardino bluegrass (Poa atropurpurea) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1998.pdf

USFWS. (2008v). *Designation of critical habitat for Berberis nevinii (Nevin's barberry).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2008-02-13/pdf/08-523.pdf#page=2
USFWS. (2009a). *Soil-Disturbance Field Guide.* Retrieved September 2015, from http://www.fs.fed.us/t-d/pubs/pdf/08191815.pdf
USFWS. (2009aa). *Species account for fountain thistle.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/fountain_thistle.pdf
USFWS. (2009ab). *Hairy orcutt grass (Orcuttia pilosa) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2578.pdf
USFWS. (2009ac). *Gilia tenuiflora ssp. hoffmannii (Hoffmann's slender-flowered gilia) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2577.pdf
USFWS. (2009ad). *Galium buxifolium (Island bedstaw) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3208.pdf
USFWS. (2009ae). *Kenwood Marsh checker-mallow (Sidalcea oregana ssp. valida) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2603.pdf
USFWS. (2009af). *Parvisedum leiocarpum (=Sedella leiocarpa) (Lake County stonecrop) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2604.pdf
USFWS. (2009ag). *Amsinckia grandiflora (large-flowered fiddleneck) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2390.pdf
USFWS. (2009ah). *Eryngium constancei (Loch Lomond coyote-thistle) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2520.pdf
USFWS. (2009ai). *Navarretia leucocephala ssp. pleiantha (many-flowered navarretia) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2391.pdf
USFWS. (2009aj). *Dudleya cymosa ssp. marcescens (Marcescent Dudleya) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2543.pdf
USFWS. (2009ak). *Species account for Metcalf Canyon jewelflower.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/metcalf_canyon_jewelflower.pdf
USFWS. (2009al). *Fremontodendron mexicanum (Mexican flannelbush) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2556.pdf
USFWS. (2009am). *Monterey Spineflower (Chorizanthe pungens var. pungens) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2393.pdf
USFWS. (2009an). *Berberis nevinii (Nevin's barberry) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2557.pdf
USFWS. (2009ao). *Deinandra conjugens (Otay tarplant) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2632.pdf
USFWS. (2009ap). *Palmate-bracted bird's beak (Cordylanthus palmatus = Chloropyron palmatus) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2628.pdf
USFWS. (2009aq). *Erigeron parishii (Parish's daisy) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2565.pdf
USFWS. (2009ar). *Species account for Pennell's Bird's-beak.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2O8

USFWS. (2009as). *Carex albida (white sedge) and Lilium pardalinum ssp. pitkinense (Pitkin marsh lily) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2555.pdf

USFWS. (2009at). *Chloropyron maritimum subsp. maritimum (Cordylanthus maritimus subsp. maritimus) (salt marsh bird's-beak) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2566.pdf

USFWS. (2009au). *Camissonia benitensis (San Benito evening-primrose) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2550.pdf

USFWS. (2009av). *Physaria (Lesquerella) kingii subsp. bernardina (San Bernardino Mountains bladderpod) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2567.pdf

USFWS. (2009aw). *Acanthomintha ilicifolia (San Diego thornmint) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2571.pdf

USFWS. (2009ax). *Species account for San Mateo thornmint.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/san_mateo_thornmint.pdf

USFWS. (2009ay). *Species account for San Mateo woolly sunflower.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/San_Mateo_woolly_sunflower.pdf

USFWS. (2009az). *Cupressus abramsiana (Santa Cruz Cypress) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2551.pdf

USFWS. (2009b). *Point Arena mountain beaver (Aplodontia rufa nigra) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2396.pdf

USFWS. (2009ba). *Dudleya nesiotica (Santa Cruz Island dudleya) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2576.pdf

USFWS. (2009bb). *Thysanocarpus conchuliferus (Santa Cruz Island Fringepod) 5-year review.* Retrieved from http://www.cabi.org/isc/FullTextPDF/2011/20117202404.pdf

USFWS. (2009bc). *Dudleya cymosa ssp. ovatifolia (Santa Monica Mountains dudleya) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3224.pdf

USFWS. (2009bd). *Polygonum hickmanii (Scotts Valley polygonum) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3225.pdf

USFWS. (2009be). *Scotts Valley spineflower (Chorizanthe robusta var. hartwegii) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4028.pdf

USFWS. (2009bf). *Solano grass (Orcuttia mucronata = Tuctoria mucronata) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2398.pdf

USFWS. (2009bg). *Navarretia fossalis (Spreading navarretia) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2574.pdf

USFWS. (2009bh). *Brodiaea filifolia (thread-leaved brodiaea) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2570.pdf

USFWS. (2009bi). *Species account for Tiburon jewelflower.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/Tiburon_jewelflower.pdf

USFWS. (2009bj). *Species account for Tiburon mariposa lily.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/tiburon_mariposa_lily.pdf

USFWS. (2009bk). *Species account for Tiburon paintbrush.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/tiburon_paintbrush.pdf

USFWS. (2009bl). *Astragalus tricarinatus (triple-ribbed milk-vetch) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2560.pdf

USFWS. (2009bm). *Dudleya verityi (Verity's dudleya) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2554.pdf

USFWS. (2009bn). *Species account for white-rayed pentachaeta.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/White_rayed_pentachaeta.pdf

USFWS. (2009bo). *Braunton's milk-vetch (Astragalus brauntonii) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2381.pdf

USFWS. (2009bp, January). *Western Lilly (Lilium occidentale) 5-Year Review Summary and Evaluation.* Retrieved June 22, 2016, from https://ecos.fws.gov/docs/five_year_review/doc2408.pdf

USFWS. (2009bq). *Designation of critical habitat for Peninsular bighorn sheep and determination of a distinct population segment of desert bighorn sheep (Ovis canadensis nelsoni).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2009-04-14/pdf/E9-7767.pdf#page=1

USFWS. (2009c). *Light-footed clapper rail 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2573.pdf

USFWS. (2009d). *San Clemente loggerhead shrike (Lanius ludovicianus mearnsi) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2631.pdf

USFWS. (2009e). *San Clemente sage sparrow (Amphispiza belli clementeae) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2568.pdf

USFWS. (2009f). *Owens tui chub 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3212.pdf

USFWS. (2009g). *Unarmored threespine stickleback (Gastrerosteus aculeatus williamsoni) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2629.pdf

USFWS. (2009h). *California tiger salamander - Santa Barbara County DPS 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3223.pdf

USFWS. (2009i). *Santa Cruz long-toed salamander 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2630.pdf

USFWS. (2009j). *Bay checkerspot butterfly 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2517.pdf

USFWS. (2009k). *Callippe silverspot butterfly 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2518.pdf

USFWS. (2009l). *Zayante band-winged grasshopper (Trimerotropis infantilis) and Mount Hermon June beetle (Polyphylla barbata) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2572.pdf

USFWS. (2009m). *Myrtle's silverspot butterfly 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2394.pdf

USFWS. (2009n). *Ohlone tiger beetle 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3220.pdf

USFWS. (2009o). *Revised designation of critical habitat for the Quino checkerspot butterfly (Euphydryas editha quino) - final rule.* Retrieved from https://www.federalregister.gov/articles/2009/06/17/E9-13800/endangered-and-threatened-wildlife-and-plants-revised-designation-of-critical-habitat-for-the-quino

USFWS. (2009p). *Quino checkerspot butterfly (Euphydryas editha quino) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4341.pdf

USFWS. (2009q). *Shasta crayfish 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2552.pdf

USFWS. (2009r, November 3). *Species Fact Sheet for Applegate's Milk-vetch (Astragalus applegatei).* Retrieved June 22, 2016, from https://www.fws.gov/oregonfwo/species/Data/ApplegatesMilkVetch/

USFWS. (2009s). *Clara Hunt's milk-vetch (Astragalus clarianus) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc2519.pdf

USFWS. (2009t). *Lupinus tidestromii (Clover lupine) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3210.pdf

USFWS. (2009u). *Astragalus lentiginosus var. coachellae (Coachella Valley milk-vetch). 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3211.pdf

USFWS. (2009v). *Species account for coyote ceanothus*. Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/coyote_ceanothus.pdf

USFWS. (2009w). *Erigonum ovalifolium var. vineum (Cushenbury buckwheat) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2562.pdf

USFWS. (2009x). *Astragalus albens (Cushenbury milk-vetch) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2563.pdf

USFWS. (2009y). *Acanthoscyphus (Oxytheca) parishii var. goodmaniana (Cushenbury oxytheca) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2564.pdf

USFWS. (2009z). *Astragalus lentiginosus var. piscinensis (Fish Slough milk-vetch) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc2385.pdf

USFWS. (2010a). *Fresno kangaroo rat (Dioldomys nitratoides exilis) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3214.pdf

USFWS. (2010aa). *Ambrosia pumila (San Diego ambrosa) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3557.pdf

USFWS. (2010ab). *Eryngium aristulatum var. parishii (San Diego button-celery) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3569.pdf

USFWS. (2010ac). *Pogogyne abramsii (San Diego mesa mint) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3568.pdf

USFWS. (2010ad). *Monolopia (=Lembertia) congdonii (San Joaquin wooly-threads) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3556.pdf

USFWS. (2010ae). *Eriastrum densifolium subsp. sanctorum (Santa Ana River woolly-star) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3780.pdf

USFWS. (2010af). *Dodecahema leptoceras (slender-horned spineflower) 5-year review*. Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3622.pdf
USFWS. (2010ag). *Chorizanthe valida (Sonoma spineflower) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3558.pdf
USFWS. (2010ah). *Species account for Springville clarkia.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/Springville_Clarkia.pdf
USFWS. (2010ai). *Astragalus pycnostachyus var. lanosissimus (Ventura marsh milk-vetch) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3554.pdf
USFWS. (2010aj, February 2). *McDonald's Rock-Cress (Arabis mcdonaldiana) Species Fact Sheet (2010).* Retrieved June 22, 2016, from https://www.fws.gov/oregonfwo/species/Data/McDonaldsRockCress/
USFWS. (2010b). *Giant kangaroo rat - 5-year review - summary and evaluation.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3215.pdf
USFWS. (2010c). *Pacific pocket mouse 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3552.pdf
USFWS. (2010d). *Salt marsh harvest mouse 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3221.pdf
USFWS. (2010e). *San Joaquin kit fox (Vulpes macrotis mutica) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3222.pdf
USFWS. (2010f). *Tipton kangaroo rat (Dipodomys nitratoides nitratoides) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3228.pdf
USFWS. (2010g). *Coastal California gnatcatcher (Polioptila californica californica) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3571.pdf
USFWS. (2010h). *Draft Yuma clapper rail recovery plan, first revision.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/Draft%20Yuma%20Clapper%20Rail%20Recovery%20Plan,%20First%20Revision.pdf
USFWS. (2010i). *Revised critical habitat for Santa Ana sucker - final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2010-12-14/pdf/2010-30447.pdf
USFWS. (2010j). *Revised designation of critical habitat for California red-legged frog - final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2010-03-17/pdf/2010-4656.pdf#page=2
USFWS. (2010k). *Blunt-nosed leopard lizard (Gambelia silus) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3209.pdf
USFWS. (2010l). *Coachella Valley fringe-toed lizard 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3562.pdf
USFWS. (2010m). *San Bruno elfin butterfly and mission blue butterfly 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3216.pdf
USFWS. (2010n). *Verbesina dissita (big-leaved crownbeard) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3559.pdf
USFWS. (2010o). *Plagiobothrys strictus and Poa napensis 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3218.pdf

USFWS. (2010p). *Species account for Chinese Camp brodiaea*. Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/chinese_camp_brodiaea.pdf
USFWS. (2010q). *Arctostaphylos glandulosa subsp. crassifolia (Del Mar manzanita) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3565.pdf
USFWS. (2010r). *Eriogonum apricum (inclusive of vars. apricum and prostratum) (Ione buckwheat = Irish Hill buckwheat) and Arctostaphylos myrtifolia (Ione manzanita) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3560.pdf
USFWS. (2010s). *Malacothrix indecora (Santa Cruz Island malacothrix) and Malacothrix squalida (island malacothrix) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3615.pdf
USFWS. (2010t). *Helianthemum greenei (Island rush-rose) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3555.pdf
USFWS. (2010u). *Dudleya stolonifera (Laguna Beach liveforever) 5-year revew: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3553.pdf
USFWS. (2010v). *Species account for mariposa pussypaws.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/Mariposa_pussypaws.pdf
USFWS. (2010w). *Pogogyme nudiuscula (Otay mesa mint) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3567.pdf
USFWS. (2010x). *Arctostaphylos pallida (Pallid manzanita) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4105.pdf
USFWS. (2010y). *Species account for Red Hills vervain.* Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Plants/Documents/Red_Hills_vervain.pdf
USFWS. (2010z). *Chorizanthe robusta var. robusta (robust spineflower) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4029.pdf
USFWS. (2011a). *Buena Vista Lake ornate shrew (Sorex ornatus relictus) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3889.pdf
USFWS. (2011aa). *Sidalcea pedata (pedate checker-mallow) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3614.pdf
USFWS. (2011ab). *Thelypodium stenopetalum (slender-petaled mustard) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3617.pdf
USFWS. (2011ac). *Alopecurus aequalis var. sonomensis (Sonoma alopecurus) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3898.pdf
USFWS. (2011ad). *Vine Hill clarkia (Clarkia imbricata) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3892.pdf
USFWS. (2011ae). *Bakersfield cactus (Opuntia treleasei = Opuntia bailaris var. treleasei) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3888.pdf
USFWS. (2011af). *Delphinium leuteum (yellow larkspur) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3900.pdf

USFWS. (2011b). *Morro Bay kangaroo rat (Dipodomys heermanni morroensis) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3641.pdf

USFWS. (2011c). *Peninsular bighorn sheep (Ovis canadensis nelsoni) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3637.pdf

USFWS. (2011d). *Stephens' kangaroo rat (Dipodomys stephensi) 5-year revew.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3775.pdf

USFWS. (2011e). *Revised critical habitat for the marbled murrelet*. Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2011-10-05/pdf/2011-25583.pdf

USFWS. (2011f). *Little Kern golden trout (Oncorhynchus mykiss whitei) five year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3894.pdf

USFWS. (2011g). *Revised critical habitat for the Arroyo toad - final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2011-02-09/pdf/2011-1703.pdf

USFWS. (2011h). *Alameda whipsnake (Masticophis lateralis euryxanthus) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3886.pdf

USFWS. (2011i). *California freshwater shrimp (Syncaris pacifica) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3890.pdf

USFWS. (2011j). *Determination of endangered status for Casey's June beetle and designation of critical habitat - final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2011-09-22/pdf/2011-24047.pdf

USFWS. (2011k). *Lotis blue butterfly (Lycaeides argyrognomon lotis) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3960.pdf

USFWS. (2011l). *Species profile for Oregon silverspot butterfly* . Retrieved from http://www.fws.gov/arcata/es/inverts/orSS/ss_bfly.html

USFWS. (2011m, May 6). *Desert Tortoise Recovery Plan.* Retrieved June 20, 2016, from https://www.fws.gov/nevada/desert_tortoise/documents/recovery_plan/RRP%20for%20the%20Mojave%20Desert%20Tortoise%20-%20May%202011.pdf

USFWS. (2011n). *Beach layia (Layia carnosa) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3972.pdf

USFWS. (2011o). *Orcuttia californica (California orcutt grass) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3618.pdf

USFWS. (2011p). *Baccharis vanessae (Encinitas baccharis) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3974.pdf

USFWS. (2011q). *Castilleja campestris ssp. succulenta (fleshy owl's clover) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3893.pdf

USFWS. (2011r). *Rorippa gambellii [Nasturtium gambelii] (Gambel’s watercress) 5-year review: summary and evaluation.* Retrieved from https://www.fws.gov/carlsbad/SpeciesStatusList/5YR/20111107_5YR_NAGA.pdf

USFWS. (2011s). *Deinandra increscens ssp. villosa (Gaviota tarplant) 5-year review: summary and evaluation.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3884.pdf

USFWS. (2011t). *Species Fact Sheet: Gentner's Fritillary (Fritillaria gentneri)*. Retrieved from http://www.fws.gov/oregonfwo/Species/Data/GentnersFritillary/

USFWS. (2011u). *Arabis [Boechera] hoffmannii (Hoffmann’s rock-cress) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3948.pdf

USFWS. (2011v). *Chorizanthe howellii (Howells spineflower) 5-year review.* Retrieved from http://www.fws.gov/arcata/es/plants/howellsSpineflower/documents/2011%20Howells%20spineflower%205YR%20Status%20Review.pdf

USFWS. (2011w). *Noccaea fendleri ssp. californica (Kneeland Prairie penny-cress) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3947.pdf

USFWS. (2011x). *Cirsium loncholepis (Cirsium scariosum var. loncholepis) (La Graciosa thistle) 5-year review: summary and evaluation.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3638.pdf

USFWS. (2011y). *Final revised designation of critical habitat for Astragalus jaegerianus (Lane Mountain milk-vetch).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2011-05-19/pdf/2011-12330.pdf

USFWS. (2011z). *Eriodictyon capitatum (Lompoc yerba santa) 5-year review: summary and evaluation.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc3606.pdf

USFWS. (2012a). *5-year review, short form summary, Monardella viminea (willowy monardella).* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4013.pdf

USFWS. (2012b). *Riparian woodrat (Neotoma fuscipes riparia) 5-year review - summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4016.pdf

USFWS. (2012c). *Designation of revised critical habitat for the northern spotted owl; final rule*. Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2012-12-04/pdf/2012-28714.pdf

USFWS. (2012d). *Revised endangered status, revised critical habitat designation, and taxonomic revision for Monardella linoides ssp. viminea; final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2012-03-06/pdf/2012-3903.pdf

USFWS. (2012e). *Designation of Critical Habitat for Lost River Sucker and Shortnose Sucker.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2012-12-11/pdf/2012-29332.pdf

USFWS. (2012f). Mountain yellow-legged frog (Rana muscosa) southern California distinct population segment 5-year review. *Mountain yellow-legged frog (Rana muscosa) southern California distinct population segment 5-year review*. Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4001.pdf

USFWS. (2012g, July 13). *mountain yellow-legged frog 5-year review summary evaluation.* Retrieved June 20, 2016, from mountain yellow-legged frog 5-year review summary evaluation: https://ecos.fws.gov/docs/five_year_review/doc4001.pdf

USFWS. (2012h). *Giant garter snake (Thamnophis gigas) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4009.pdf

USFWS. (2012i). *Behren's silverspot butterfly (Speyeria zerene behrensii) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4007.pdf

USFWS. (2012j). *Conservancy fairy shrimp (Branchinecta conservatio) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4012.pdf

USFWS. (2012k). *Longhorn fairy shrimp (Branchinecta longiantenna) 5-year review*. Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4011.pdf

USFWS. (2012l). *Revised critical habitat for the Riverside fairy shrimp - final rule.* Retrieved from https://www.federalregister.gov/articles/2012/12/04/2012-28250/endangered-and-threatened-wildlife-and-plants-revised-critical-habitat-for-the-riverside-fairy

USFWS. (2012m). *Removal of the valley elderberry longhorn beetle from the federal list of endangered and threatened wildlife; proposed rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2012-10-02/pdf/2012-23843.pdf

USFWS. (2012n). *Chorizanthe pungens var. hartwegiana (Ben Lomond spineflower) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3973.pdf
USFWS. (2012o). *Sidalcea keckii (Keck's Checkermallow) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4010.pdf
USFWS. (2012p). *5-year review Malacothamnus clementinus (San Clemente Island bush mallow).* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3998.pdf
USFWS. (2012q). *Castilleja grisea (San Clemente Island Indian paintbrush) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4000.pdf
USFWS. (2012r). *12-month finding on a petition to downlist three San Clemente Island plant species; proposed rule to reclassify two San Clemente Island plant species; taxonomic correction; proposed rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2012-05-16/pdf/2012-11339.pdf
USFWS. (2012s). *Acmispon dendroideus var. traskiae (San Clemente Island lotus) 5-Year Review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc3999.pdf
USFWS. (2012t). *Lessingia germanorum (San Francisco lessingia) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4017.pdf
USFWS. (2012u). *Determination of endangered status for Arctostaphylos franciscana (Franciscan manzanita) throughout its range.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2012-09-05/pdf/2012-21742.pdf
USFWS. (2012v). *Atriplex coronata var. notatior (San Jacinto Valley crownscale) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4139.pdf
USFWS. (2012w). *Malacothamnus fasciculatus var. nesioticus (Santa Cruz Island bushmallow) 5-Year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4130.pdf
USFWS. (2012x). *Sibara filifolia (Santa Cruz Island rock-cress) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4002.pdf
USFWS. (2012y). *Showy Indian clover (Trifolium amoenum) 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4018.pdf
USFWS. (2013a). *Birds protected by the Migratory Bird Treaty Act.* Retrieved from http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtintro.html
USFWS. (2013b). *Designation of critical habitat for Astragalus lentiginosus var. coachellae (Coachella Valley milk-vetch).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2013-02-13/pdf/2013-03109.pdf
USFWS. (2013c). *California condor 5-year review.* Retrieved from http://www.fws.gov/uploadedFiles/Region_8/NWRS/Zone_1/Hopper_Mountain_Complex/Hopper_Mountain/Sections/News/News_Items/PDFs/_California%20Condor%20Five%20Year%20Review_2013%20Final%20Published.pdf
USFWS. (2013d). *12-month finding on a petition and proposed rule to remove the Inyo California towhee from the federal list of endangered and threatened wildlife.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2013-11-04/pdf/2013-26122.pdf
USFWS. (2013e). *Paiute cutthroat trout (Oncorhynchus clarkii seleniris) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4164.pdf
USFWS. (2013f). *Designation of critical habitat for the tidewater goby - final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2013-02-06/pdf/2013-02057.pdf
USFWS. (2013g). *Endangered status for the Sierra Nevada yellow-legged frog and the northern distinct population segment of the mountain yellow-legged frog, and threatened status for*

the Yosemite toad; proposed rule. Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2013-04-25/pdf/2013-09600.pdf

USFWS. (2013h, January 27). *Recovering the Santa Cruz Long-toed Salamander*. Retrieved June 20, 2016, from https://www.fws.gov/endangered/news/episodes/bu-Winter2014/story3/Index.html

USFWS. (2013i). *Ash-grey paintbrush (Castillja cinerea) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4138.pdf

USFWS. (2013j). *Delphinium bakeri (Baker's Larkspur) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4006.pdf

USFWS. (2013k). *Caulanthus californicus (California jewelflower) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4190.pdf

USFWS. (2013l). *California taraxacum (Taraxacum californicum) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4266.pdf

USFWS. (2013m). *Recovery outline for Casey's June beetle (Dinacoma caseyi).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/CJB_Recovery_Outline_FINAL.pdf

USFWS. (2013n). *Lasthenia conjugens (Contra Costa Goldfields) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4335.pdf

USFWS. (2013o). *Trichostema austromontanum ssp. compactum (Hidden Lake bluecurls) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4173.pdf

USFWS. (2013p). *Island barberry (Berberis pinnata subsp. insularis) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4152.pdf

USFWS. (2013q). *Eremalche kernensis (Kern mallow) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4510.pdf

USFWS. (2013r). *Allium munzii (Munz's onion) 5 -year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4272.pdf

USFWS. (2013r). *Canada Lynx Fact Sheet.* Retrieved June 16, 2016, from Canada Lynx Fact Sheet: https://www.fws.gov/mountain-prairie/es/species/mammals/lynx/CandaLynxFactSheet_091613.pdf

USFWS. (2013s). *Designation of critical habitat for Arctostaphylos franciscana (Franciscan manzanita).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2013-12-20/pdf/2013-30165.pdf

USFWS. (2013t). *Orcuttia inaequalis (San Joaquin orcutt grass) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4188.pdf

USFWS. (2013u). *Ceanothus ophiochilus (Vail Lake Ceanothus) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4170.pdf

USFWS. (2013v, May 13). *McDonald's Rock-Cress (Arabis mcdonaldiana) 5-Year Review (2013)*. Retrieved June 22, 2016, from https://ecos.fws.gov/docs/five_year_review/doc4151.pdf

USFWS. (2013w). *Designation of critical habitat for Buena Vista lake shrew - final rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2013-07-02/pdf/2013-15586.pdf

USFWS. (2014a). *National Wetlands Inventory website*. Retrieved May 15, 2015, from http://www.fws.gov/wetlands/

USFWS. (2014b). *Recovery plan for tidal marsh ecosystems of northern and central California.* Retrieved from http://www.fws.gov/sacramento/es/Recovery-Planning/Tidal-Marsh/Documents/TMRP_Volume1_RP.pdf

USFWS. (2014c). *Southwestern willow flycatcher 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4437.pdf
USFWS. (2014d). *Western snowy plover.* Retrieved from http://www.fws.gov/arcata/es/birds/WSP/plover.html
USFWS. (2014e). *Western Yellow-billed Cuckoo Factsheet.* Retrieved from https://www.fws.gov/sacramento/outreach/Public-Advisories/WesternYellow-BilledCuckoo/docs/WYBC-factsheet-southwestlearning.pdf
USFWS. (2014f). *The Colorado pikeminnow and the razorback sucker.* Retrieved from http://www.fws.gov/southwest/sjrip/GB_FS.cfm
USFWS. (2014g). *Reclassifying the tidewater goby from endangered to threatened - proposed rule.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2014-03-13/pdf/2014-05335.pdf
USFWS. (2014h). *California tiger salamander central California DPS 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4466.pdf
USFWS. (2014i). *Desert slender salamander 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4333.pdf
USFWS. (2014j). *Oregon spotted frog.* Retrieved from ODFW: http://www.fws.gov/oregonfwo/articles.cfm?id=149489458
USFWS. (2014k). *Oregon spotted frog.* Retrieved from http://www.fws.gov/oregonfwo/articles.cfm?id=149489458
USFWS. (2014l). *Mojave desert tortoise.* Retrieved from http://www.fws.gov/nevada/desert_tortoise/dt/dt_life.html
USFWS. (2014m). *Palos Verdes blue butterfly 5-year review.* Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4334.pdf
USFWS. (2014n). *Draft recovery plan for the Santa Rosa Plain.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/Draft%20Recovery%20Plan%20for%20Santa%20Rosa%20Plain%20for%20publication%201-6-2015.pdf
USFWS. (2014o). *Holocarpha macradenia (Santa Cruz tarplant) 5-year review: summary and evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4365.pdf
USFWS. (2014p). *Arctostaphylos confertiflora (Santa Rosa Island manzanita) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4447.pdf
USFWS. (2014q). *Endangered status for Vandenberg monkeyflower.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2014-08-26/pdf/2014-20054.pdf
USFWS. (2014r). *Threatened species status for Ivesia webberi; final rule.* Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2014-06-03/pdf/2014-12627.pdf
USFWS. (2014s). *Candiate Species.* Retrieved from Section 4 of the Endangered Species Act: https://www.fws.gov/endangered/esa-library/pdf/candidate_species.pdf
USFWS. (2014t, December 29). *Candidate Conservation/How Can You Help Conservation?* Retrieved from http://www.fws.gov/endangered/what-we-do/how-you-can-help.html
USFWS. (2015a, January 26). *Wetlands Mapper Legend Categories.* Retrieved April 20, 2015, from National Wetland Inventory: http://www.fws.gov/wetlands/Data/Mapper-Wetlands-Legend.html
USFWS. (2015aa). *Species profile for California clapper rail.* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B04A
USFWS. (2015ab). *California condor recovery program.* Retrieved from http://www.fws.gov/cno/es/CalCondor/Condor.cfm

USFWS. (2015ac). *Species profile for California condor*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B002
USFWS. (2015ad). *California condor recovery program - threats.* Retrieved from http://www.fws.gov/cno/es/CalCondor/CondorThreats.cfm
USFWS. (2015ae). *Species Profile for Least Tern*. Retrieved from ECOS: http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=B07N
USFWS. (2015af). *Species profile for coastal California gnatcatcher*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=B08X
USFWS. (2015ag). *Species profile for Inyo California towhee*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action%3bjsessionid=A39246F3BF635A6675B34F3763B57AFB?spcode=B07Q
USFWS. (2015ah). *Species profile for least Bell's vireo*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B067
USFWS. (2015ai). *Species profile for light-footed clapper rail*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B04B
USFWS. (2015aj). *Species profile for Pacific pocket mouse*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A0BY
USFWS. (2015ak). *Species profile for northern spotted owl*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=B08B
USFWS. (2015al). *Species profile for San Clemente loggerhead shrike*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B05R
USFWS. (2015am). *Species profile for San Clemente sage sparrow*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B05S&ftb_embed=true#crithab
USFWS. (2015an). *Species profile for short-tailed albatross*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=B00Y
USFWS. (2015ao). *Species profile for southwestern willow flycatcher*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B094
USFWS. (2015ap). *Species profile for snowy plover*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=B07C
USFWS. (2015ar). *Species Profile for Yellow-billed Cuckoo (Coccyzus americanus)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B06R
USFWS. (2015as). *Species profile for Yuma clapper rail*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B00P
USFWS. (2015at). *Species profile for bonytail chub*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=E020
USFWS. (2015au). *Species Profile for Chinook Salmon*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=E06D
USFWS. (2015av). *Species profile for Colorado pikeminnow*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=E006
USFWS. (2015aw). *Species profile for Delta smelt*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E070
USFWS. (2015ax). *Species profile for desert pupfish*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E044#lifeHistory

USFWS. (2015ay). *Species profile for Lahontan Cutthroat Trout (Oncorhynchus clarkii henshawi)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E00Y
USFWS. (2015az). *Species profile for Peninsular bighorn sheep*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A0DR
USFWS. (2015b, January 26). *Data Limitations, Exclusions and Precautions*. Retrieved May 11, 2015, from http://www.fws.gov/wetlands/Data/Limitations.html
USFWS. (2015ba). *Species profile for Lost River sucker*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E052
USFWS. (2015bb). *Species profile for Owens pupfish*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E00A
USFWS. (2015bc). *Species profile for Owens tui chub*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E02W#crithab
USFWS. (2015bd). *Species profile for Paiute cutthroat trout*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E00G#crithab
USFWS. (2015be). *Species profile for razorback sucker*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=E054
USFWS. (2015bf). *Species Profile for Shortnose Sucker (Chasmistes brevirostris)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E055
USFWS. (2015bg). *Species Profile for Steelhead Trout*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=E08D
USFWS. (2015bh). *Species profile for unarmored threespine stickleback*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=E00X
USFWS. (2015bi). *Species Profile for Warner Sucker (Catostomus warnerensis)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E057
USFWS. (2015bj). *Withdrawal of proposed rule to reclassify the Arroyo toad as threatened - final rule*. Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2015-12-23/html/2015-32075.htm
USFWS. (2015bk). *Species profile for California tiger salamander*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D01T#crithab
USFWS. (2015bl). *Species profile for desert slender salamander*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D005#crithab
USFWS. (2015bm). *Species profile for Oregon spotted frog*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D02A
USFWS. (2015bn). *Species profile for Santa Cruz long-toed salamander*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D000#crithab
USFWS. (2015bo). *Species profile for Sierra Nevada yellow-legged frog*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D04M#crithab
USFWS. (2015bp). *Species profile for Yosemite toad*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D02K#crithab
USFWS. (2015bq). *Species profile for Alameda whipsnake*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C04A#crithab
USFWS. (2015br). *Species profile for blunt-nosed leopard lizard*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C001
USFWS. (2015bs). *Species profile for Coachella Valley fringe-toed lizard*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C02I#crithab

USFWS. (2015bt). *Species profile for desert tortoise*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C04L
USFWS. (2015bu). *Species profile for giant garter snake*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C057#crithab
USFWS. (2015bv). *Species profile for San Francisco garter snake*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C002#crithab
USFWS. (2015bw). *Species profile for green sea turtle (Chelonia mydas)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00S
USFWS. (2015bx). *Leatherback sea turtle fact sheet*. Retrieved from http://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/PDF/Leatherback-Sea-Turtle.pdf
USFWS. (2015by). *Species profile for leatherback sea turtle*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00F
USFWS. (2015bz, February 13). *ECOS Environmental Conservation Online System Listed Species*. Retrieved April 24, 2016, from http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=CA&status=listed
USFWS. (2015c). *Threatened & endangered species active critical habitat report*. Retrieved from http://ecos.fws.gov/ecp/report/table/critical-habitat.html
USFWS. (2015ca). *Lost River Sucker*. Retrieved from http://www.fws.gov/oregonfwo/articles.cfm?id=149489443
USFWS. (2015cb). *Species profile for olive ridley sea turtle*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C00V
USFWS. (2015cc). *Olive ridley sea turtle fact sheet*. Retrieved from http://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/olive-ridley-sea-turtle.htm
USFWS. (2015cd). *Species profile for Bay checkerspot butterfly*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I021#crithab
USFWS. (2015ce). *Species profile for Behren's silverspot butterfly*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I031
USFWS. (2015cf). *Species profile for California freshwater shrimp*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=K01W#crithab
USFWS. (2015cg). *Species profile for Callippe silverspot butterfly*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I019#crithab
USFWS. (2015ch). *Species profile for Carson wandering skipper*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I0RG
USFWS. (2015ci). *Species profile for Casey's June beetle*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=I0TG
USFWS. (2015cj). *Species profile for conservancy fairy shrimp*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=K03D#crithab
USFWS. (2015ck). *Species profile for Delhi Sands flower-loving fly*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=I0MG
USFWS. (2015cl). *Species profile for Kern primrose sphinx moth*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=I01C
USFWS. (2015cm). *Species profile for Laguna Mountains skipper*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=I0LW

USFWS. (2015cn). *Species profile for longhorn fairy shrimp*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=K03E#crithab
USFWS. (2015co). *Species profile for lotis blue butterfly*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=I00I#crithab
USFWS. (2015cp). *Species profile for mission blue butterfly*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I00J#crithab
USFWS. (2015cq). *Species profile for Morro shoulderband snail*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=G00D#crithab
USFWS. (2015cr). *Farallon Islands National Wildlife Refuge*. Retrieved from Wildlife and habitat: http://www.fws.gov/refuge/Farallon/wildlife_and_habitat/index.html
USFWS. (2015cs). *Species profile for Myrtle's silverspot butterfly*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I00N#crithab
USFWS. (2015ct). *Species profile for Ohlone tiger beetle*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I0OW#crithab
USFWS. (2015cu). *Species profile for Oregon Silverspot Butterfly (Speyeria zerene hippolyta)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I01A
USFWS. (2015cv). *Species profile for Palos Verdes blue butterfly*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I01B#crithab
USFWS. (2015cw). *Species information - Shasta crayfish*. Retrieved from https://www.fws.gov/sacramento/es_species/Accounts/Invertebrates/es_shasta-crayfish.htm
USFWS. (2015cx). *Species profile for Shasta crayfish*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=K01U#crithab
USFWS. (2015cy). *Species profile for valley elderberry longhorn beetle*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=I01L
USFWS. (2015cz). *Species profile for Vernal Pool Fairy Shrimp (Branchinecta lynchi)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=K03G
USFWS. (2015d). *Species profile for Amargosa vole*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A082
USFWS. (2015da). *Species profile for white abalone*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=G0C8
USFWS. (2015db). *Species profile for Amargosa niterwort*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2E8
USFWS. (2015dc). *Species profile for Antioch Dunes evening-primrose*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1ZN
USFWS. (2015dd). *Species profile for ash-grey paintbrush*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0CL
USFWS. (2015de). *Species profile for Baker's larkspur*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0LZ
USFWS. (2015df). *Species profile for Bakersfield cactus*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2YG
USFWS. (2015dg). *Species profile for beach layia*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q34T
USFWS. (2015dh). *Eremogene ursina (Bear Valley Sandwort) 5-year review*. Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4606.pdf

USFWS. (2015di). *Species profile for Bear Valley sandwort*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q03Z
USFWS. (2015dj). *Species profile for Ben Lomond spineflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q30Y
USFWS. (2015dk). *Species profile for Ben Lomond wallflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q29X
USFWS. (2015dl). *Species profile for big-leaved crownbeard*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q3GB
USFWS. (2015dm). *Species profile for Burke's goldfields*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1XU
USFWS. (2015dn). *Species profile for California jewelflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2Y8
USFWS. (2015do). *Species profile for California taraxacum*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1SB
USFWS. (2015dp). *Species profile for Calistoga allocarya*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1HV
USFWS. (2015dq). *Species profile for Clara Hunt's milk-vetch*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q05J
USFWS. (2015dr). *Species profile for clover lupine*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2DD
USFWS. (2015ds). *Dudleya abramsii ssp. parva (= Dudleya parva) (Conejo dudleya) 5-year review*. Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4507.pdf
USFWS. (2015dt). *Species profile for Conejo dudleya*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0O7
USFWS. (2015du). *Species profile for Contra Costa wallflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1WA
USFWS. (2015dv). *Species profile for Del Mar manzanita*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q036
USFWS. (2015dw). *Species profile for Encinitas baccharis*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q264
USFWS. (2015dx). *Species profile for Hidden Lake bluecurls*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q237
USFWS. (2015dy). *Species profile for Howell's spineflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q270
USFWS. (2015dz). *Species profile for Kenwood Marsh checker-mallow*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1OU
USFWS. (2015e). *Amargosa vole recovery plan action status*. Retrieved from http://ecos.fws.gov/roar/pub/planImplementationStatus.action?documentId=400200&entityId=28
USFWS. (2015ea). *Species profile for Kern mallow*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2TD
USFWS. (2015eb). *Species profile for Marcescent dudleya*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0OC
USFWS. (2015ec). *Species profile for Menzies' wallflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q29W

USFWS. (2015ed). *Species profile for Monterey gilia*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2AJ
USFWS. (2015ee). *Species profile for Monterey spineflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q271
USFWS. (2015ef). *Species profile for Napa bluegrass*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1ID
USFWS. (2015eg). *Species profile for Orcutt's spineflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0EY
USFWS. (2015eh). *Species profile for palmate-bracted bird's beak.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1UT
USFWS. (2015ei). *Species profile for Pitkin Marsh lily*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q141
USFWS. (2015ej). *Species profile for robust spineflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q3O7
USFWS. (2015ek). *Species profile for San Bernardino bluegrass.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1I9
USFWS. (2015el). *Species profile for San Joaquin wooly-threads*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q34W
USFWS. (2015em). *Species profile for Santa Cruz cypress*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=R005
USFWS. (2015en). *Species profile for Santa Monica Mountains dudleya*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q3AK
USFWS. (2015eo). *Species profile for Sebastopol meadowfoam*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1Y1
USFWS. (2015ep). *Species profile for showy Indian clover*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q238
USFWS. (2015eq). *Species profile for Sonoma alopecurus*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q01F
USFWS. (2015er). *Species profile for Sonoma spineflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1UF
USFWS. (2015es). *Species profile for Sonoma sunshine*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1TO
USFWS. (2015et). *Southern Mountain wild-buckwheat (Eriogonum kennedyi var. austromontanum) 5-year review.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4605.pdf
USFWS. (2015eu). *Species profile for Southern Mountain wild-buckwheat*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0S7
USFWS. (2015ev). *Designation of critical habitat for Diplacus vandenbergensis (Vandenberg monkeyflower).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2015-08-11/pdf/2015-19352.pdf
USFWS. (2015ew). *Species profile for Verity's dudleya.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2OM
USFWS. (2015ex). *Draft recovery plan for Clarkia imbricata (Vine Hill clarkia).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/Draft%20Recovery%20Plan%20for%20Vine%20Hill%20Clarkia_7-23-15.pdf

USFWS. (2015ey). *Species profile for Vine Hill clarkia*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0FO
USFWS. (2015ez). *Species profile for water howellia (Howellia aquatilis)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2RM#crithab
USFWS. (2015f). *Species profile for giant kangaroo rat*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A08P
USFWS. (2015fa). *Species profile for Webber ivesia*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q34J
USFWS. (2015fb). *Species profile for white sedge*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0BL
USFWS. (2015fc). *Species profile for yellow larkspur*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0M2
USFWS. (2015fd, February 27). *Recovery Plan for Four Subspecies of Island Fox (Urocyon littoralis)*. Retrieved from https://www.fws.gov/ventura/docs/recplans/Recovery%20Plan%20for%20Four%20Subspecies%20of%20Island%20Fox_2-27-15%20final.pdf
USFWS. (2015fe). *Species profile for Green Sturgeon*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E09K
USFWS. (2015ff). *Species profile for California tiger salamander*. Retrieved from http://www.fws.gov/sacramento/es_species/Accounts/Amphibians-Reptiles/es_ca-tiger-salamander.htm
USFWS. (2015g). *Fact sheet for the gray wolf.* Retrieved from http://www.fws.gov/wafwo/species/Fact%20sheets/Gray%20wolf%20final.pdf
USFWS. (2015h). *Species profile for gray wolf.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A00D#crithab
USFWS. (2015i). *Species profile for Point Arena mountain beaver*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A0BJ
USFWS. (2015j). *Species profile for riparian brush rabbit*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A0DN
USFWS. (2015k). *Species profile for riparian woodrat.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A0FC
USFWS. (2015l). *Species profile for salt marsh harvest mouse.* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A03Y
USFWS. (2015m). *Species profile for San Joaquin Kit fox.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A006
USFWS. (2015n). *Recovery plan and initiation of status review for four subspecies of Island fox (Urocyon littoralis).* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2015-03-09/pdf/2015-05029.pdf
USFWS. (2015o). *Species profile for Santa Catalina Island fox.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A08K
USFWS. (2015p). *Species profile for Sierra Nevada bighorn sheep*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0DS#crithab
USFWS. (2015q). *Species profile for Stephens kangaroo rat*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A08Q#crithab
USFWS. (2015r). *Species profile for marbled murrelet (Brachyramphus marmoratus)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B08C

USFWS. (2015r). *Species profile for Tipton kangaroo rat*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A08S#crithab
USFWS. (2015s). *Species profile for blue whale*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=A02M
USFWS. (2015t). *Species profile for finback whale*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=A02O
USFWS. (2015u). *Species profile for Guadalupe fur seal*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0A8#crithab
USFWS. (2015v). *Species profile for humpback whale (Megaptera novaeangliae)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A02Q
USFWS. (2015w). *Species profile for sei whale*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A02S#crithab
USFWS. (2015x). *Southern sea otter 5-year review*. Retrieved from https://ecos.fws.gov/docs/five_year_review/doc4627.pdf
USFWS. (2015y). *Species profile for southern sea otter*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0A7#crithab
USFWS. (2015z). *Species profile for sperm whale*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A02T
USFWS. (2016a, April 25). *Listed species believed to or known to occur in California*. Retrieved April 25, 2016, from http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=CA&status=listed
USFWS. (2016aa). *Species profile for Indian Knob mountain balm*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1W5
USFWS. (2016ab). *Species profile for Ione buckwheat*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0QW
USFWS. (2016ac). *Species profile for Ione manzanita*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q03G
USFWS. (2016ad). *Species profile for island barberry*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q08H
USFWS. (2016ae). *Species profile for island bedstraw*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0VF
USFWS. (2016af). *Species profile for island malacothrix*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q3EK
USFWS. (2016ag). *Species profile for island phacelia*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1FV
USFWS. (2016ah). *Species profile for island rush-rose*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0YA
USFWS. (2016ai). *Species profile for Keck's checker-mallow*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1OS
USFWS. (2016aj). *Species profile for Kneeland Prairie penny-cress*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2KF
USFWS. (2016ak). *Species profile for Laguna Beach liveforever*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0OH
USFWS. (2016al). *Species profile for Lake County stonecrop*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1C2

USFWS. (2016am). *Species profile for Lane Mountain milk-vetch*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q064
USFWS. (2016an). *Species profile for large-flowered fiddleneck (Amsinckia grandiflora)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1SU
USFWS. (2016ao). *Species profile for Layne's butterweed*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1O2
USFWS. (2016ap). *Species profile for Loch Lomond coyote thistle*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q29S
USFWS. (2016aq). *Species profile for many-flowered navarretia*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q19B
USFWS. (2016ar). *Species profile for Marin dwarf-flax*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1X6
USFWS. (2016as). *Species profile for Mariposa pussypaws*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q0AS
USFWS. (2016at). *Species fact sheet marsh sandwort*. Retrieved from http://www.fws.gov/wafwo/species/Fact%20sheets/MarshSandwort_factsheet.pdf
USFWS. (2016au). *Species profile for marsh sandwort*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q25H
USFWS. (2016av). *Species profile for Metcalf Canyon jewelflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q222
USFWS. (2016aw). *Species profile for Mexican flannelbush*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2OZ
USFWS. (2016ax, April 24). *ECOS Environmental Conservation Online System Candidate Species*. Retrieved April 24, 2016, from http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=CA&status=candidate
USFWS. (2016ay). *Species profile for Nevin's barberry*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q08G
USFWS. (2016az). *Species profile for Nipomo mesa lupine*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q161
USFWS. (2016b, April 25). *Candidate species believed to or known to occur in California*. Retrieved April 25, 2016, from http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=CA&status=candidate
USFWS. (2016ba). *Species profile for Otay mesa-mint*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2GS
USFWS. (2016bb). *Species profile for Otay tarplant*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0YQ
USFWS. (2016bc). *Species profile for Pallid manzanita*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q03I
USFWS. (2016bd). *Species profile for Parish's daisy*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q29D
USFWS. (2016be). *Species profile for Pedate checker-mallow*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2IS
USFWS. (2016bf). *Species profile for Peirson's milk-vetch*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2ND
USFWS. (2016bg). *Species profile for Pennell's bird's-beak*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2O8

USFWS. (2016bh). *Species profile for Pine Hill flannelbush*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0V1
USFWS. (2016bi). *Species profile for Pismo clarkia*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1UJ
USFWS. (2016bj). *Species profile for Presidio clarkia*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1UI
USFWS. (2016bk). *Species profile for Presidio manzanita*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1T0
USFWS. (2016bl). *Species profile for purple amole*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0ET
USFWS. (2016bm). *Species profile for Red Hills vervain*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2LO
USFWS. (2016bn). *Species profile for salt marsh bird's-beak*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1US
USFWS. (2016bo). *Species profile for San Benito evening-primrose*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q26O
USFWS. (2016bp). *Species profile for San Bernardino Mountains bladderpod*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2CD
USFWS. (2016bq). *Species profile for San Clemente Island bush-mallow*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1YR
USFWS. (2016br). *Species profile for San Clemente Island indian paintbrush*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1U2
USFWS. (2016bs). *Species profile for San Clemente Island larkspur*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1VC
USFWS. (2016bt). *Species profile for San Clemente Island lotus*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1YO
USFWS. (2016bu). *Species profile for San Clemente Island woodland-star*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q14U
USFWS. (2016bv). *Species profile for San Diego button-celery*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1W9
USFWS. (2016bw). *Species profile for San Diego mesa-mint.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q20P
USFWS. (2016bx). *Species profile for San Fernando Valley spineflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0EZ
USFWS. (2016by). *Species profile for Pine Hill ceanothus*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0DK
USFWS. (2016bz). *Species profile for San Francisco lessingia.* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q3AI
USFWS. (2016c). *Removing the San Miguel island fox, Santa Rosa island fox, and Santa Cruz island fox from the federal list of endangered and threatened wildlife, and reclassifying the Santa Catalina island fox from endangered to threatened.* Retrieved from https://www.gpo.gov/fdsys/pkg/FR-2016-02-16/pdf/2016-02669.pdf
USFWS. (2016ca). *Species profile for San Joaquin Adobe sunburst*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1K3
USFWS. (2016cb). *Species profile for San Mateo thornmint*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q24H

USFWS. (2016cc). *Species profile for San Mateo woolly sunflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2TK
USFWS. (2016cd). *Species profile for Santa Ana River woolly-star*. Retrieved from Santa Ana River Woolly-star (Eriastrum densifolium ssp. sanctorum)
USFWS. (2016ce). *Species profile for Santa Barbara Island liveforever*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1VT
USFWS. (2016cf). *Species profile for Santa Clara Valley dudleya*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q32V
USFWS. (2016cg). *Species profile for Santa Cruz Island dudleya*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0OF
USFWS. (2016ch). *Species profile for Santa Cruz Island fringepod*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2KH
USFWS. (2016ci). *Species profile for Santa Cruz Island malacothrix*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q35Q
USFWS. (2016cj). *Species profile for Santa Cruz Island rockcress*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1OF
USFWS. (2016ck). *Species profile for Santa Cruz tarplant*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0ZL
USFWS. (2016cl). *Species profile for Santa Rosa Island manzanita*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q037
USFWS. (2016cm). *Species Profile for Slender Orcutt Grass*. Retrieved January 2016 , from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1AZ
USFWS. (2016cn). *Species profile for slender-horned spineflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2T6
USFWS. (2016co). *Species profile for slender-petaled mustard*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2KB
USFWS. (2016cp). *Species profile for soft-leaved paintbrush*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0D1
USFWS. (2016cq). *Species profile for Springville clarkia*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2O6
USFWS. (2016cr). *Species profile for Stebbins' morning-glory*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0AU
USFWS. (2016cs). *Species profile for Tiburon mariposa lily*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1TU
USFWS. (2016ct). *Species profile for Tiburon paintbrush*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q26R
USFWS. (2016cu). *Species profile for triple-ribbed milk-vetch*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2ZO
USFWS. (2016cv). *Species profile for Vail Lake ceanothus*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q3AH
USFWS. (2016cw). *Species profile for Vandenberg monkeyflower*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q3NC
USFWS. (2016cx). *Species profile for Ventura marsh milk-vetch*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q076
USFWS. (2016cy, June 17). *National Wildlife Refuge System*. Retrieved July 2, 2016, from https://www.fws.gov/refuges/refugeLocatorMaps/California.html

USFWS. (2016cz). *Species profile for white-rayed pentachaeta*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2F3
USFWS. (2016d). *Species profile for San Miguel Island fox*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A08I
USFWS. (2016da). *Species profile for willowy monardella*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q18M
USFWS. (2016db). *Species profile for Yreka phlox*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1GG
USFWS. (2016dc). *Farallon*. Retrieved from https://www.fws.gov/refuge/farallon/multimedia/refuge_gallery.html
USFWS. (2016dd, April 24). *ECOS Environmental Conservation Online System Candidate Species*. Retrieved April 24, 2016, from http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=CA&status=candidate
USFWS. (2016de). *Trust resources report (California).* Retrieved from http://ecos.fws.gov/ipac/project/NTZOO3RHA5G3RJXHVR4LONI76E/resources
USFWS. (2016df). *Species profile for Morro manzanita*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q259
USFWS. (2016dg). *Western Lilly (Lilium occidentale) ECOS Species Profile.* Retrieved June 22, 2016, from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1Y0
USFWS. (2016dh). *ECOS species profile for Arroyo toad.* Retrieved June 22, 2016, from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=D020
USFWS. (2016di). *Species profile for Santa Cruz Island bush-mallow*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q16R
USFWS. (2016dj). *Species profile for California orcutt grass*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1ZO
USFWS. (2016dk). *Species profile for Eureka dune grass*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q225
USFWS. (2016dl). *Species Profile for Coho salmon (Oncorhynchus (=salmo) kisutch).* Retrieved August 10, 2016, from http://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=E08A
USFWS. (2016dm). *California Tiger Salamander*. Retrieved August 30, 2016, from Sacramento Fish and Wildlife Office: https://www.fws.gov/sacramento/es_species/Accounts/Amphibians-Reptiles/es_ca-tiger-salamander.htm
USFWS. (2016dn, May 4). *San Francisco Garter snake Fact sheet*. Retrieved June 20, 2016, from https://www.fws.gov/sacramento/es_kids/sf-garter-snake/es_kids_sf-garter-snake.htm
USFWS. (2016do). *Refuge List by State*. Retrieved from https://www.fws.gov/refuges/profiles/ByState.cfm?state=CA
USFWS. (2016dp). *Trust resources report (California).* Retrieved from http://ecos.fws.gov/ipac/project/NTZOO3RHA5G3RJXHVR4LONI76E/resources
USFWS. (2016dq, May 4). *California Red-Legged Frog*. Retrieved June 22, 2016, from Sacramento Fish & Wildlife Office: https://www.fws.gov/sacramento/es_species/Accounts/Amphibians-Reptiles/es_ca-red-legged-frog.htm

USFWS. (2016dr). *ECOS species profile for Mountain Yellow-Legged frog (Rana muscosa).* Retrieved June 22, 2016, from mountain yellow-legged frog 5-year review summary evaluation: https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D02H

USFWS. (2016e). *Species profile for Santa Cruz Island fox*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A08L

USFWS. (2016f). *Species profile for Santa Rosa Island fox*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A08M

USFWS. (2016g). *Species profile for California red-legged frog*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=D02D

USFWS. (2016h, May). *California tiger salamander central California DPS 5-year review.* Retrieved June 20, 2016, from http://www.fws.gov/sacramento/es_species/Accounts/Amphibians-Reptiles/es_ca-tiger-salamander.htm

USFWS. (2016i). *Species profile for California seablite*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q3AF

USFWS. (2016j). *Species profile for Catalina Island mountain-mahogany*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0DQ

USFWS. (2016k). *Species profile for Chorro Creek bog thistle*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1UG

USFWS. (2016l). *Species profile for coyote ceanothus*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1U3

USFWS. (2016m). *Species profile for Cushenbury buckwheat*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1W8

USFWS. (2016n). *Species profile for Cushenbury milk-vetch*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2Z7

USFWS. (2016o). *Species profile for Cushenbury oxytheca*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q36L

USFWS. (2016p). *California Fairy Shrimp.* Retrieved June 15, 2016, from USFWS: https://www.fws.gov/sacramento/es/Recovery-Planning/Vernal-Pool/Documents/CA_fairy_shrimp.pdf

USFWS. (2016p). *Species profile for El Dorado bedstraw*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0VG

USFWS. (2016q). *Owens Tui Chub (Gila bicolor ssp.) ECOS Species Profile - California Counties*. Retrieved from http://ecos.fws.gov/tess_public/profile/countiesByState?entityId=225&state=California

USFWS. (2016r). *Species profile for Eureka Valley evening-primrose*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1ZM

USFWS. (2016s). *Species profile for few-flowered navarretia*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q19A

USFWS. (2016t). *Species profile for Fish Slough milk-vetch*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q25Z

USFWS. (2016u). *Species profile for fountain thistle*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q1UH

USFWS. (2016v). *Species profile for Gambel's watercress*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q38L

USFWS. (2016w). *Species Profile for Greene's Tuctoria (Tuctoria greenei)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q23K
USFWS. (2016x). *Species profile for Hoffmann's rock-cress*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q02U
USFWS. (2016y). *Species profile for Hoffmann's slender-flowered gilia.* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0WC
USFWS. (2016z). *Species profile for Hoover's spurge*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q0E9
USGCRP. (2009). *Global Climate Change Impacts in the United States.* New York: Cambridge University Press.
USGCRP. (2014a). *National Climate Assessment: Southwest*. Retrieved from U.S. Global Change Research Program: http://nca2014.globalchange.gov/report/regions/southwest
USGCRP. (2014b). *U.S. Global Change Research Program: Precipitation Change*. Retrieved from National Climate Assessment: http://nca2014.globalchange.gov/report/our-changing-climate/precipitation-change
USGCRP. (2014c). *National Climate Assessment: Changes in Storms*. Retrieved July September, 2015, from U.S. Global Change Research Program: http://nca2014.globalchange.gov/report/our-changing-climate/changes-storms
USGCRP. (2014d). *National Climate Assessment: Coastal Zone Development and Ecosystems*. Retrieved from U.S. Global Change Research Program: http://nca2014.globalchange.gov/report/regions/coasts#narrative-page-16832
USGCRP. (2014e). *National Climate Assessment - Extreme Weather.* Retrieved October 6, 2015, from http://nca2014.globalchange.gov/report/our-changing-climate/extreme-weather#intro-section-2
USGCRP. (2014f). *National Climate Assessment - Northwest Region*. Retrieved November 12, 2015, from http://nca2014.globalchange.gov/report/regions/northwest#intro-section-2
USGCRP. (2014g). *2014 National Assessement - Water Resources*. Retrieved October 10, 2015, from http://nca2014.globalchange.gov/report/sectors/water
USGS. (1964). *Physiographic divisions of the conterminous U.S.* Retrieved from http://water.usgs.gov/GIS/metadata/usgswrd/XML/physio.xml
USGS. (1999). *How Ground Water Occurs*. Retrieved February 12, 2013, from U.S. Geological Survey General Interest Publication: http://pubs.usgs.gov/gip/gw/how_a.html
USGS. (2000a). *Land Subsidence in the United States (Fact Sheet 165-00).* Retrieved September 2013, from http://water.usgs.gov/ogw/pubs/fs00165/SubsidenceFS.v7.PDF
USGS. (2000b). *Estimated Use of Water in the US in 2000*. Retrieved December 9, 2015, from http://pubs.usgs.gov/circ/2004/circ1268/htdocs/text-conversion.html
USGS. (2003). *National Landslide Hazards Mitigation Strategy – A Framework for Loss Reduction*. Retrieved September 2013, from http://pubs.usgs.gov/circ/c1244/c1244.pdf
USGS. (2004). *General Geologic History.* Retrieved December 2015, from http://pubs.usgs.gov/of/2004/1007/geologic.html
USGS. (2005). *Elevations and Distances in the United States*. Retrieved August 9, 2016, from http://egsc.usgs.gov/isb//pubs/booklets/elvadist/elvadist.html
USGS. (2007). *Petroleum Systems of the San Joaquin Basin Province, California -- geochemical characteristics of oil types: chapter 9.* Reston: U.S. Geological Survey. Retrieved December 2015, from http://pubs.er.usgs.gov/publication/pp17139

USGS. (2009, October 2). *Science in your Backyard: California*. Retrieved December 8, 2015, from https://www2.usgs.gov/state/state.asp?State=CA
USGS. (2010). *What is "Peak Acceleration" or "Peak Ground Acceleration" (PGA)?* Retrieved April 2015, from http://geohazards.usgs.gov/deaggint/2002/documentation/parm.php
USGS. (2011, August). *Gap Analysis Program (GAP).* Retrieved from National Land Cover, Version 2: http://gapanalysis.usgs.gov/gaplandcover/data/
USGS. (2012a). *Death Valley geology field trip*. Retrieved December 2015, from http://geomaps.wr.usgs.gov/parks/deva/ftbad2.html
USGS. (2012b). *Earthquake Glossary - Earthquake.* Retrieved July 2015, from http://earthquake.usgs.gov/learn/glossary/?term=earthquake
USGS. (2012c, December). *The USGS Land Cover Institute*. Retrieved August 2015, from http://landcover.usgs.gov/classes.php/
USGS. (2012d, November). *Gap Analysis Program (GAP).* Retrieved from Protected Areas Database of the United States (PADUS), version 1.3 Fee: http://gapanalysis.usgs.gov/padus/
USGS. (2013a). *Land Subsidence from Ground-water Pumping*. Retrieved September 2013, from http://geochange.er.usgs.gov/sw/changes/anthropogenic/subside/
USGS. (2013b). *Glossary of Glacier Terminology.* Retrieved August 2015, from http://pubs.usgs.gov/of/2004/1216/text.html#tz
USGS. (2014a). *Geologic Provinces of the United States: Basin and Range Province*. Retrieved October 2015, from http://geomaps.wr.usgs.gov/parks/province/basinrange.html
USGS. (2014b). *Earthquake Facts.* Retrieved December 2015, from http://earthquake.usgs.gov/learn/facts.php
USGS. (2014c). *Understanding Plate Motions.* Retrieved December 2015, from http://pubs.usgs.gov/gip/dynamic/understanding.html
USGS. (2014d). *Historic Earthquakes California*. Retrieved December 2014, from http://earthquake.usgs.gov/earthquakes/states/events/1857_01_09.php
USGS. (2014e). *Measuring the Size of an Earthquake.* Retrieved July 2015, from http://earthquake.usgs.gov/learn/topics/measure.php
USGS. (2014f). *Landslide Overview Map of the Conterminous United States.* Retrieved June 2015, from http://landslides.usgs.gov/hazards/nationalmap/
USGS. (2014g, November). *Water Resources of the United States*. Retrieved July 2015, from http://www.usgs.gov/water/
USGS. (2014h). *National Atlas of the United States*. Retrieved Septmeber 2015, from http://nationalmap.gov/small_scale/printable/fedlands.html
USGS. (2014i, October 2). *Pacific Province*. Retrieved December 8, 2015, from http://geomaps.wr.usgs.gov/parks/province/pacifmt.html
USGS. (2014j, Ocober 2). *Geological Provinces of the United States: Pacific: Pacific-Cascades Volcanic Province*. Retrieved December 8, 2015, from http://geomaps.wr.usgs.gov/parks/province/cascade1.html
USGS. (2015a). *Structural Geology*. Retrieved July 2015, from http://www.usgs.gov/science/science.php?thcode=2&code=1117
USGS. (2015b). *Water Science Glossary of Terms.* Retrieved June 2015, from http://water.usgs.gov/edu/dictionary.html#B
USGS. (2015c). *Paleontology.* Retrieved July 2015, from http://www.usgs.gov/science/science.php?term=861

USGS. (2015d, December 15). *Geologic Glossary*. Retrieved December 15, 2015, from http://geomaps.wr.usgs.gov/parks/misc/glossarya.html

USGS. (2015e, April 14). *Aquifer Basics: Sand and Gravel Aquifers of Alluvial and Glacial Origin*. Retrieved July 2015, from http://water.usgs.gov/ogw/aquiferbasics/sandgravel.html

USGS. (2015f, February 19). *Deaths from U.S. Earthquakes: 1811-2014*. Retrieved December 22, 2015, from http://earthquake.usgs.gov/earthquakes/states/us_deaths.php

USGS. (2016a). *Mineral Commodity Summaries.* Reston: USGS. Retrieved from http://minerals.usgs.gov/minerals/pubs/mcs/

USGS. (2016b). *Earthquake Facts and Earthquake Fantasy*. Retrieved from http://earthquake.usgs.gov/learn/topics/megaqk_facts_fantasy.php

USGS. (2016c). *Tectonic Processes*. Retrieved from http://www.usgs.gov/science/science.php?code=1145&thcode=2

USGS. (2016d, February 10). *Explanations for the National Water Conditions*. Retrieved from Water Resources of the United States: http://water.usgs.gov/nwc/explain_data.html

UVA Weldon Cooper Center. (2015). *University of Virginia Weldon Cooper Center for Public Service, National Population Projections, 2020-2040.* Projections for the 50 States and D.C., one-click download of all files, file USProjections_2020to2040_all_data_udpated_noshapefile.zip. Retrieved March 2015, from http://www.coopercenter.org/demographics/national-population-projections

Ventura County APCD. (1995, May 9). REGULATION XI - Rule 222 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/VEN/CURHTML/R220.PDF

Ventura County APCD. (2004, April 13). Regulation II, Rule 10 - Permits Required. Retrieved December 30, 2015, from http://www.vcapcd.org/Rulebook/Reg2/RULE%2010.pdf

Ventura County APCD. (2006, November 14). Regulation II - Rule 26.1 - New Source Review - Definitions. Retrieved June 17, 2016, from http://www.arb.ca.gov/drdb/ven/curhtml/r26-1.pdf

Ventura County APCD. (2008, June 10). REGULATION IV - Rule 55 - Fugitive Dust. Retrieved June 17, 2016, from http://www.arb.ca.gov/drdb/ven/curhtml/r55.pdf

Ventura County APCD. (2011, April 12). Regulation II - Rule 33 - Part 70 Permits. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/VEN/CURHTML/R33.PDF

Ventura County APCD. (2013, November 12). Regulation II, Rule 23 - Exemptions from Permit. Retrieved December 30, 2015, from http://www.vcapcd.org/Rulebook/Reg2/RULE%2023.pdf

Vereecken, W., Van Heddeghem, W., Deruyck, M., Puype, B., Lannoo, B., & Joseph, W. (2011, July). Power Consumption in Telecommunications Networks: Overview and Reduction Strategies. *IEEE Communications Magazine*, pp. 62-69. Retrieved Septembe 22, 2015, from http://www.researchgate.net/publication/228774201

Visit California. (2015a). *Discover the North Coast*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-north-coast

Visit California. (2015b). *Discover Shasta Cascade*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-shasta-cascade

Visit California. (2015c). *Discover Gold Country*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-gold-country

Visit California. (2015d). *Discover the San Francisco Bay Area*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-san-francisco-bay-area
Visit California. (2015e). *Discover the Central Valley*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-central-valley
Visit California. (2015f). *Discover the High Sierra*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-high-sierra
Visit California. (2015g). *Discover the Central Coast*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-central-coast
Visit California. (2015h). *Discover Los Angeles County*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-los-angeles-county
Visit California. (2015i). *Orange County*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-orange-county
Visit California. (2015j). *Discover the Deserts*. Retrieved December 2015, from http://www.visitcalifornia.com/region/discover-deserts
VTA. (2012, November 14). *Light Rail System Overview*. Retrieved December 9, 2015, from http://www.vta.org/sfc/servlet.shepherd/document/download/069A0000001FvwxIAC
Wagner, W. L., & Hoch, P. C. (2016). *Camissonia benitensis.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=16897
Walden, G. K., Patterson, R., Garrison, L. M., & Hansen, D. R. (2016). Phacelia insularis var. insularis, revision 1. *Jepson eFlora*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=63439
Wallace, W. J. (1955). A suggested chronology for southern California archaeology. *Southwestern Journal of Anthropology*, 214-230.
Wetherwax, M., Chuang, T., & Heckard, L. (2014). *Castilleja grisea*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=18212
Wetherwax, M., Chuang, T., & Heckard, L. R. (2016). Castilleja mollis. *Castilleja mollis*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=18257
Wilderness.net. (2016). *California*. Retrieved from http://www.wilderness.net/NWPS/stateViewStatic?state=ca&map=canorth
Williams, D.F. (1986). *Mammalian species of special concern in California.* Retrieved from https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83760&inline
Williams, M. P. (2016). *Berberis pinnata subsp. insularis.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=49426
Windham, M., & Al-Shehbaz, I. A. (2014). Boechera hoffmannii. *Boechera hoffmannii*. Retrieved from http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=91728
Wojciechowski, M., & Spellenberg, R. (2016a). *Astragalus lentiginosus var. coachellae.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=54786
Wojciechowski, M., & Spellenberg, R. (2016b). Astragalus lentiginosus var. piscinensis. *Jepson eFlora*. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=54809
Wojciechowski, M., & Spellenberg, R. (2016c). *Astragalus jaegerianus.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=14876
Wojciechowski, M., & Spellenberg, R. (2016d). *Astragalus magdalenae var. peirsonii.* Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=54832
Wojciechowski, M., & Spellenberg, R. (2016e). Astragalus tricarinatus. Retrieved from http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=15098

Wojciechowski, M., & Spellenberg, R. (2016f). Astragalus pycnostachyus var. lanosissimus. *Jepson eFlora*. Retrieved from http://herbaria4.herb.berkeley.edu/eflora_display.php?tid=54916

World Wildlife Fund. (2015). *What is an Ecoregion?* Retrieved July 1, 2015, from http://wwf.panda.org/about_our_earth/ecoregions/about/what_is_an_ecoregion/

Yolo-Solano AQMD. (1994a, February 23). Regulation II - Rule 3.1 - General Permit Requirements. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/YS/CURHTML/R3-1.HTM

Yolo-Solano AQMD. (1994b, June 22). Regulation III, Rule 3.2 - Exemptions. Retrieved December 30, 2015, from http://www.arb.ca.gov/DRDB/YS/CURHTML/R3-2.HTM

Yolo-Solano AQMD. (1995, February 8). Regulation X - Rule 10.3 - General Conformity. Retrieved June 17, 2016, from http://www.arb.ca.gov/DRDB/YS/CURHTML/R10-3.HTM

Yolo-Solano AQMD. (2015, February 11). Regulation III, Regulation 3.8 - Federal Operating Permits. Retrieved December 30, 2015, from http://www.arb.ca.gov/DRDB/YS/CURHTML/R3-8.pdf

GIS REFERENCES

BIA. (2003, December). Cultural Resources: Approximate Historic Boundaries of Tribes. (GIS Metadata) Retrieved August 2015, from http://sagemap.wr.usgs.gov/ftp/regional/ind3.html and http://www.arcgis.com/home/item.html?id=2e915ef3df48422283e5b2c7d89dfcba

BLS. (2015). Socioeconomics: Unemployment. (GIS Metadata) Retrieved August 2015, from Local Area Unemployment Statistics, Employment status of the civilian noninstitutional population, 1976 to 2014 annual averages. State Data, Annual Average Series, Employment status of the civilian noninstitutional population, annual averages: http://www.bls.gov/lau/rdscnp16.htm

CADWR. (2001). Water Resources: Surface Water / Watersheds. (GIS Metadata) Retrieved March 2015, from California Department of Water Resources: http://www.water.ca.gov/waterplan/gis/index.cfm

Digital Aeronautical Flight Information File. (2015, June). Land Use, Recreation, and Airspace: MTR Airspace. (GIS Metadata) Retrieved June 2015, from National Geospatial-Intelligence Agency: https://pki.geo.nga.mil/servlet/ShowHomepage?menu=Products and Services

Digital Aeronautical Flight Information File. (2015, June). Land Use, Recreation, and Airspace: SUA Airspace. (GIS Metadata) Retrieved June 2015, from National Geospatial-Intelligence Agency: https://pki.geo.nga.mil/servlet/ShowHomepage?menu=Products and Services

Environmental Systems Research Institute (ESRI). (2016). All Maps. (GIS Metadata) Retrieved August 2015, from http://www.arcgis.com/home/group.html?owner=esri&title=ESRI%20Data%20%26%20Maps&content=all&_ga=1.174384612.712313298.1421186728&q=rivers&t=group&start=1

FAA. (2015, June). Infrastructure: Transportation. (GIS Metadata) Retrieved June 2015, from Airport hubs data. Data is updated every 8 weeks. Data downloaded by state: http://www.faa.gov/airports/airport_safety/airportdata_5010/

FAA. (2015, June). Land Use, Recreation, and Airspace: Composite Airspace. (GIS Metadata) Retrieved June 2015, from Data is updated every 8 weeks: http://www.faa.gov/airports/airport_safety/airportdata_5010/

FAA. (2015, June). Land Use, Recreation, and Airspace: Private Airspace. (GIS Metadata) Retrieved June 2015, from Data is updated every 8 weeks. : http://www.faa.gov/airports/airport_safety/airportdata_5010/

FAA. (2015, June). Land Use, Recreation, and Airspace: Public Airspace. (GIS Metadata) Retrieved June 2015, from Data is updated every 8 weeks: http://www.faa.gov/airports/airport_safety/airportdata_5010/

FCC. (2014, June). Infrastructure: FCC Towers. (GIS Metadata) Retrieved August 2015, from Data was obtained through a more advanced search by BAH being in direct touch with Cavell, Mertz &

Associates to obtain ALL the relevant data across the country: http://wireless2.fcc.gov/UlsApp/AsrSearch/asrAdvancedSearch.jsp

FCC. (2014, June). Infrastructure: FCC Wireless. (GIS Metadata) Retrieved August 2015, from David F. LaBranche, P.E. Geospatial Information Officer (GIO) OASD (EI&E) 571-372-6768 at Defense Installations Spatial Data Infrastructure (DISDI): http://www.broadbandmap.gov/data-download

FCC. (2015). Infrastructure: FCC Fiber. (GIS Metadata) Retrieved August 2015, from http://www.broadbandmap.gov/data-download

FHWA. (2015, September 14). Infrastructure: Transportation. (GIS Metadata) Retrieved September 14, 2015, from Byways and National Scenic Trails; Gary A. Jensen; Research Implementation Team Leader; FHWA; 1200 New Jersey Ave, SE Room E76-304: http://www.fhwa.dot.gov/byways/ https://www.nps.gov/ncrc/programs/nts/nts_trails.html

FHWA. (2015, August). Visual Resources: Natural Areas. (GIS Metadata) Retrieved August 2015, from National Scenic Byways Program. Data obtained by Gary A. Jensen, Research Implementation Team Leader, Office of Human Environment HEPH-30, Federal Highway Administration, 1200 New Jersey Avenue, SE Room E76-304, Washington, DC 20590, 202-366-2048, gary.je: http://www.fhwa.dot.gov/byways/

National Atlas and Interagency Wild and Scenic Rivers Coordinating Council. (2009). Visual Resources: Natural Areas. (GIS Metadata) Retrieved September 2015, from NPS: https://www.rivers.gov/mapping-gis.php

National Audubon Society. (2015). Biological Resources: Important Bird Areas. (GIS Metadata) Retrieved September 2015, from Web service, data is not saved locally: http://gis.audubon.org/arcgisweb/rest/services/NAS/ImportantBirdAreas_Poly/MapServer

National Heritage Areas Program Office. (2011). Visual Resources: Representative Sample of Some Historic and Cultural Resources that May be Visually Sensitive. (GIS Metadata) Retrieved August 2015, from Department of Interior, National Parks Service, National Heritage Areas Program Office: https://www.nps.gov/heritageareas/

NERR. (2012). Water Resources: Estuaries and Critical Resource Waters. (GIS Metadata) Retrieved August 2015, from NOAA, Office of Coastal Management, National Estuarine Research Reserve System (NERRS): http://cdmo.baruch.sc.edu/get/gis.cfm

NPS. (2011). Air Quality: Class 1 Areas. (GIS Metadata) Retrieved August 2015, from http://science.nature.nps.gov/im/gis/index.cfm

NPS. (2015). Land Use, Recreation, and Airspace: Recreation. (GIS Metadata) Retrieved September 2015, from United States Park, NPS, Department of Interior: http://www.arcgis.com/home/item.html?id=578968f975774d3fab79fe56c8c90941

NPS. (2015, August). Visual Resources: Cultural Heritage. (GIS Metadata) Retrieved September 2015, from United States Park, NPS, Department of Interior [US Parks]: http://www.arcgis.com/home/item.html?id=578968f975774d3fab79fe56c8c90941

NPS. (2015, August). Visual Resources: Cultural Heritage. (GIS Metadata) Retrieved September 2015, from United States Park, NPS, Department of Interior [National Monuments and Icons]: http://mapservices.nps.gov/arcgis/rest/services/cultural_resources/nhl_public/MapServer

NPS. (2015, August). Visual Resources: Natural Areas. (GIS Metadata) Retrieved September 2015, from United States Park, National Parks Service, Department of Interior [National Scenic and Historic trails]: https://www.nps.gov/ncrc/programs/nts/nts_trails.html

NPS. (2015, August). Visual Resources: Natural Areas. (GIS Metadata) Retrieved September 2015, from United States Park, NPS, Department of Interior [US Parks]: http://www.arcgis.com/home/item.html?id=578968f975774d3fab79fe56c8c90941

NRCS. (2006). Soils: Soil Suborders. (GIS Metadata) Retrieved April 2015, from Downloaded by state-level: https://gdg.sc.egov.usda.gov/

NRHP. (2015). Cultural Resources: National Heritage. (GIS Metadata) Retrieved August 2015, from Stutts M. 2014. NRHP. National Register properties are located throughout the U.S. and their associated territories around the globe: https://irma.nps.gov/DataStore/Reference/Profile/2210280

U.S. Census Bureau. (2015c). Environmental Justice. (GIS Metadata) Retrieved July 2915, from U.S. Environmental Protection Agency. "EJSCREEN Environmental Justice Mapping and Screening Tool: EJSCREEN Technical Documentation.": http://www2.epa.gov/ejscreen/technical-documentation-ejscreen

U.S. Census Bureau. (2015f, April). Socioeconomics: Population Distribution. (GIS Metadata) Retrieved August 2015, from American Community Survey and Puerto Rico Community Survey 2013 Subject Definitions. 2013_ACSSubjectDefinitions: http://www2.census.gov/programs-surveys/acs/tech_docs/subject_definitions/2013_ACSSubjectDefinitions.pdf

U.S. Census Bureau. (2015j). Socioeconomics: Median Household Income. (GIS Metadata) Retrieved August 2015, from American Community Survey, 2009-2013 5-Year Summary File, Table B02001, Race. Obtained via Census Bureau online DataFerrett tool: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. Census Bureau. (Undated(a)). Environmental Justice. (GIS Metadata) Retrieved August 2015, from "2010 Census Urban and Rural Classification and Urban Area Criteria." Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010 urbanized areas and urban clusters for the U.S., Puerto Rico, and Island Areas: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. Census Bureau. (Undated(a)). Socioeconomics: Median Household Income. (GIS Metadata) Retrieved August 2015, from "2010 Census Urban and Rural Classification and Urban Area Criteria." Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010

urbanized areas and urban clusters for the U.S., Puerto Rico, and Island Areas: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. Census Bureau. (Undated(a)). Socioeconomics: Population Distribution. (GIS Metadata) Retrieved August 2015, from "2010 Census Urban and Rural Classification and Urban Area Criteria." Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010 urbanized areas and urban clusters for the U.S. first sorted by state FIPS code, then USACE code: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. Census Bureau. (Undated(a)). Socioeconomics: Unemployment. (GIS Metadata) Retrieved August 2015, from "2010 Census Urban and Rural Classification and Urban Area Criteria." Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010 urbanized areas and urban clusters for the U.S. first sorted by state FIPS code then by USACE code: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. DOT Bureau of Transportation Statistics National Transportation Atlas Database. (2015). Infrastructure: Transportation. (GIS Metadata) Retrieved August 2015, from Railroads, Major Highways data: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_atlas_database/2015/polyline

United States National Atlas. (2014). Land Use, Recreation, and Airspace: Recreation. (GIS Metadata) Retrieved September 2015, from http://nationalmap.gov/small_scale/

United States National Atlas. (2014). Visual Resources: Natural Areas. (GIS Metadata) Retrieved September 2015, from http://nationalmap.gov/small_scale/

USACE. (2015, March 17). Infrastructure: Transportation. (GIS Metadata) Retrieved August 2015, from Port Data. Has since been updated: http://www.navigationdatacenter.us/gis/gis1.htm

USDA-NRCS, USGS, and USEPA. (2015). Water Resources: Surface Water and Watersheds. (GIS Metadata) Retrieved August 2015, from USDA NRCS watershed Boundary Data and Tools: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/watersheds/dataset/

USEPA. (2011). Water Resources: Groundwater. (GIS Metadata) Retrieved August 2015, from https://www.epa.gov/dwssa/map-sole-source-aquifer-locations

USEPA. (2013). Biological Resources: Ecoregions. (GIS Metadata) Retrieved August 2015, from Level III and IV ecoregions of the continental United States. National Health and Environmental Effects Research Laboratory, Corvallis, Oregon, Map scale 1:3,000,000: http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm

USEPA. (2014). Water Resources: Impaired Water. (GIS Metadata) Retrieved August 2015, from https://www.epa.gov/waterdata/waters-geospatial-data-downloads

USEPA. (2015). Human Health and Safety: TRI. (GIS Metadata) Retrieved September 2015, from Web service, data is not saved locally: https://map11.epa.gov/arcgis/rest/services/NEPAssist/NEPAVELayersPublic

USEPA. (2015b, April 21). Air Quality: Nonattainment Areas. (GIS Metadata) Retrieved August 2015, from The Green Book Nonattainment Areas for Criteria Pollutants: https://www3.epa.gov/airquality/greenbook/gis_download.html

USFWS. (2014). Biological Resources: Important Bird Areas. (GIS Metadata) Retrieved September 2015, from https://www.fws.gov/gis/data/national/

USFWS. (2014). Wetlands. (GIS Metadata) Retrieved August 2015, from State level data layer: https://www.fws.gov/wetlands/Data/Data-Download.html

USFWS. (2015, December 4). Land Use, Recreation, and Airspace: Recreation. (GIS Metadata) Retrieved September 2015, from National Wildlife Refuge Boundaries: http://www.arcgis.com/home/item.html?id=7b90f9c5e8044d189a5764758ce3775e

USFWS. (2015, December 14). Visual Resources: Natural Areas. (GIS Metadata) Retrieved September 2015, from USFWS National Wildlife Refuge System, Realty Division: http://www.arcgis.com/home/item.html?id=7b90f9c5e8044d189a5764758ce3775e

USGS. (1999 to 2001). Visual Resources: Land Cover. (GIS Metadata) Retrieved August 2015, from USGS GAP Analysis Land Cover, National Land Cover Dataset; Landsat 7 ETM+; Imagery provided for Spring, Summer and Fall dates between 1999 and 2001: http://gapanalysis.usgs.gov/gaplandcover/data/download/

USGS. (2003, October). Water Resources: Groundwater. (GIS Metadata) Retrieved August 2015, from http://water.usgs.gov/ogw/aquifer/map.html

USGS. (2010). Geology: Surface Geology. (GIS Metadata) Retrieved April 2015, from http://www.arcgis.com/home/item.html?id=2967ae2d1be14a8fbf5888b4ac75a01f

USGS. (2012). Cultural Resources: Physiographic Provinces. (GIS Metadata) Retrieved April 2015, from Physiographic provinces and regions are made from the same dataset; downloaded by state-level: http://services.arcgis.com/ZzrwjTRez6FJiOq4/arcgis/rest/services/US_PhysiographicProvinces/FeatureServer

USGS. (2012). Geology: Landslide Incidence. (GIS Metadata) Retrieved May 2015, from Web service, data is not saved locally: https://www.arcgis.com/home/item.html?id=b3fa4e3c494040b491485dbb7d038c8a

USGS. (2013). Geology: Karst Subsidence. (GIS Metadata) Retrieved May 2015, from Two data layers within the same source show different varieties of Karst, and were published on different dates: http://services.arcgis.com/hoKRg7d6zCP8hwp2/arcgis/rest/services/Appalachian_Karst_Features/FeatureServer

USGS. (2014). Geology: Seismic Hazard. (GIS Metadata) Retrieved April 2015, from http://services.arcgis.com/VTyQ9soqVukalItT/arcgis/rest/services/USPGA_Seismic_Hazard/FeatureServer

USGS, Protected Areas of the United States. (2012, 11 30). Land Use, Recreation, and Airspace: Land Ownership. (GIS Metadata) Retrieved August 2015, from Data was updated in 5/5/2016. Maps were completed in December 2015 prior to this update: http://gapanalysis.usgs.gov/padus/data/download/

USGS, Protected Areas of the United States. (2012, November 30). Land Use, Recreation, and Airspace: Recreation. (GIS Metadata) Retrieved September 2015, from Data was updated in 5/5/2016. Maps were completed in December 2015 prior to this update: http://gapanalysis.usgs.gov/padus/data/download/

USGS, Protected Areas of the United States. (2012, November 30). Visual Resources: Cultural Heritage. (GIS Metadata) Retrieved September 2015, from Data was updated in 5/5/2016. Maps were completed in December 2015 prior to this update: http://gapanalysis.usgs.gov/padus/data/download/

USGS, Protected Areas of the United States. (2012, November 30). Visual Resources: Natural Areas. (GIS Metadata) Retrieved September 2015, from Data was updated in 5/5/2016. Maps were completed in December 2015 prior to this update. : http://gapanalysis.usgs.gov/padus/data/download/

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