

## 4 Affected Environment

This chapter describes the human, physical, and natural environmental conditions that could be affected by the Proposed Action. Specifically, this Environmental Assessment (EA) considers effects on the environmental resource categories identified in Appendix A of Federal Aviation Administration (FAA) Order 1050.1E, Chg. 1, *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1E). The potential environmental impacts of the Proposed Action and No Action Alternatives are discussed in Chapter 5, *Environmental Consequences*.

The technical terms and concepts discussed in this chapter are explained in Chapter 1, *Background*.

### 4.1 General Study Area

To describe Existing Conditions in the Northern California Metroplex, the FAA developed a General Study Area. The General Study Area is used to evaluate the potential for environmental impacts under the Proposed Action. Two overall objectives guided the development of the General Study Area:

1. The General Study Area captures all flight paths identified for the No Action Alternative using 2011 radar data (the latest year of complete data available) and the flight paths designed for the Proposed Action, up to the point at which 95 percent of departing aircraft are at or above 10,000 feet above ground level (AGL) and 95 percent of arriving aircraft are at or above 7,000 feet AGL. As stated in FAA Order 1050.1E, Appendix A, Paragraph 14.5e, the FAA requires consideration of impacts of airspace actions from the surface to 10,000 feet AGL if the study area is larger than the immediate area around an airport or involves more than one airport. Furthermore, policy guidance issued by the FAA Program Director for Air Traffic Airspace Management states that, for air traffic project environmental analyses, noise impacts should be evaluated for proposed changes in arrival procedures between 3,000 and 7,000 feet AGL and departure procedures between 3,000 and 10,000 feet AGL for large civil jet aircraft weighing over 75,000 pounds.<sup>22</sup>
2. The lateral boundary of the General Study Area is based on where aircraft cross U.S. Census tract boundaries at the 10,000/7,000 feet AGL thresholds. This extent is concisely defined to focus on areas of air traffic flow.

**Exhibit 4-1** depicts the General Study Area developed for this EA. **Table 4-1** identifies the counties that fall within or are intersected by the General Study Area boundary. In total, the General Study Area includes 11 entire counties and portions of 12 additional counties.

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<sup>22</sup> Department of Transportation, Federal Aviation Administration, *Memorandum Regarding Altitude Cut-Off for National Airspace Redesign (NAR) Environmental Analyses*, September 15, 2003.

**Table 4-1 Counties in the General Study Area**

Alameda County	Merced County <sup>1</sup>	Sacramento County	Santa Clara County	Sutter County
Colusa County	Monterey County <sup>1</sup>	San Benito County <sup>1</sup>	Santa Cruz County	Yolo County <sup>1</sup>
Contra Costa County	Napa County <sup>1</sup>	San Francisco County	Solano County	Yuba County <sup>1</sup>
El Dorado County <sup>1</sup>	Nevada County <sup>1</sup>	San Joaquin County <sup>1</sup>	Sonoma County <sup>1</sup>	
Marin County	Placer County <sup>1</sup>	San Mateo County	Stanislaus County <sup>1</sup>	

Notes:

1/ Only a portion of the county falls within the General Study Area

Source: National Atlas of the United States of America: U.S. County Boundaries, 2005; ATAC Corporation, August 2012.

Prepared by: ATAC Corporation, April 2013.

## 4.2 Resource Categories or Sub-Categories Not Affected

This section discusses the environmental resource categories or sub-categories that would remain unaffected by the Proposed Action. These resource categories would remain unaffected, either because the resource does not exist within the General Study Area or the types of activities associated with the Proposed Action would not affect them. The resource categories or sub-categories are as follows:

- **Coastal Resources:** The Proposed Action does not involve land acquisition or ground disturbing activities that would affect coastal resources.
- **Construction Impacts:** The Proposed Action does not involve any construction or ground disturbing activities.
- **Farmlands:** The Proposed Action would not involve any land acquisition or ground disturbance that would have the potential to convert existing farmland to a non-agricultural use.
- **Fish, Wildlife and Plants (*Fish and Plants sub-categories only*):** The Proposed Action is generally situated in areas above 3,000 feet AGL and would not involve ground disturbance or other activities that would affect plant or terrestrial animal species.
- **Floodplains:** The Proposed Action would not be located in areas that include floodplains.
- **Hazardous Materials, Pollution Prevention, and Solid Waste:** The Proposed Action would not generate, disturb, transport, or treat hazardous materials or solid waste.
- **Historic, Architectural, Archeological, and Cultural Resources (*Archeological and Architectural sub-categories only*):** The Proposed Action would not involve land acquisition or ground disturbing activities that would affect archaeological or architectural resources.



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- **Light Emissions and Visual Impacts:** The Proposed Action would not involve construction of any structures that would introduce new sources of lighting or result in visual impacts to surrounding areas. The changes to air traffic associated with the Proposed Action would generally occur at altitudes at or above 3,000 feet AGL and in the same general areas in which aircraft currently operate. Accordingly, the distances between aircraft and viewers on the ground would be sufficient to avoid intrusions and new aircraft operations would not be introduced to the viewshed that would constitute an adverse impact.
- **Natural Resources and Energy Supply (*Natural Resources sub-category only*):** The Proposed Action would not require use of unusual natural resources or other materials, or those in short supply.
- **Secondary (Induced) Impacts:** The Proposed Action would not cause changes in patterns of population movement or growth, public service demands, or business and economic activity. In addition, implementation of the Proposed Action would not result in an increase in the number of aircraft operations at the Study Airports. Furthermore, the Proposed Action does not involve construction of airport facilities that would result in or induce an increase in operational capacity or other ground disturbing activities that would involve the relocation of people or businesses.
- **Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks**
  - ***Socioeconomic Impacts sub-category:*** The Proposed Action would not involve acquisition of real estate, relocation of residents or community businesses, disruption of local traffic patterns, loss in community tax base, or changes to the fabric of the community.
  - ***Children's Environmental Health and Safety Risks sub-categories:*** The Proposed Action would not involve products or substances with which a child is likely to be exposed, come into contact, ingest, or use. Furthermore, the Proposed Action would not result in a local increase in emissions that would have the potential to affect children's health. Accordingly, there would be no increase in environmental health and safety risks that could disproportionately affect children.
- **Water Quality:** The Proposed Action does not involve any ground disturbing activities that would result in an increase in impervious surfaces or affect water quality or ground water.
- **Wetlands:** The Proposed Action does not involve land acquisition or ground disturbing activities that would affect wetlands.
- **Wild and Scenic Rivers:** One designated river, the lower branch of the American River, is located within the General Study Area, running approximately 23 miles from Folsom Lake, through the City of Sacramento, to its confluence with the Sacramento River. However, the Proposed Action would not involve ground disturbance or any other activity that would result in any diminishment of the scenic, recreational, or biological value of the river.

### 4.3 Potentially Affected Resource Categories or Sub-Categories

This section provides information on the current conditions within the General Study Area for those environmental resource categories or components that the Proposed Action could potentially affect. These environmental resource categories or sub-categories include:

- **Noise** (Section 4.3.1)
- **Compatible Land Use** (Section 4.3.2)
- **Department of Transportation Act: Section 4(f) Resources** (Section 4.3.3)
- **Historic, Architectural, Archeological, and Cultural Resources – *Historic and Cultural Resources sub-categories only*** (Section 4.3.4)
- **Fish, Wildlife, and Plants – *Wildlife sub-category only*** (Section 4.3.5)
- **Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks – *Environmental Justice sub-category only*** (Section 4.3.6)
- **Natural Resources and Energy Supply- *Energy Supply sub-category only (aircraft fuel only)*** (Section 4.3.7)
- **Air Quality** (Section 4.3.8)
- **Climate** (Section 4.3.9)

The following sections discuss each of the above listed environmental resource categories in detail.

#### 4.3.1 Noise

Aircraft noise is often the most noticeable environmental effect associated with any aviation project. This section discusses FAA guidance on conducting noise analyses, noise model input development, and existing aircraft noise conditions. **Appendix E** provides background information on the physics of sound, the effects of noise on people, and noise metrics. Detailed information on the noise analysis is provided in the *NorCal OAPM Aircraft Noise Technical Report*, available on the OAPM Project website (<http://www.oapmenvironmental.com>).

##### 4.3.1.1 Noise Modeling Methodology

To comply with NEPA requirements, the FAA has issued guidance on the assessment of aircraft noise in FAA Order 1050.1E. This guidance requires that aircraft noise analysis use the yearly Day-Night Average Sound Level (DNL) metric. The DNL metric is a single value representing the aircraft sound level over a 24-hour period and includes all of the sound energy generated within that period. The DNL metric includes a 10 decibel (dB) weighting for noise events occurring between 10:00 P.M. and 6:59 A.M. (i.e., nighttime). This weighting helps account for the greater level of annoyance caused by nighttime noise events when ambient noise levels are lower. Accordingly, the metric essentially equates one nighttime flight to 10 daytime flights. The DNL metric is further discussed in **Appendix E**.

In addition to requiring the use of the DNL metric, FAA Order 1050.1E also requires that aircraft noise be evaluated using one of three noise models: (1) the Integrated Noise Model

(INM), (2) the Heliport Noise Model (HNM), or (3) the Noise Integrated Routing System (NIRS). NIRS is typically used for flight track changes over large areas and at altitudes over 3,000 feet AGL. For this EA, the FAA uses NIRS, Version 7.0b to analyze noise associated with the Proposed Action and No Action Alternative.

To evaluate Existing Conditions, the FAA conducted a detailed analysis of aircraft operating under instrument flight rules (IFR) conditions in 2011. Although the noise environment around major airports comes almost entirely from jet aircraft operations, the DNL calculations reflect noise from many types of jet and propeller aircraft operations on IFR flight plans that could be affected by the Proposed Action. Most aircraft around major airports that operate under IFR conditions obtain direction from air traffic control (ATC) related to separation from surrounding aircraft in these busy areas.

When operating outside certain categories of controlled airspace, aircraft operating under visual flight rules (VFR) conditions are not required to be in contact with ATC. Because these aircraft operate at the discretion of the pilot and are often not required to file flight plans, the FAA has very limited information for these operations. Subsequently, there is no known source for comprehensive route, altitude, aircraft type, and frequency information for VFR operations in the General Study Area. However, even if complete information were available for VFR operations, the Proposed Action evaluated in the EA would not require any changes to routing or altitudes to accommodate these operations. If they could be modeled, they would use the same flight routes and altitudes under the Proposed Action and No Action Alternative scenarios. Their operations would not be affected by the forecast conditions in 2014 (i.e., the first year of implementation) and 2019 (i.e., five years after implementation) for either the Proposed Action or the No Action Alternative. Therefore, VFR aircraft were not included in the analysis.

NIRS requires a variety of inputs, including local environmental data (e.g., temperature and humidity), runway layout, number and type of aircraft operations, runway use, and flight tracks. Accordingly, detailed information on aircraft operations for the Study Airports was assembled for input into NIRS. This includes specific aircraft fleet mix information, including aircraft type, arrival and departure times, and origin/destination airport.

A total of 690,384 IFR-filed flights to/from the Study Airports were identified through an examination of radar data obtained from the FAA's Performance Data Analysis and Reporting System (PDARS). The PDARS database was queried for the 2011 calendar year for all IFR-filed flights that operated at the Study Airports within the General Study Area. During this 365-day period, 15 days of data were unusable due to radar equipment anomalies, operational outages, or extreme weather events that made the data unreliable. The 350 days of usable data span all seasons and runway usage configurations for the Study Airports in the General Study Area. This data was used to develop the average annual day (AAD) fleet mix, time of day (day and night), and runway use input for NIRS. More detailed information related to the NIRS inputs for Existing Conditions is provided in the *NorCal OAPM Aircraft Noise Technical Report*, available on the OAPM Project website (<http://www.oapmenvironmental.com>).

The PDARS data provided tracks for each flight that occurred within the 350 day period of 2011. In addition to defining the AAD track locations that represent a typical flow of traffic, The data was not only used to define the AAD track locations and use representing a typical flow of traffic, but also the typical climb and descent patterns that occur along each flow. Patterns also include top-of-climb and top-of-descent locations for fuel burn modeling

purposes. The tracks were analyzed using proprietary software in order to visualize and analyze the radar data. All the trajectories were “bundled” into a set of tracks, representing a flow. The flows comprise all typical flight routings within the General Study Area for an annual average day. NIRS tracks are then developed based on the group of radar tracks representing each flow.

The NIRS model was used to calculate noise levels for the following specific locations on the ground:

- **Census Block Centroids:** The NIRS model can calculate DNL at the geographic centers (i.e., centroids) of census blocks to estimate the population exposed to varying levels of aircraft noise exposure. For this EA, population within the General Study Area was analyzed using 2010 U.S. Census block geometries.<sup>23</sup> A census block is the smallest geographical unit used by the United States Census to collect data. The census block centroid DNL represents the DNL for the total maximum potential population within that census block. Because noise levels are analyzed only at the centroid point and applied to the entire census block area population, and because the area represented by each centroid varies depending on the density of population, the actual noise exposure level for individuals will vary from the reported level based on their proximity to the geographic centroid.
- **Grid Points:** The NIRS model can also be used to calculate noise exposure at evenly spaced grid points. For this EA, the General Study Area was covered with a grid with points spaced evenly at intervals of 0.5 nautical miles (nm). This grid was used to calculate noise at regular intervals throughout the General Study Area, as well as within properties requiring evaluation under Section 4(f) of the *U.S. Department of Transportation (DOT) Act of 1966* (i.e., Section 4(f) Resources). These resources are discussed further in Sections 4.3.3.
- **Unique Points:** Noise levels at sites of interest that are too small to be captured in the 0.5 nm grid can also be analyzed using the NIRS model. Such sites include individual Section 4(f) resources that are less than one square nm in area (such as significant public parks or trails), and specific historic sites (such as individual buildings). See Section 4.3.3 for a discussion of what constitutes a Section 4(f) resource and Section 4.3.4 for a discussion of historic properties in the General Study Area.

In total, noise exposure levels were calculated at 98,282 census block centroids (centroids in the General Study Area that represent areas with population), 94,046 grid points, and 12,215 unique points throughout the General Study Area.

#### 4.3.1.2 Existing Aircraft Noise Exposure

**Table 4-2** identifies the total population exposed to aircraft noise between DNL 45 dB and 60 dB, DNL 60 dB and 65 dB, and DNL 65 dB and higher. This data is provided to establish a baseline for existing aircraft noise exposure. **Exhibit 4-2** provides a graphical representation of 2011 Existing Conditions noise exposure within the General Study Area by DNL 5 dB bands. As shown on **Exhibit 4-2**, areas exposed to higher DNL are generally aligned with Study Airport runways and areas with existing aircraft traffic.

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<sup>23</sup> U.S. Census Bureau, *2010 Tracts and American Community Survey Selected Economic Characteristics*, 2010.

**Table 4-2 Maximum Population Exposed to Aircraft Noise (DNL) within the Study Area (2011)**

DNL Range (dB)	Population
DNL 45 dB to DNL 60 dB	2,080,685
DNL 60 dB to less than DNL 65 dB	39,419
DNL 65 dB and higher	3,137
Total Above DNL 45 dB	2,123,241

Sources: U.S. Department of Transportation, Federal Aviation Administration, *NIRS Version 7.0b3*; U.S. Census Bureau, *2010 Tracts and American Community Survey Selected Economic Characteristics*, 2010.

Prepared by: ATAC Corporation, October 2013.

### 4.3.2 Compatible Land Use

Existing land use in the General Study Area is characterized by using generalized land coverage data obtained from the U.S. Geological Survey (USGS) *2006 National Land Cover Database (NLCD 2006)*. As shown on **Exhibit 4-3**, land use in the General Study Area is typified by dense urban development around the San Francisco and San Pablo Bays, and in portions of the Central Valley surrounding the City of Sacramento. Areas of agricultural land use predominate in the Central Valley, east and northeast of the Bay Area, and in a portion of the Salinas Valley southeast of San Jose. Areas of evergreen forest and shrub/scrub cover mountainous areas along the coast and in the foothills of the Sierra Nevada in the northeastern portion of the General Study Area. Grassland and shrub/scrub cover hilly and mountainous areas that fall between the southern portions of the Bay Area and the Central Valley. The General Study Area includes numerous large parks, recreational areas, wilderness areas, forests, and other types of resources managed by federal and state agencies. Section 4.3.3 further discusses these resources.

### 4.3.3 Department of Transportation Act, Section 4(f) Resources

Section 4(f) of the *U.S. Department of Transportation Act of 1966* (49 U.S.C. § 303(c)), states that, subject to exceptions for *de minimis* impacts:

... [The] Secretary [of Transportation] may approve a transportation program or project (other than any project for a park road or parkway under section 204 [1] of title 23) requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of an historic site of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site) only if...there is no prudent and feasible alternative to using that land; and... the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use.

The term “use” includes both direct (i.e., physical) and indirect (i.e., constructive) impacts to Section 4(f) properties. Direct use is the physical occupation or alteration of a Section 4(f) property or any portion of a Section 4(f) property. A constructive use does not require direct physical impacts or occupation of a Section 4(f) resource, but would occur when an action would result in substantial impairment of a resource to the degree that the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished.

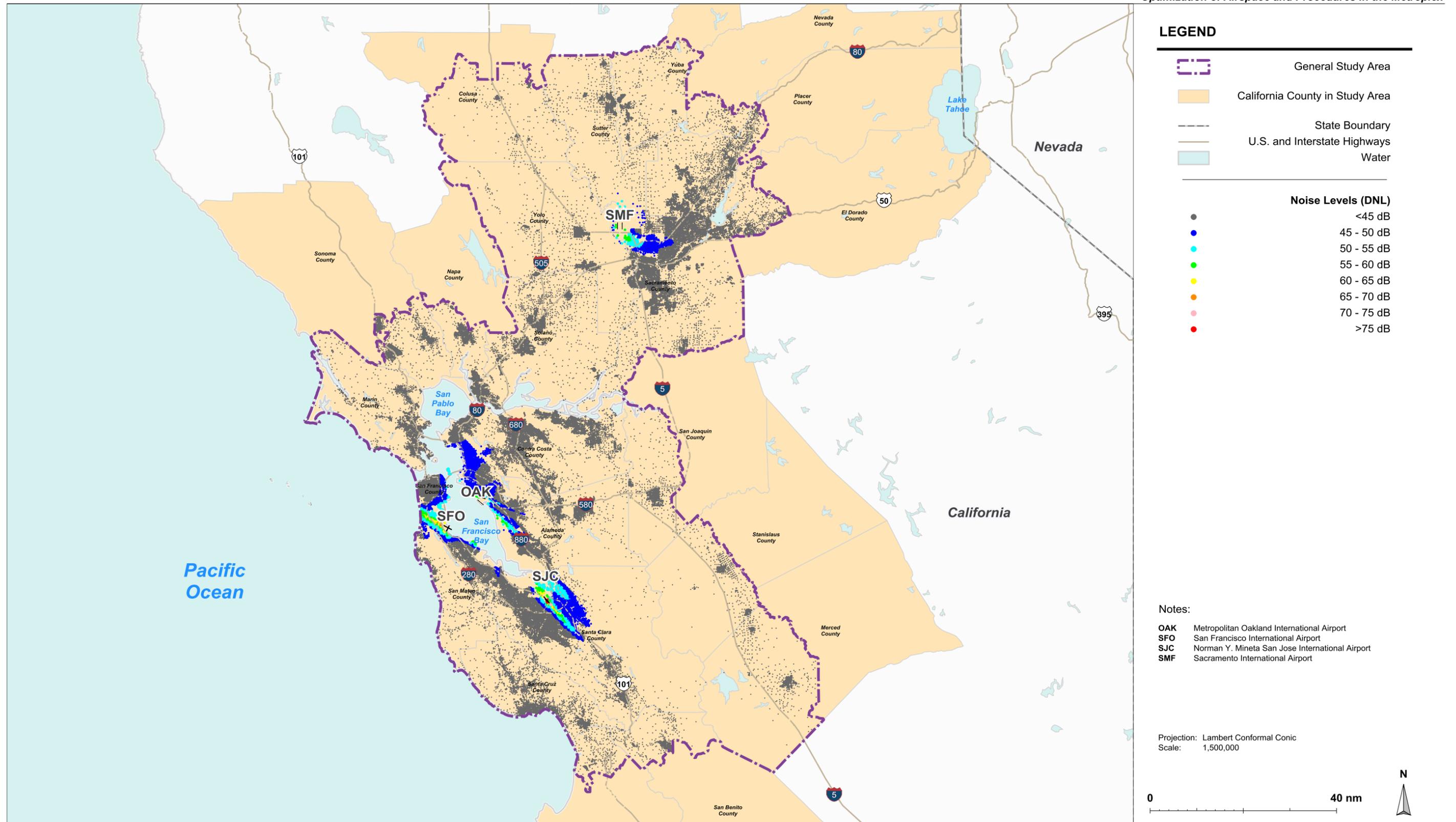
Parks and natural areas where a quiet setting is a generally recognized purpose and attribute receive special consideration. In these areas, the FAA official “must consult all appropriate Federal, State, and local officials having jurisdiction over the affected Section 4(f) resources when determining whether project-related noise impacts would substantially impair the resource.” Privately owned parks, recreation areas, and wildlife refuges are not subject to the Section 4(f) provisions.

Many Section 4(f) properties are also subject to the Section 6(f) of the *Land and Water Conservation Fund (LWCF) Act of 1965* (16 U.S.C. § 460l-4 *et seq.*) Section 6(f) states that no public outdoor recreation areas acquired or developed with LWCF assistance can be converted to non-recreation uses without the approval of the Secretary of the Interior. The Secretary of the Interior may only approve conversions if they are in accordance with the comprehensive statewide outdoor recreation plan, and if other recreation lands of reasonably equivalent usefulness and location will replace the converted areas.

#### 4.3.3.1 Section 4(f) Resources in the General Study Area

Data collected from both federal and state sources was used to identify Section 4(f) resources within the General Study Area. A total of 6,689 Section 4(f) resources were identified within the General Study Area. **Exhibit 4-4** depicts the locations of these resources. The locations of historic and cultural resources, also considered Section 4(f) resources, are discussed in Section 4.4 and depicted on **Exhibit 4-5**.

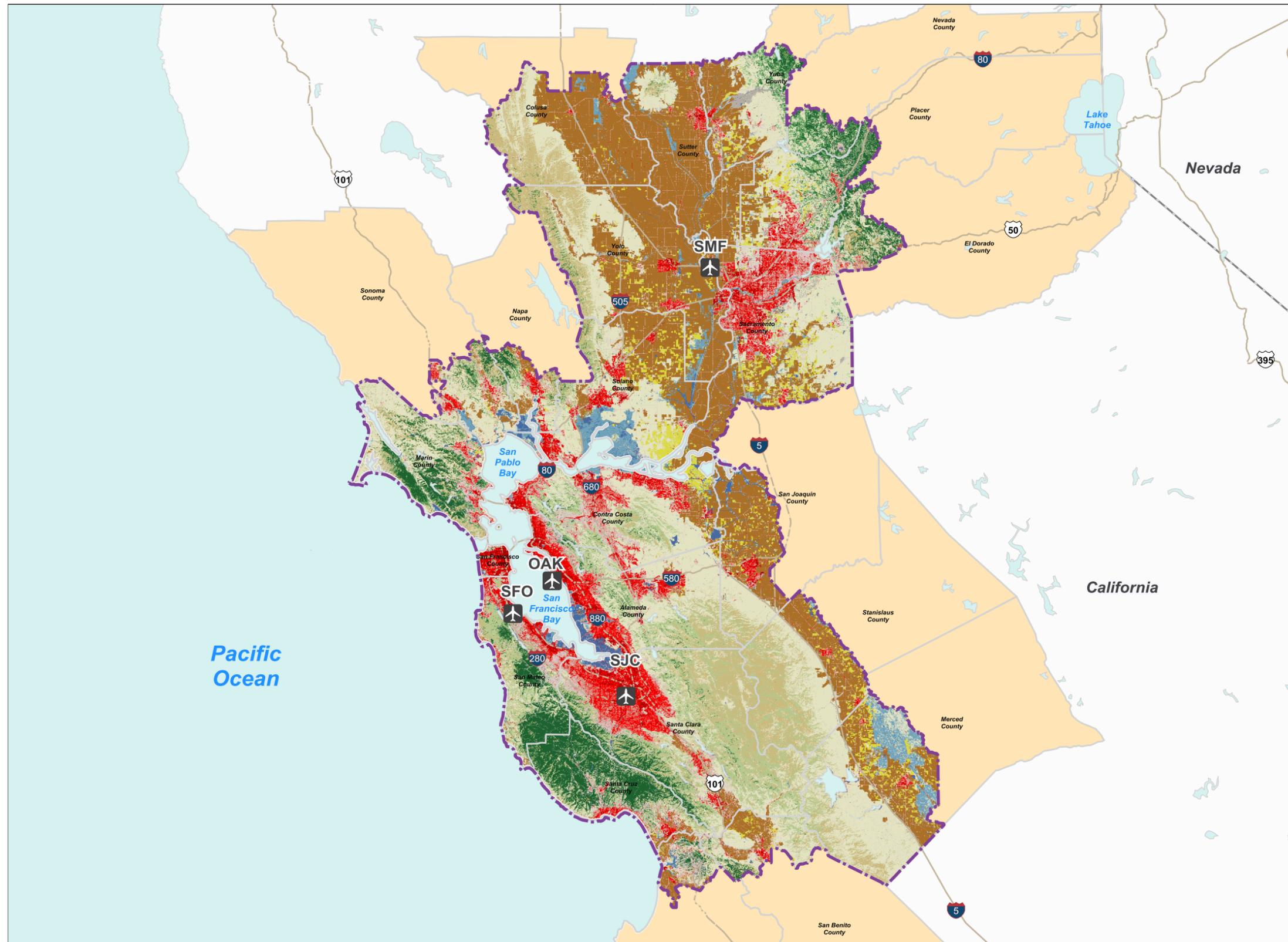
A list of the Section 4(f) resources identified in the General Study Area, the type of resource (i.e., federal, state, or local), the county in which they are located, site acreage, and DNL calculated for each resource under existing conditions is provided in the *NorCal OAPM Noise Technical Report* available on the project website (<http://www.oapmenvironmental.com>).



Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDIC Airport and Runway databases, 2012; ATAC Corporation: Study Area Boundary, 2012, and Noise Levels, 2013.  
Prepared by: ATAC Corporation, July 2014.

Exhibit 4-2

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**LEGEND**

- General Study Area Boundary
  - Study Airport
  - California County in Study Area
  - State Boundary
  - U.S. and Interstate Highways
  - Water
- National Land Cover Data**
- Open Water
  - Perennial ice/snow
  - Developed, open space
  - Developed, low intensity
  - Developed, medium intensity
  - Developed, high intensity
  - Barren land
  - Deciduous forest
  - Evergreen forest
  - Mixed forest
  - Shrub/scrub
  - Grassland/herbaceous
  - Hay/pasture
  - Cultivated crops
  - Woody wetlands
  - Herbaceous wetlands

Notes:

- OAK** Metropolitan Oakland International Airport
- SFO** San Francisco International Airport
- SJC** Norman Y. Mineta San Jose International Airport
- SMF** Sacramento International Airport

Projection: Lambert Conformal Conic  
Scale: 1,500,000



Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2012; Multi-Resolution Land Characteristics (MRLC) Consortium: 2006 National Land Cover Database  
Prepared by: ATAC Corporation, July 2014.

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#### **4.3.4 Historic, Architectural, Archeological, and Cultural Resources – Historic and Cultural Resources Sub-Categories**

The *National Historic Preservation Act (NHPA) of 1966* (16 U.S.C. § 470, as amended) requires federal agencies to consider the effects of their undertakings on properties listed or eligible for listing in the National Register of Historic Properties (i.e., National Register). Compliance requires consultation with the Advisory Council on Historic Preservation (ACHP), State Historic Preservation Officers (SHPO), and/or the Tribal Historic Preservation Officers (THPO).

It is possible that changes in aircraft flight routes associated with the Proposed Action could introduce or increase aircraft routing over historic resources and result in potential adverse aircraft noise impacts. For purposes of this EA, historic properties are defined as resources that are listed or eligible for listing in the National Register or relevant SHPO listings, or that have been identified through tribal consultation for values other than their archaeological qualities. As noted in Section 4.2, the Proposed Action does not involve ground disturbance that could potentially impact archaeological or architectural resources. Thus, these resources are not further discussed in this EA.

##### **4.3.4.1 Historic and Cultural Resources in the General Study Area**

**Exhibit 4-5** shows the location of historic and cultural resources identified in the General Study Area. A total of 767 National Register listed properties and eight tribal properties were identified. Historic properties are representative of every period in California history, include some of the nation's most important historic and cultural resources from the Spanish colonial, Mexican, and American periods. A list of the historic and cultural resources identified in the General Study Area, the county in which they are located, and DNL calculated for each resource under existing conditions is provided in the *NorCal OAPM Noise Technical Report* available on the project website (<http://www.oapmenvironmental.com>).

#### **4.3.5 Fish, Wildlife, and Plants – Wildlife Sub-Category**

This section discusses the existing wildlife resources within the General Study Area. The Proposed Action involves redesign of standard instrument arrival and departure procedures (generally above 3,000 feet AGL) and the supporting airspace management structure serving the Study Airports. Accordingly, discussion is focused on avian and bat species that may be present within the General Study Area.

##### **4.3.5.1 Threatened and Endangered Species and Migratory Birds**

The *Endangered Species Act (ESA) of 1973* (16 U.S.C. § 1531 *et seq.*), requires the evaluation of all federal actions to determine whether a Proposed Action is likely to jeopardize any proposed, threatened, or endangered species or proposed or designated critical habitat. A federal action is one that is conducted, funded, or permitted by a federal agency. Section 7 of the ESA requires the lead federal agency – in this case the FAA – to consult with the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) to determine whether the proposed federal action would jeopardize the continued existence of any species listed or proposed for listing as threatened or endangered, or would result in the destruction or adverse modification of

designated or proposed critical habitat. Critical habitat includes areas that will contribute to the recovery or survival of a listed species. Federal agencies are responsible for determining if an action “may affect” listed species. If so, the federal agency is required to prepare a Biological Assessment (BA) to determine if the action is “likely to adversely affect the species.” The presence of federal and state listed avian and bat species was assessed based on agency lists and reports. Data from the USFWS were used to identify potential federally-listed species.

#### 4.3.5.2 Migratory Birds

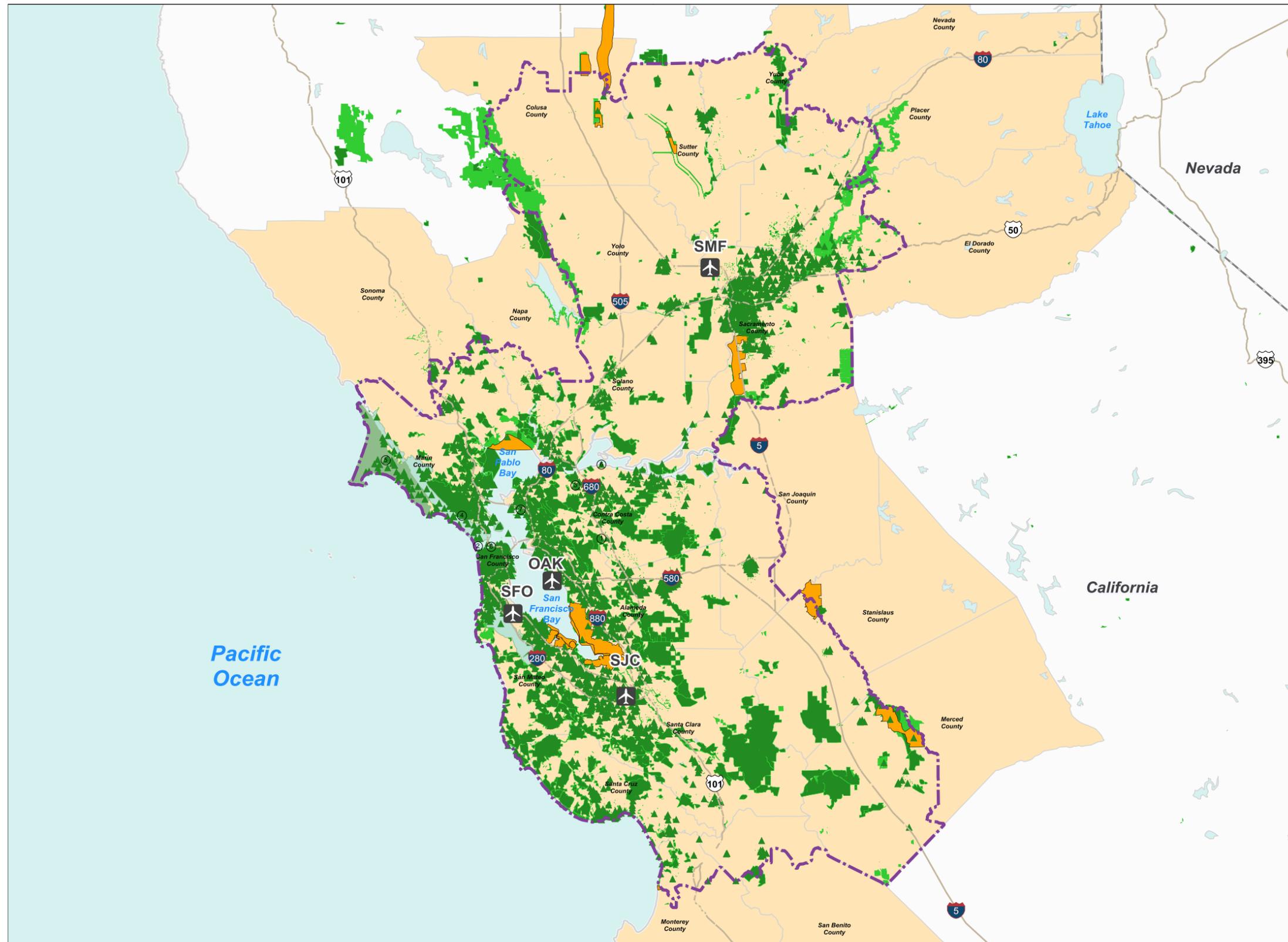
The *Migratory Bird Treaty Act (MBTA) of 1918* (16 U.S.C. §§ 703-712) prohibits the taking of any migratory bird and any part, nest, or egg of any such bird, without a permit issued by the USFWS. “Take” under the MBTA is defined as the action or attempt to “pursue, hunt, shoot, capture, collect, or kill.” Migratory birds listed under the ESA are managed by the agency staff members who handle compliance with Section 7 of the ESA; management of all other migratory birds is overseen by the Migratory Bird Division of the ESA. Several migratory bird species occur in, or migrate through, the General Study Area.

Birds migrate along four main routes or flyways in North America loosely delineated by geographic region: (1) Atlantic, (2) Central, (3) Mississippi, and (4) Pacific. The General Study Area for the NorCal OAPM Project is located within the Pacific Flyway. These flyways are not specific lines the birds follow but broad areas through which the birds migrate.

Migration routes may be defined as the various lanes birds travel from their breeding ground to their winter quarters. The actual routes followed by a given bird species differ by distance traveled, starting time, flight speed, geographic position and latitude of the breeding, and wintering grounds. The Pacific Flyway includes multiple primary migration routes throughout these areas and connects to other primary flyway routes.

The most frequently traveled migration routes conform very closely to major topographical features that lie in the general north-south movement of migratory bird flyways. Therefore, the lanes of heavier concentration in the General Study Area follow principal valleys (e.g., Central Valley) and mountain ranges (e.g. Sierra Nevada).

**Table 4-3** lists the federally listed threatened and endangered bird species of concern that are found within the General Study Area by county where they are reported to occur. No federally listed bat species are found within the General Study Area.



**LEGEND**

- General Study Area Boundary
- Study Airport
- California County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water

**Potential Section 4(f) Resources**

- National Forest
- National Park
- National Recreation Area
- National Preserve
- National Wildlife Refuge
- State/Local Park
- Park/Trail

- ①: Eugene O'Neill National Historic Site
- ②: Golden Gate National Recreation Area
- ③: John Muir National Historic Site
- ④: Muir Woods National Monument
- ⑤: Point Reyes National Seashore
- ⑥: Port Chicago Naval Magazine National Monument
- ⑦: Rosie the Riveter WWII Home Front National Historical Park
- ⑧: The Presidio of San Francisco

Notes:

**OAK** Metropolitan Oakland International Airport  
**SFO** San Francisco International Airport  
**SJC** Norman Y. Mineta San Jose International Airport  
**SMF** Sacramento International Airport

Projection: Lambert Conformal Conic  
 Scale: 1,500,000



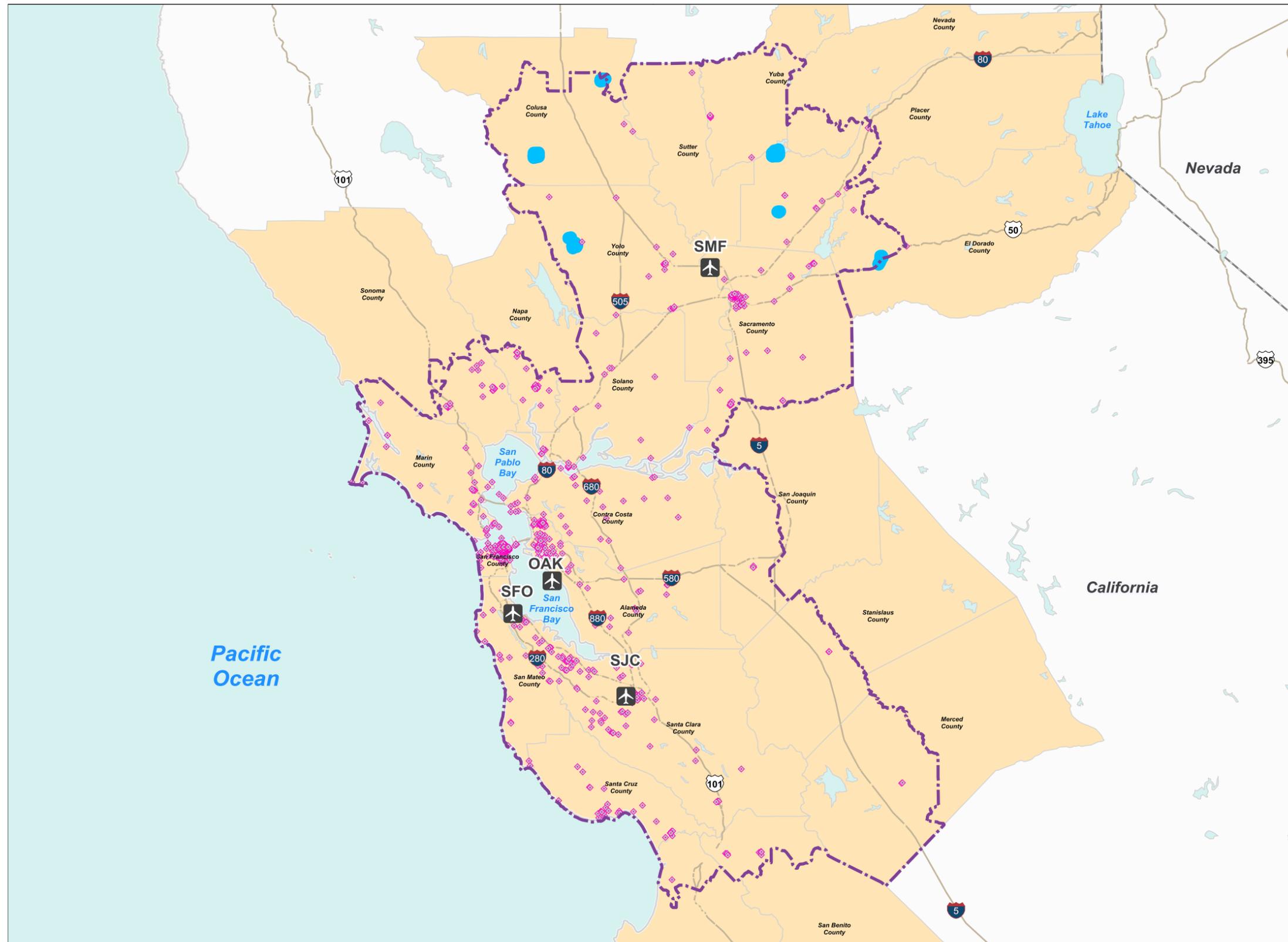
Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; Water Bodies, 2005; and Federal Lands, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; National Park Service: Register of Historic Places, 2012; U.S. Geological Survey: Geographic Names Information System (state and local parks/trails), 2013; GreenInfo Network: California Public Lands Database, 2013; ATAC Corporation: Study Area Boundary, 2012.

Prepared by:

ATAC Corporation, July 2014.

**Section 4(f) Resources  
in the General Study Area**

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**LEGEND**

- General Study Area Boundary
- Study Airport
- California County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Historic Resources
- Tribal Lands

Notes:

- OAK** Metropolitan Oakland International Airport
- SFO** San Francisco International Airport
- SJC** Norman Y. Mineta San Jose International Airport
- SMF** Sacramento International Airport

Projection: Lambert Conformal Conic  
Scale: 1,500,000



Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; National Park Service: Register of Historic Places, 2012; U.S. Census Bureau: The American Indian / Alaska Native / Native Hawaiian (AIANNH), 2012; ATAC Corporation: Study Area Boundary, 2012.

Prepared by:

ATAC Corporation, July 2014.

Exhibit 4-5

## Historic and Cultural Resources in the General Study Area

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**Table 4-3 Federally Listed Avian Species Potentially Found in the General Study Area**

Status	Species	Type	County of Occurrence
Candidate	Greater sage-grouse ( <i>Centrocercus urophasianus</i> )	Avian	El Dorado
Endangered	California Clapper rail ( <i>Rallus longirostris obsoletus</i> )	Avian	Alameda, Contra Costa, Marin, Monterey, Napa, Sacramento, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma
Endangered	California least tern ( <i>Sterna antillarum browni</i> )	Avian	Monterey, Santa Cruz
Threatened	Western snowy plover ( <i>Charadrius alexandrinus nivosus</i> )	Avian	Alameda, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Sonoma
Threatened	Northern spotted owl ( <i>Strix occidentalis caurina</i> )	Avian	Colusa, Marin, Napa, Sonoma
Threatened	Marbled murrelet ( <i>Brachyramphus marmoratus</i> )	Avian	Marin, Santa Cruz, Sonoma
Endangered	California condor ( <i>Gymnogyps californianus</i> )	Avian	San Benito
Endangered	Least Bell's vireo ( <i>Vireo bellii pusillus</i> )	Avian	San Benito, Santa Cruz
Endangered	Southwestern willow flycatcher ( <i>Empidonax traillii extimus</i> )	Avian	San Benito, Santa Cruz
Sources:	U.S. Fish and Wildlife Service, <i>Endangered Species</i> ( <a href="http://www.fws.gov/endangered/">http://www.fws.gov/endangered/</a> ; accessed June 2013).		
Prepared by:	ATAC Corporation, June 2013.		

**Table 4-4** provides a listing of California state-listed threatened and endangered species.

**Table 4-4 State-Listed Threatened and Endangered Bird Species in California (1 of 2)**

Arizona Bell's vireo ( <i>Vireo bellii arizonae</i> ) <sup>3</sup>	Bald eagle ( <i>Haliaeetus leucocephalus</i> ) <sup>3</sup>
Bank swallow ( <i>Riparia riparia</i> ) <sup>4</sup>	Belding's savannah sparrow ( <i>Passerculus sandwichensis beldingi</i> ) <sup>3</sup>
California black rail ( <i>Laterallus jamaicensis coturniculus</i> ) <sup>4</sup>	California clapper rail ( <i>Rallus longirostris obsoletus</i> ) <sup>1,3</sup>
California condor ( <i>Gymnogyps californianus</i> ) <sup>1,3</sup>	California least tern ( <i>Sterna antillarum browni</i> ) <sup>1,3</sup>
Coastal California gnatcatcher ( <i>Polioptila californica californica</i> ) <sup>3,5</sup>	Elf owl ( <i>Micrathene whitneyi</i> ) <sup>3</sup>
Gila woodpecker ( <i>Melanerpes uropygialis</i> ) <sup>3,5</sup>	Gilded northern flicker ( <i>Colaptes auratus chrysoides</i> ) <sup>3</sup>
Great gray owl ( <i>Strix nebulosa</i> ) <sup>3</sup>	Greater sandhill crane ( <i>Grus canadensis tabida</i> ) <sup>4</sup>
Inyo California towhee ( <i>Pipilo crissalis eremophilus</i> ) <sup>1,4,5</sup>	Least Bell's vireo ( <i>Vireo bellii pusillus</i> ) <sup>1,3</sup>
Light-footed clapper rail ( <i>Rallus longirostris levipes</i> ) <sup>1,3,5</sup>	Marbled murrelet ( <i>Brachyramphus marmoratus</i> ) <sup>2,3</sup>
San Clemente sage sparrow ( <i>Amphispiza belli clementeae</i> ) <sup>2,5</sup>	San Clemente loggerhead shrike ( <i>Lanius ludovicianus mearnsi</i> ) <sup>1,5</sup>
Southwestern willow flycatcher ( <i>Empidonax traillii extimus</i> ) <sup>1,3</sup>	Short-tailed albatross ( <i>Phoebastria (=Diomedea) albatrus</i> ) <sup>1,5</sup>

**Table 4-4 State-Listed Threatened and Endangered Bird Species in California (2 of 2)**

Willow flycatcher ( <i>Empidonax traillii</i> ) <sup>3</sup>	Swainson's hawk ( <i>Buteo swainsoni</i> ) <sup>4</sup>
Yuma clapper rail ( <i>Rallus longirostris yumanensis</i> ) <sup>1,4,5</sup>	Western yellow-billed cuckoo ( <i>Coccyzus americanus occidentalis</i> ) <sup>3</sup>
	Xantus's murrelet ( <i>Synthliboramphus hypoleucus</i> ) <sup>4</sup>

Notes:

1/ Federally listed as Endangered

2/ Federally listed as Threatened

3/ State listed as Endangered

4/ State listed as Threatened

5/Unlikely to be found in the General Study Area

Source: U.S. Fish and Wildlife Service, Threatened & Endangered Species, Listings and occurrences for California ([http://ecos.fws.gov/tess\\_public/pub/stateListingAndOccurrenceIndividual.jsp?state=CA&s8fid=112761032792&s8fid=112762573902](http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=CA&s8fid=112761032792&s8fid=112762573902); accessed December 2013); California Department of Fish and Game, Threatened and Endangered Birds ([http://www.dfg.ca.gov/wildlife/nongame/t\\_e\\_spp/bird.html](http://www.dfg.ca.gov/wildlife/nongame/t_e_spp/bird.html); accessed December 2013).

Prepared by: ATAC Corporation, December 2013.

#### 4.3.5.3 Existing Wildlife Strikes

The aviation community has long recognized that the threat of aircraft collision with wildlife is real and increasing. Globally, wildlife strikes have killed more than 229 people and destroyed over 210 aircraft since 1988.<sup>24</sup> Contributing factors to this threat include an increase in large bird populations as well as an increase in air traffic operations by quieter, turbofan-powered aircraft. According to the FAA National Wildlife Strike Database, since 1990 the majority (92 percent) of aircraft collisions with wildlife have occurred below 3,000 feet AGL.

Wildlife strike reports from 2011 were collected from the FAA *National Wildlife Strike Database* for each Study Airport. According to the wildlife strike reports, Study Airports accounted for 3.3 percent of the 2011 national wildlife strike total and three percent of the 2011 national avian/bat strike total. **Table 4-5** summarizes wildlife and avian/bat strikes at each of the Study Airports for 2011. Of the 340 avian/bat strikes reported for 2011, 262 included information on the altitude at which the strike took place. A total of 23 of the 262 bird strikes reported occurred at altitudes above 3,000 feet.

**Table 4-5 2011 Study Airports Wildlife and Avian/Bat Strike Summary**

Airport	Avian/Bat	Strikes		Total
			Other Wildlife	
OAK	60	5		65
SFO	79	1		80
SJC	52	3		55
SMF	139	1		140
Total	330	10		340

Source: U.S. Department of Transportation, Federal Aviation Administration, *Wildlife Strike Database* (<http://wildlife-mitigation.tc.faa.gov/wildlife/database.aspx>; accessed August, 2012).

Prepared by: ATAC Corporation, June 2013.

<sup>24</sup> U.S. Department of Transportation, Federal Aviation Administration, *Wildlife Strikes to Civil Aircraft in the United States, 1990-2010*, Serial Report Number 17, 2011.

#### 4.3.6 Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks – Environmental Justice Sub-Category

This section is limited to a discussion of Environmental Justice as it pertains to potential aircraft noise impacts in the General Study Area. An environmental justice analysis considers the potential of the proposed project alternatives to cause disproportionate and adverse effects on low-income or minority populations. In the event that adverse effects are determined, applicable mitigation ensures that no minority or low-income populations bear a disproportionate burden of those effects.

As discussed in FAA Order 1050.1E, both Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and the accompanying Presidential Memorandum, as well as Order DOT 5610.2, *Environmental Justice*, require the FAA to provide for meaningful public involvement by minority and low-income populations. These documents encourage consideration of environmental justice impacts in EAs to determine whether a disproportionately high and adverse impact may occur.

The socioeconomic and racial characteristics of the population within the General Study Area are based on data from the 2010 U.S. Census. Minority and low-income populations for each census tract within the General Study Area were identified using Geographic Information Systems (GIS). This analysis defines and identifies minority population census tracts and low-income population census tracts as follows:

- A **Minority Population census tract** is defined as a tract having a minority population percentage greater than the average minority population percentage of the General Study Area. Based on the 2010 census data, the average percentage of minority population residing in the General Study Area was 41 percent. Therefore, every census tract with a percentage of minority population greater than 41 percent was identified as a census tract of environmental justice concern. A minority population is defined as “any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy or activity.”<sup>25</sup> Minority means a person who is Black, Hispanic or Latino, Asian American, American Indian and Alaskan Native, or Native Hawaiian and Other Pacific Islander.<sup>26</sup>
- A **Low-Income Population census tract** is defined as a tract having a greater percentage of low-income population than the average percentage of low-income population residing in the General Study Area. Based on the 2010 Poverty Guidelines identified by the Department of Health and Human Services (HHS), the poverty threshold for a household of three persons was set at \$18,310 for the 48 contiguous states, and therefore is applicable to the General Study Area. For the

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<sup>25</sup> Order DOT 5610.2, *Environmental Justice*, May 2, 2012.

<sup>26</sup> Id.

purposes of identifying low-income population census tracts, the HHS threshold of \$18,310 was used. Based on the 2010 data, the average percentage of low-income population residing in the General Study Area was 8.2 percent. Therefore, every census tract with a percentage of low-income population greater than 8.2 percent was identified as a census tract of environmental justice concern.

**Exhibit 4-6** depicts areas of environmental justice concern in the General Study Area. **Table 4-6** shows the total population, minority population, and low-income population for each county in the General Study Area as reported by the 2010 Census.

**Table 4-6 Selected Populations in the General Study Area**

County	Population	General Study Area Population			
		Minority	% of Total	Low Income	% of Total
Alameda County	1,494,876	804,598	54%	134,125	9%
Colusa County	16,649	5,458	33%	1,865	11%
Contra Costa County	1,037,817	381,514	37%	79,526	8%
El Dorado County	78,681	10,112	13%	2,567	3%
Marin County	250,666	50,340	20%	10,838	4%
Merced County	49,020	8,107	17%	9,115	19%
Monterey County	42,580	8,686	20%	4,344	10%
Napa County	110,081	21,800	20%	8,291	8%
Nevada County	13,880	871	6%	585	4%
Placer County	322,705	51,503	16%	15,487	5%
Sacramento County	1,408,480	563,366	40%	164,402	12%
San Benito County	49,160	12,334	25%	5,023	10%
San Francisco County	797,983	389,124	49%	61,644	8%
San Joaquin County	100,687	46,188	46%	6,617	7%
San Mateo County	711,622	287,377	40%	34,715	5%
Santa Clara County	1,762,754	865,800	49%	119,370	7%
Santa Cruz County	259,402	45,164	17%	22,199	9%
Solano County	411,620	197,199	48%	34,124	8%
Sonoma County	153,539	25,935	17%	9,731	6%
Stanislaus County	38,376	12,137	32%	4,848	13%
Sutter County	94,192	32,240	34%	12,163	13%
Yolo County	198,889	66,161	33%	21,169	11%
Yuba County	67,091	21,088	31%	10,811	16%

Source: U.S. Census Bureau, *2010 Tracts and American Community Survey Selected Economic Characteristics*, 2010.

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### 4.3.7 Energy Supply (Aircraft Fuel)

This section describes fuel consumption by IFR aircraft arriving at and departing from the Study Airports. Using the NIRS model, aircraft fuel burn was calculated to estimate aircraft fuel consumption associated with air traffic flows under 2011 Existing Conditions. NIRS calculates fuel burn using the same input used for calculating noise. (See Section 4.3.1.1 for a discussion of NIRS model inputs.) Based on the NIRS calculation, IFR aircraft arriving at and departing from the Study Airports burn approximately 2,298,970 kg of fuel on an AAD basis.

### 4.3.8 Air Quality

This section describes air quality conditions within the General Study Area. In the United States, air quality is generally monitored and managed at the county or regional level. The U.S. Environmental Protection Agency (EPA), pursuant to mandates of the federal *Clean Air Act*, (42 U.S.C. § 7401 *et seq.*), has established the National Ambient Air Quality Standards (NAAQS) to protect public health, the environment, and quality of life from the detrimental effects of air pollution. Standards have been established for the following criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter (PM), and sulfur dioxide (SO<sub>2</sub>). PM standards have been established for inhalable coarse particles ranging in diameter from 2.5 to 10 micrometers (µm) [referred to as PM<sub>10</sub>] and fine particles less than 2.5 µm [PM<sub>2.5</sub>] in diameter.

In accordance with the *Clean Air Act Amendments of 1977*, (91 Stat. 685, P.L. 95-95), the EPA uses air monitoring data it compiles as well as data collected by local air quality agencies to classify counties and some sub-county geographical areas by their compliance with the NAAQS. An area with air quality at or below the NAAQS is designated as an attainment area. An area with air quality that exceeds the NAAQS is designated as a nonattainment area. Nonattainment areas are further classified as extreme, severe, serious, moderate, and marginal by the extent the NAAQS are exceeded. Areas that have been reclassified from nonattainment to attainment are identified as maintenance areas. An area may be designated as unclassifiable when there is a temporary lack of data on which to base its attainment status. **Table 4-7** identifies those areas within the General Study Area that are in nonattainment or maintenance for one or more criteria pollutants.

The FAA has determined that aircraft operations at or above the average mixing height of 3,000 feet AGL have a very small effect on pollutant concentrations at ground level.<sup>27</sup> The mixing height represents the height of the completely mixed portion of the atmosphere that begins at the earth's surface and extends to a few thousand feet overhead where the atmosphere becomes fairly stable.<sup>28</sup>

**Table 4-7 NAAQS Attainment Areas in the General Study Area (1 of 2)**

Pollutant	Status	County
Ozone (O <sub>3</sub> )	Nonattainment (Extreme)	Merced, Stanislaus, San Joaquin
	Nonattainment (Severe 15)	Sacramento, Yolo, Placer, El Dorado, Solano
	Nonattainment (Moderate)	Santa Clara, San Mateo, San Francisco, Alameda, Contra Costa, Solano, Napa, Sonoma, Marin, Nevada
PM <sub>10</sub>	Nonattainment	Sacramento <sup>1</sup>

<sup>27</sup> Wayson, Roger, and Fleming, Gregg, "Consideration of Air Quality Impacts by Airplane Operations at or Above 3000 feet AGL," Volpe National Transportation Systems Center and FAA Office of Environment & Energy, FAA-AEE-00-01-DTS-34, September 2000 ([http://www.faa.gov/regulations\\_policies/policy\\_guidance/envir\\_policy/](http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/)).

<sup>28</sup> U.S. Department of Transportation, Federal Aviation Administration, *Air Quality Procedures For Civilian Airports & Air Force Bases*, April 1997 ([http://www.faa.gov/regulations\\_policies/policy\\_guidance/envir\\_policy/airquality\\_handbook/media/Handbook.PDF](http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/media/Handbook.PDF)).

**Table 4-7 NAAQS Attainment Areas in the General Study Area (2 of 2)**

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PM <sub>2.5</sub>	Nonattainment	Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano <sup>1</sup> , Sonoma <sup>1</sup> , Merced, San Joaquin, Stanislaus, Yuba, Sutter, El Dorado <sup>1</sup> , Placer <sup>1</sup> , Sacramento, Solano <sup>1</sup> , Yolo <sup>1</sup>
Carbon Monoxide (CO)	Maintenance	Alameda <sup>1</sup> , Contra Costa <sup>1</sup> , Marin <sup>1</sup> , Napa <sup>1</sup> , San Francisco, San Mateo <sup>1</sup> , Santa Clara <sup>1</sup> , Solano <sup>1</sup> , Sonoma <sup>1</sup> , Placer <sup>1</sup> , Sacramento <sup>1</sup> , Yolo <sup>1</sup> , San Joaquin <sup>1</sup>

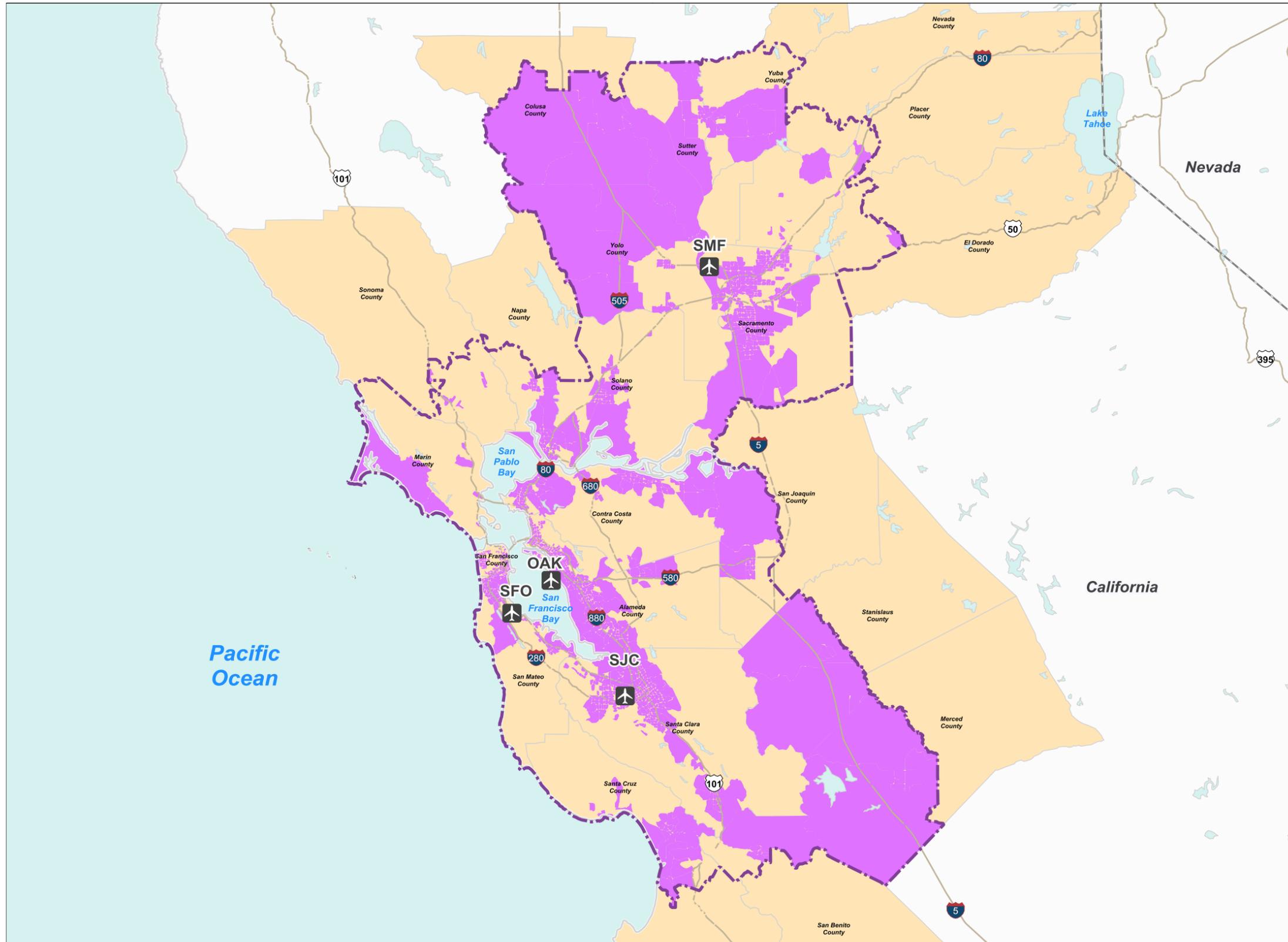
Notes:

1\ Partial county.

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Sources: U.S. Environmental Protection Agency, *Green Book* (<http://www.epa.gov/oaqps001/greenbk/>; accessed August, 2012).

Prepared by: ATAC Corporation, June 2013.



**LEGEND**

- General Study Area Boundary
- Study Airport
- California County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Environmental Justice Community

Notes:

- OAK** Metropolitan Oakland International Airport
- SFO** San Francisco International Airport
- SJC** Norman Y. Mineta San Jose International Airport
- SMF** Sacramento International Airport

Projection: Lambert Conformal Conic  
Scale: 1,500,000



Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Census Bureau: 2010 Tracts, Profile of General Population and Housing Characteristics, and American Community Survey Selected Economic Characteristics; ATAC Corporation: Study Area Boundary, 2012.

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### 4.3.9 Climate

Greenhouse gases (GHGs) are naturally occurring and man-made gases that trap heat in the earth's atmosphere. These gases include CO<sub>2</sub>, methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>). According to the EPA, in 2009 the General Accounting Office (GAO) reported that domestic aviation contributed approximately three percent of national CO<sub>2</sub> emissions.<sup>29</sup> Similarly, the International Civil Aviation Organization (ICAO) estimated that aviation accounted for approximately three percent of all man-made global CO<sub>2</sub> emissions.<sup>30</sup> The FAA considers CO<sub>2</sub> emissions from aircraft to be the primary GHG of concern.

In October 2010, the CEQ issued the *Federal GHG Accounting and Reporting Guidance* establishing requirements for federal agencies to calculate and report GHG emissions associated with their operations. The federal guidance also established a single metric for reporting all GHGs in metric tons (MT) of CO<sub>2</sub> equivalent (CO<sub>2</sub>e) or MTCO<sub>2</sub>e.

For purposes of this EA, the amount of fuel burned by IFR aircraft arriving and departing from the Study Airports in the General Study Area as estimated by the NIRS model is used to calculate total MTCO<sub>2</sub>e. Fuel burn calculations are discussed in Section 4.3.7, *Energy Supply*. The calculated fuel burn was used to estimate the total MT of CO<sub>2</sub>, reported here as MTCO<sub>2</sub>e. **Table 4-8** presents the total estimated MTCO<sub>2</sub>e along with estimates of all national and global emissions of MTCO<sub>2</sub>e.

**Table 4-8 NorCal OAPM CO<sub>2</sub>e Estimates (2011)**

NorCal OAPM	National	Global
0.00072 MMT	148 MMT	50,100 MMT <sup>1</sup>

Notes:  
<sup>1</sup> 2010 estimate.  
 MMT=Million Metric Tons

Source: U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011* (EPA 430-R-13-001), April 12, 2013; United Nations Environment Programme, *The Emissions Gap Report 2012*, November 2012; ATAC Corporation, March 2013.

Prepared by: ATAC Corporation, October 2013.

<sup>29</sup>United States Congress, U.S. Government Accountability Office, *Aviation and Climate Change. GAO Report to Congressional Committees*, (2009). (<http://www.gao.gov/new.items/d09554.pdf>).

<sup>30</sup> Alan Melrose, "European ATM and Climate Adaptation: A Scoping Study," in *ICAO Environmental Report*. (2010).

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