2.8 Water Resources

This chapter analyzes the surface water and groundwater resources of the Bay Area in relation to the location of projects comprising the proposed Plan. Stormwater runoff, flooding and inundation hazards are also addressed in this chapter. For a discussion of sea (and bay) level rise impacts, see *Chapter 2.5: Climate Change and Greenhouse Gases*. For a discussion of water supply impacts, see *Chapter 2.12*: *Public Utilities and Facilities*.

Environmental Setting

PHYSICAL SETTING

Climate

Climatic conditions in the Bay Area are generally characterized as Mediterranean with moist, mild winters and hot, dry summers. However, the region's varied topography creates several microclimates dependent upon elevation, proximity to the San Francisco Bay or coast, and orientation. As a result, stark climatic differences reflected in temperature, rainfall amounts, and evapotranspiration can occur over relatively short distances. The Bay Area is largely governed by weather patterns originating in the Pacific Ocean, primarily by the southern descent of the Polar Jet Stream bringing with it mid-latitude cyclonic storms in winter. More than 90 percent of precipitation in the Bay Area falls between November and April. Bay Area lowlands (i.e., valley bottoms) receive an annual rainfall of about 15 to 20 inches in the South Bay and about 20 to 25 inches in the North Bay. Higher elevations in the region, particularly along the north- or west-facing slopes of the North Bay, may receive over 40 inches of rain per year. In the summer, the Hawaiian High Pressure cell over the northern Pacific creates mild and dry weather for the region. However, summer in the Bay Area is also known for its thick marine fog layer, which is brought into the Bay by a diurnal westerly breeze formed by the strong pressure gradient between the hot Central Valley and the cooler coastal areas. This moist air is cooled to dewpoint when it crosses the cooler waters of the California Current near the coast. This advection process results in a thick fog forming just offshore, which is pulled eastward through gaps and passes into the Bay Area. Fog diminishes with distance inland from the Bay.[1] **Table 2.8-1** summarizes monthly and annual average precipitation for select sites throughout the Bay Area.

[1] California Department of Water Resources and the California Water Boards, *San Francisco Bay Integrated Water Management Plan*, 2006.

TABLE 2.8-1: AVERAGE MONTHLY PRECIPITATION, SELECTED BAY AREA SITES

	Inches[1]												
Site	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	***Annual***
Fairfield (1950-2012)	4.8	4.0	3.1	1.4	0.6	0.2	0.0	0.1	0.2	1.3	2.8	4.3	**22.7**
Napa, State Hospital (1893-2012)	5.1	4.4	3.4	1.7	0.7	0.2	0.0	0.1	0.3	1.4	3.0	4.5	**24.7**
Oakland, Airport (1948-2012)	3.7	2.7	2.6	1.4	0.4	0.2	0.0	0.1	0.2	1.1	2.5	3.1	**18.0**
Redwood City (1906-2012)	4.4	3.5	2.7	1.2	0.4	0.1	0.0	0.1	0.2	1.0	2.1	3.5	**19.2**
Richmond (1950-2012)	4.8	3.8	3.3	1.7	0.5	0.2	0.0	0.1	0.2	1.3	2.9	4.4	**23.2**
San Francisco, Mission Dolores (1914-2012)	4.4	3.8	2.9	1.4	0.6	0.2	0.0	0.1	0.2	1.1	2.6	4.0	**21.2**
San José (1893-2012)	2.9	2.7	2.3	1.2	0.4	0.1	0.0	0.1	0.2	0.8	1.5	2.4	**14.6**
San Rafael, Civic Center (1894-2012)	8.1	6.5	4.7	2.0	0.7	0.2	0.0	0.1	0.4	1.9	4.1	6.8	**35.6**
Santa Rosa (1902-2012)	6.2	5.3	4.1	2.1	1.0	0.3	0.0	0.1	0.4	1.6	3.6	5.5	**30.1**

1. Rounded to the nearest one-tenth of an inch.

Source: Western Regional Climate Center website, www.wrcc.dri.edu, accessed July 2012

Regional Hydrology

The San Francisco Bay estuary system is one of the largest in t he country and drains approximately 40 percent of California. Water from the Sacramento and San Joaquin Rivers of the Central Valley flow into what is known as the Delta region, then into the sub-bays, Suisun Bay and San Pablo Bay, and finally into the Central Bay and out the Golden Gate. The Delta is a large triangle of interconnected sloughs and agricultural "islands" that forms a key link in California's water delivery system. Some of the fresh water flows through the Delta and into Bay, but much is diverted from the Bay. Nearly half of the surface water in California starts as rain or snow that falls within the watershed and flows downstream toward the Bay. Much of the water flowing toward the Bay is diverted for agricultural, residential, and industrial purposes as well as delivery to distant cities of southern California as part of state and federal water projects.

The two major drainages, the Sacramento and San Joaquin Rivers receive more than 90 percent of runoff during the winter and spring months from rainstorms and snow melt. San Francisco Bay encompasses approximately 1,600 square miles and is surrounded by the nine Bay Area counties of which seven border the Bay. Other surface waters flow either directly to the Bay or Pacific Ocean. The drainage basin that

contributes surface water flows directly to the Bay covers a total area of 3,464 square miles. The largest watersheds include Alameda Creek (695 square miles), the Napa River (417 square miles), and Coyote Creek (353 square miles) watersheds. The San Francisco Bay estuary includes deep-water channels, tidelands, and marshlands that provide a variety of habitats for plants and animals. The salinity of the water varies widely as the landward flows of saline water and the seaward flows of fresh water converge near the Benicia Bridge. The salinity levels in the Central Bay can vary from near oceanic levels to one-quarter as much, depending on the volume of freshwater runoff.

Surface Waters

Surface waters in the Bay Area include freshwater rivers and streams, coastal waters, and estuarine waters. Many of the original drainages toward the San Francisco Bay have been channelized and put underground in areas through the urbanization of the area, though a few still remain. Estuarine waters include the San Francisco Bay Delta from the Golden Gate to the Sacramento and San Joaquin Rivers, and the lower reaches of various streams that flow directly into the Bay, such as the Napa and Petaluma Rivers in the North Bay and the Coyote and San Francisquito Creeks in the South Bay. Major water bodies, including creeks and rivers, in the Bay Area are presented in **Figure 2.8-1**. Major rivers and streams are also listed below by county:

- Alameda County: Alameda Creek, San Leandro Creek, San Lorenzo Creek
- Contra Costa County: San Pablo Creek
- Marin County: Corte Madera Creek, Lagunitas Creek, Gallinas Creek, Miller Creek, Novato Creek
- Napa County: Huichica Creek, Napa River
- San Francisco City and County: None
- San Mateo County: Cordilleras Creek, San Mateo Creek, Sanchez Creek
- Santa Clara County: Adobe Creek, Coyote Creek, Guadalupe River, Llagas Creek (drains to the Pacific Ocean via the Pajaro River), Los Gatos Creek, Permanente Creek, San Francisquito Creek, Steven's Creek
- Solano County: Green Valley Creek, Napa River, Putah Creek, Suisun Creek
- Sonoma County: Petaluma River, Russian River, Santa Rosa Creek, Sonoma Creek

Groundwater

A groundwater basin is defined as an area underlain by permeable materials capable of furnishing a significant supply of groundwater to wells or storing a significant amount of water. Groundwater basins are considered as three-dimensional units defined by physical barriers that contain flow. Groundwater basins are closely linked to local surface waters. As water flows from the hills toward San Francisco Bay, it percolates through permeable soils into the groundwater basins. The entire Bay Area region is divided into a total of 28 groundwater basins and two of those basins (Napa-Sonoma Valley and Santa Clara Valley) are further divided into sub-basins. The ten primary groundwater basins in the Bay Area are the Petaluma Valley, Napa-Sonoma Valley, Suisun-Fairfield Valley, San Joaquin Valley, Clayton Valley, Diablo Valley, San Ramon Valley, Livermore Valley, Sunol Valley, and Santa Clara Valley basins.

Groundwater in the region is used for numerous purposes, including municipal and industrial water supply. However, groundwater use accounts for only about five percent of the total water usage. In general, many of the water bearing units, or aquifers, are relatively thin and yield relatively low amounts of groundwater. Groundwater quality varies significantly throughout the Bay Area with some areas of poor water quality as a result of past industrial uses or intrusion of brackish Bay water. Some of the larger basins such as Santa Clara Valley, Napa-Sonoma Valley, and Petaluma Valley have much thicker aquifers that can produce larger volumes of groundwater and generally have good water quality. Therefore, based on water quality and available resources, water supply for much of the Bay Area is provided by imported water supplies through water conveyance facilities such as the Hetch Hetchy Aqueduct, the Mokelumne Aqueduct, the North and South Bay Aqueduct, and others. A detailed discussion of water supply is included in *Chapter 2.12: Public Utilities and Facilities.*

Surface Water Quality

The quality of regional surface water resources within the Bay Area region varies considerably and is locally affected by point-source and nonpoint-source discharges throughout individual watersheds. Regulated point sources such as wastewater treatment effluent and industrial waste discharges usually involve a single point discharge into receiving waters. Point-source pollutants can also enter water bodies from urban runoff that include oil and gasoline by-products from parking lots, streets, and freeways that are collected in drainage systems and discharged directly to surface waters. Copper from brake linings and lead from counterweights contribute heavy metals to local waters. In addition, impervious surfaces increase runoff quantities, taxing flow capacities of local flood control systems and deteriorating natural habitats. Most urban runoff flows untreated into creeks, lakes, and San Francisco Bay. Other pollutant sources include upstream historic and current mining discharges and legacy pollutants that were historically emitted by industry or other human activities, but are currently banned or significantly restricted from current usage. Examples include mercury, lead, PCBs, and DDT.

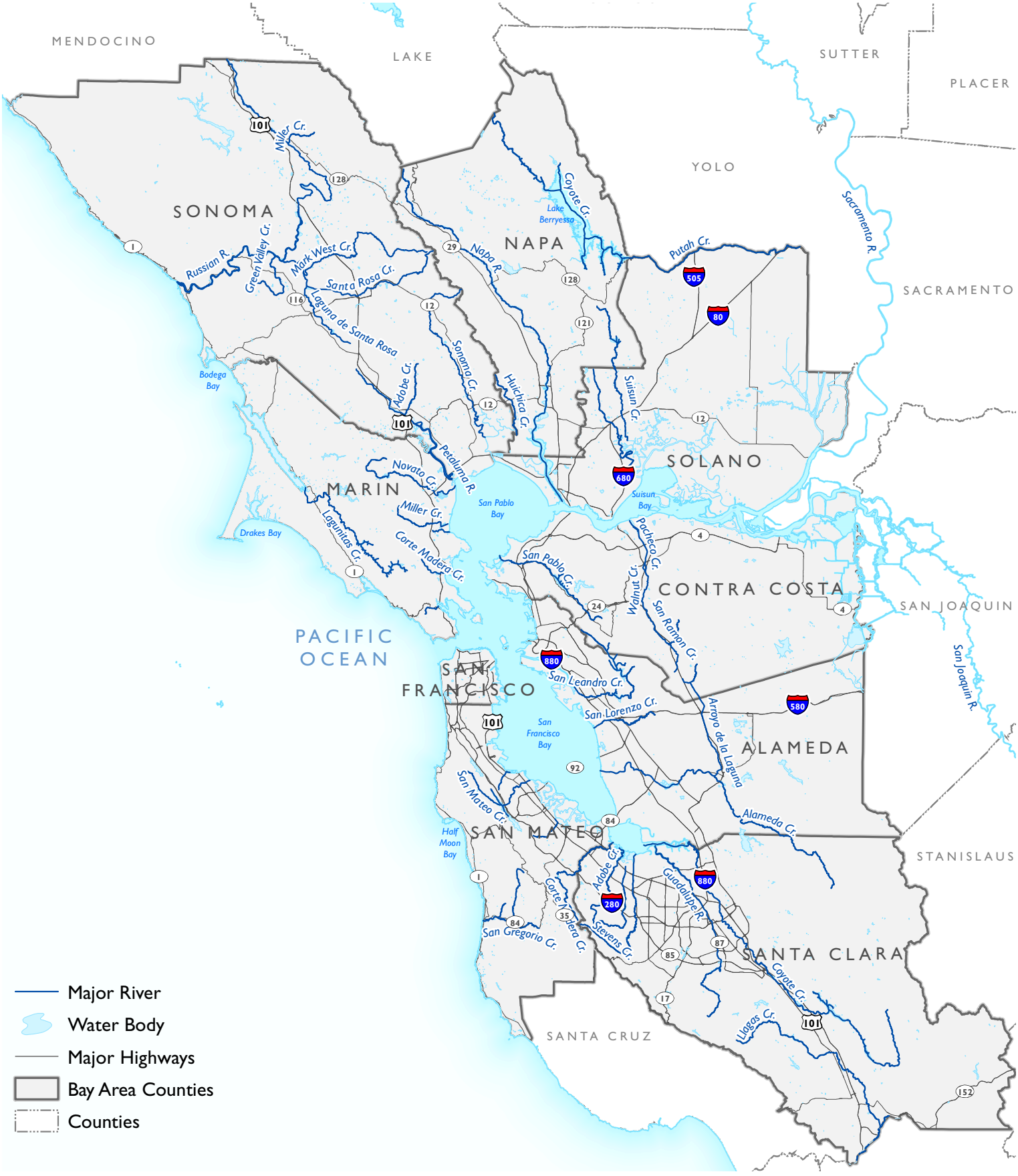
Nonpoint-source pollutants are transported into surface waters through rainfall, air, and other pathways. The nonpoint-source pollutants originate from many diffuse sources and are the leading cause of water quality degradation in the region's waterways. The sources include: pesticides, oils, and other organic materials; pesticide and sediment erosion from agricultural practices; sediment erosion from forestry roads; and pump-out spillages in marinas.

Regionally, stormwater runoff is estimated to contribute more heavy metals to San Francisco Bay than direct municipal and industrial dischargers, as well as significant amounts of motor oil, paints, chemicals, debris, grease, and detergents. Runoff in storm drains may also include pesticides and herbicides from landscaping products and bacteria from animal waste. As point-source discharges of pollution have been brought under control, the regulatory focus has shifted to nonpoint-source discharges.

In addition to the degradation of water quality in many of the region's surface waters, many of the region's creeks are channelized, culverted, or otherwise geomorphically altered, which has had adverse impacts on aquatic and riparian habitats, sediment transfer, and hydrology. There are also water quality impacts in the more rural areas of the region from grazing and agriculture, confined animal facilities, onsite sewage systems, and land conversions. Coastal watersheds are impaired due to impacts from sedimentation and habitat degradation.

Figure 2.8-1

Major Rivers, Creeks, and Other Water Bodies



Data Source: National Hydrography Dataset, 2007; ESA, 2012; Cal-Atlas Geospatial Clearinghouse, 2012; Tom Tom North America, 2011; Dyett & Bhatia, 2012.

0 5 10 20 Miles

1 in = 16 miles

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The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) has classified the San Francisco Bay and many of its tributaries as impaired for various water quality constituents. The Clean Water Act requires that states identify water bodies that do not meet water quality standards (see Regulatory Setting discussion in this chapter). Total Maximum Daily Loads (TMDLs) are action plans to restore clean water by examining these water quality problems, identifying sources of pollutants, and specifying actions that create solutions. Within the Bay Area region, the 2010 303(d) list (as defined below in Regulatory Settings discussion) includes more than 270 listings in 88 water bodies.[2] Water Board staff are currently developing TMDL projects or studies to address more than 160 of these listings. Completed and current TMDL projects in the Bay Area are shown in **Figure 2.8-2** and listed below.[3]

Completed TMDL Projects:

- Guadalupe River Watershed – Mercury
- Napa River –Sediment and Pathogens
- Richardson Bay – Pathogens
- San Francisco Bay – Mercury and PCBs
- Sonoma Creek – Pathogens and Sediment
- Tomales Bay – Mercury and Pathogens
- Urban Creeks – Pesticide Toxicity
- Walker Creek – Mercury

TMDL Projects in Development:

- Butano and Pescadero Creeks – Sediment
- Lagunitas Creek – Sediment
- Napa River – Nutrients
- North San Francisco Bay – Selenium
- San Francisquito Creek – Sediment
- San Pedro Creek and Pacifica State Beach – Indicator Bacteria
- Sonoma Creek –Nutrients
- Suisun Marsh – Low Dissolved Oxygen/Organic Enrichment, Mercury, Nutrients, and Salinity
- Walker Creek – Sediment

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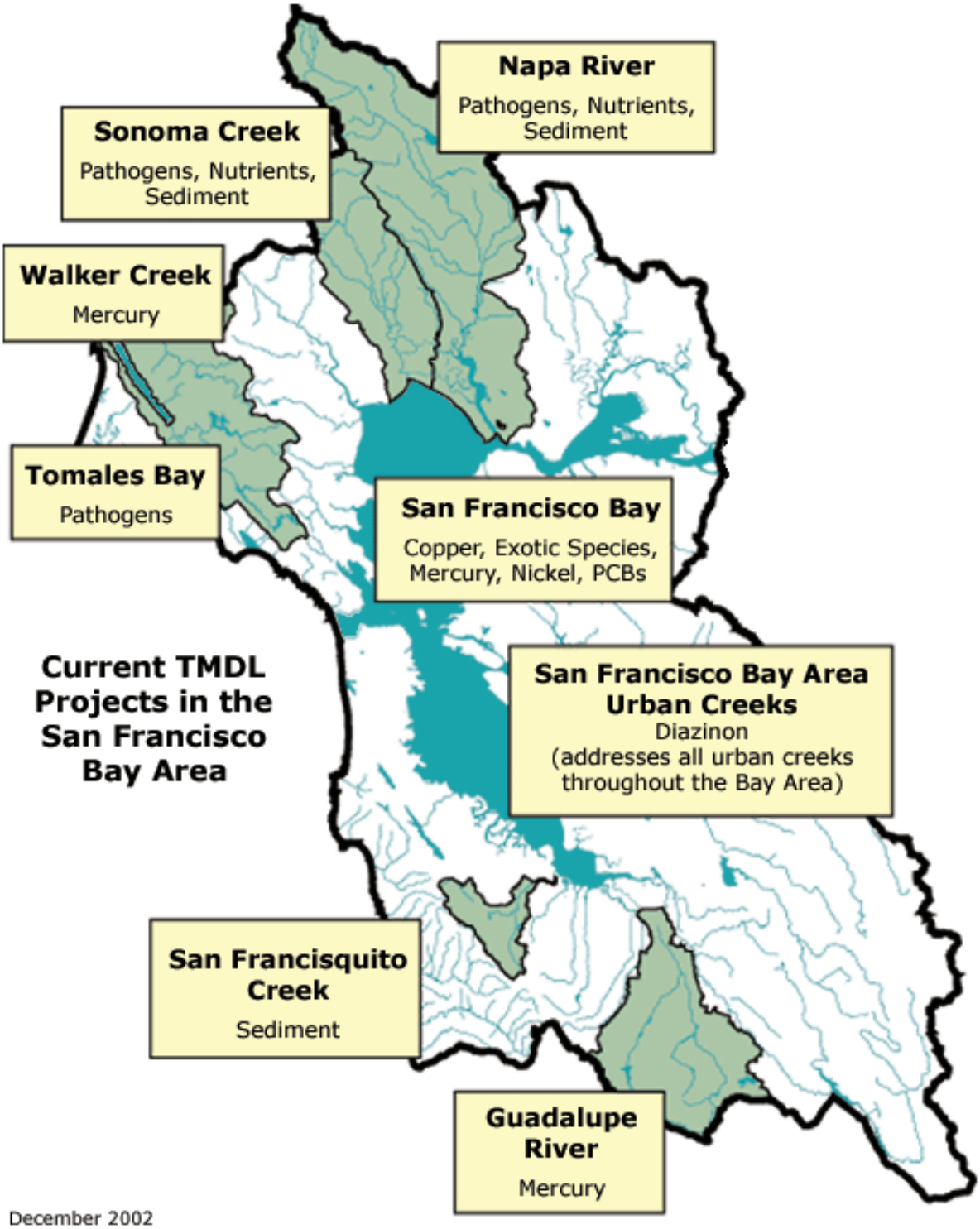
[2] Regional Water Quality Control Board, San Francisco Region (SFRWQCB), *Total Maximum Daily Loads (TMDLs) and the 303(d) List of Impaired Water Bodies*, http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/, accessed August, 7, 2012.

[3] Ibid.

TMDLs account for all pollutant sources, including discharges from wastewater treatment facilities; runoff from homes, agriculture, and streets or highways; "toxic hot spots;" and deposition from the air. The specific urban runoff Best Management Practices (BMPs) and level of implementation that will be required in TMDLs will be determined through TMDL development. The amount of pollution reductions anticipated suggests TMDLs will require significant increases in resources applied to urban runoff control and significant changes in scope and approach to urban runoff control programs.[4]

[4] San Francisco Bay Area Integrated Regional Water Management Plan Coordinating Committee (Coordinating Committee), San Francisco Bay Area IRWM Region, Background Section, also available at http://www.water.ca.gov/irwm/docs/ResourcesLinks/Submitted_Applications/P84_Round1_Planning/MarinMunicipalWaterDistrict/Att3_PG1_WorkPlan_1of2.pdf, September 28, 2010.

Figure 2.8-2: Current TMDL Projects in San Francisco Bay Area



December 2002

Source: SFRWQCB, 2012

Flood Hazards

The San Francisco Bay contains many flat low-lying marginal areas and highly developed valleys with surrounding steep terrain that is conducive to flooding, especially during intense storms. Due to the topography of alluvial plains, floodwaters escaping some stream channels may flow away from the flooding stream, crossing open areas or flowing through city streets until reaching an adjacent watercourse. This type of flooding compounds and exacerbates local flooding that occurs when storm drains and small channel become blocked or surcharged during storms.

Flood protection agencies have constructed major flood protection infrastructure projects along the following waterways to reduce the impacts of flooding[5]:

- Alameda Creek
- Corte Madera Creek
- Coyote Creek
- Guadalupe River
- Napa River
- Novato Creek
- Petaluma River
- San Francisquito Creek

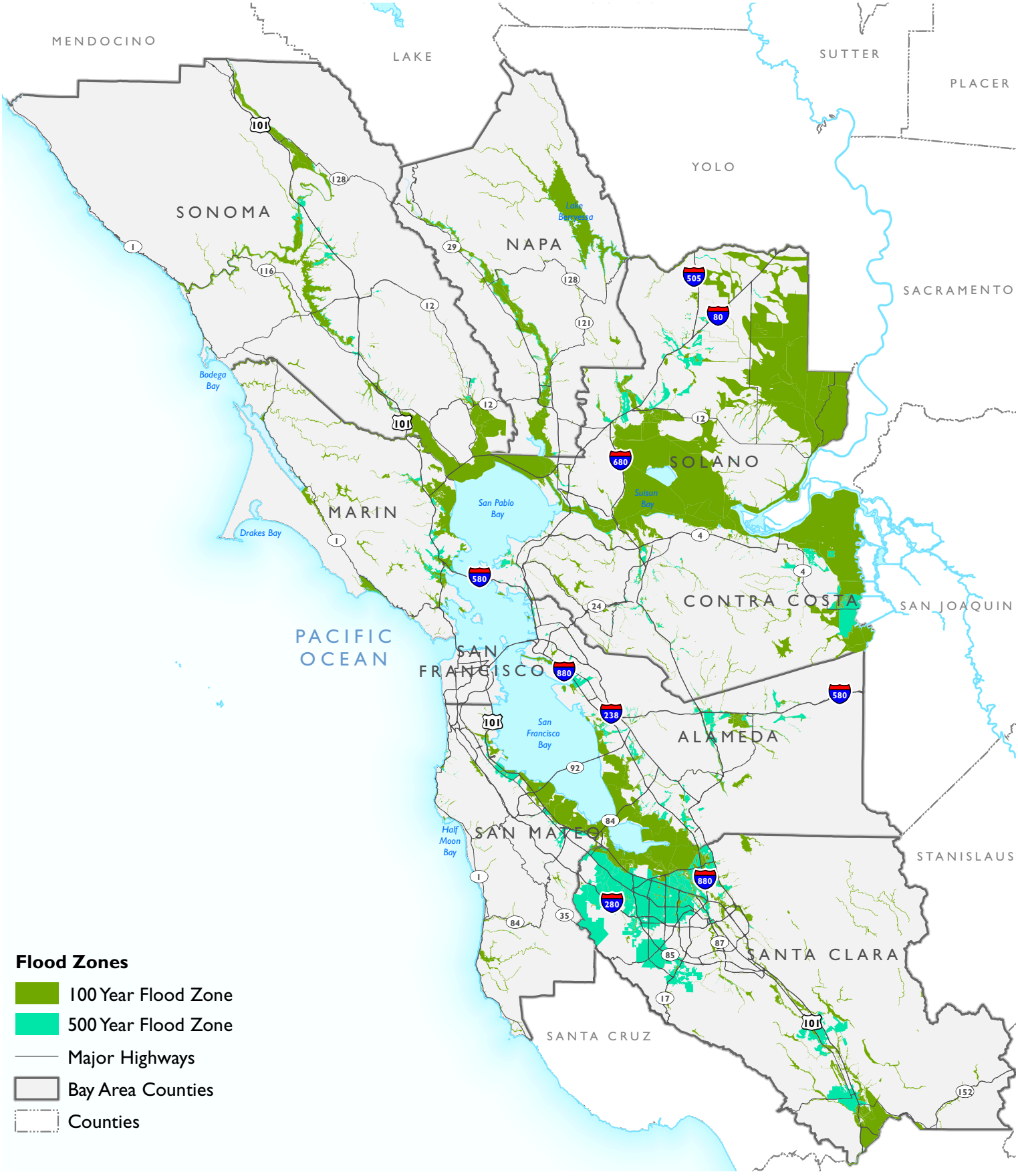
The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program. The program provides subsidized flood insurance to communities that comply with FEMA regulations to limit development in floodplains. FEMA issues Flood Insurance Rate Maps for communities participating in the National Flood Insurance Program. **Figure 2.8-3** identifies federally designated 100-year storm event flood hazard zones in the Bay Area.

FEMA further classifies high risk flood hazard zones for communities that participate in the National Flood Insurance Program where mandatory flood insurance purchase requirements apply, as shown in **Table 2.8-2.**

[5] Ibid.

Figure 2.8-3

Flood Hazard Areas



Data Source: Federal Emergency Management Agency (FEMA), 2007-2010; ESA, 2012;
Cal-Atlas Geospatial Clearinghouse, 2012; Tom Tom North America, 2011; Dyett & Bhatia, 2012.

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TABLE 2.8-2: FLOOD HAZARD ZONE CLASSIFICATION

Zone	*Description*
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
High Risk Coastal Areas	
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.
VE, V1 - 30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

All local jurisdictions regulate development within floodplains. Construction standards are established within local ordinances and planning elements to reduce flood impedance, safety risks, and property damage. Historic floods in the Bay Area have been devastating. In response, local flood control agencies and the U.S. Army Corps of Engineers have established extensive flood control projects, including dams and improved channels many of which continue to be repaired, constructed, and completed. Concrete and riprap levees and river bottoms have significantly reduced riparian habitats throughout the region.

Seiches and Tsunamis

A seiche is defined as a surface water free or standing wave oscillation that is contained within a partially or completely enclosed basin. Seiche is initiated by some event occurring within the enclosed basin – commonly meteorological (e.g., wind or pressure changes), geologic (e.g., earthquake), or other mass movement such as a surface or subsurface landslide, which results in a sloshing of water within the basin as it reflects off the perimeter of the basin. San Francisco Bay is partially enclosed, with outlets to San Pablo Bay, as well as the Pacific Ocean via the Golden Gate, and is relatively shallow, with a mean depth of approximately 27.6 feet.[6] Geologic-induced seiche events have not been documented in San Francisco Bay and meteorological effects are quickly dissipated due to the connection with the Pacific Ocean.

A tsunami is a series of waves generated in a body of water by a rapid disturbance (e.g., submarine seismic, volcanic, or landslide event) that vertically displaces water. Tsunamis affecting the Bay Area can result from offshore earthquakes within the Bay Area or from distant events. While it is most common for tsunamis to be generated by subduction faults such as those in Washington and Alaska, local tsunamis can be generated from strike-slip faults (such as the small one that was triggered by the 1906 San Andreas earthquake). The 1964 Alaska earthquake caused extensive tsunami damage that flooded and heavily damaged coastal northern California near Crescent City. Along the coast of San Francisco, Marin and Sonoma counties, maximum wave heights of 1.1 meters were recorded and no significant damage was experienced during that 1964 event. The 2011 Honshu, Japan, earthquake caused tsunami damage in Santa Cruz, Crescent City, and Berkeley.

REGULATORY SETTING

Federal Regulations

Clean Water Act

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into "waters of the United States." The Act specifies a variety of regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. Some of these tools include:

- Section 303(d) – Total Maximum Daily Loads (TMDLs)
- Section 401 – Water Quality Certification
- Section 402 – National Pollutant Discharge Elimination System (NPDES) Program
- Section 404 – Discharge of Dredge or Fill Material

Section 303(d) requires states, territories, and authorized tribes to develop a list of water-quality limited segments of rivers and other water bodies under their jurisdiction. These waters on the list do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for

[6] Calculated from U.S. Geological Survey. San Francisco Bay Bathymetry 2007. http://sfbay.wr.usgs.gov/sediment/sfbay/geostat.html.

waters on the list and develop action plans, called Total Maximum Daily Loads, to improve water quality. These are action plans designed to improve the quality of water resources. As part of the TMDL process, municipalities must examine the water quality problems and identify sources of pollutants in order to create specific actions designed to improve water quality.

Section 401 requires every applicant for a federal permit or license for any activity that may result in a discharge to a water body to obtain a water quality certification that the proposed activity will comply with applicable water quality standards.

Section 402 regulates point-source discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES) program. In California, the State Water Resources Control Board (State Water Board or SWRCB) oversees the NPDES program, which is administered by the Regional Water Quality Control Boards (RWQCBs). The NPDES program provides for both general permits (those that cover a number of similar or related activities) and individual permits. The NPDES program covers municipalities, industrial activities, and construction activities. The NPDES program includes an industrial stormwater permitting component that covers ten categories of industrial activity that require authorization under an NPDES industrial stormwater permit for stormwater discharges. Construction activities, also administered by the State Water Board, are discussed below. Section 402(p) of the federal Clean Water Act, as amended by the Water Quality Act of 1987, requires NPDES permits for stormwater discharges from municipal separate storm sewer systems (MS4s), stormwater discharges associated with industrial activity (including construction activities), and designated stormwater discharges, which are considered significant contributors of pollutants to waters of the United States. On November 16, 1990, USEPA published regulations (40 CFR Part 122), which prescribe permit application requirements for MS4s pursuant to CWA 402(p). On May 17, 1996, USEPA published an Interpretive Policy Memorandum on Reapplication Requirements for Municipal Separate Storm Sewer Systems, which provided guidance on permit application requirements for regulated MS4s. MS4 permits include requirements for post-construction control of stormwater runoff in what is known as Provision C.3. The goal of Provision C.3 is for the Permittees to use their planning authorities to include appropriate source control, site design, and stormwater treatment measures in new development and redevelopment projects to address both soluble and insoluble stormwater runoff pollutant discharges and prevent increases in runoff flows from new development and redevelopment projects. This goal is to be accomplished primarily through the implementation of low impact development (LID) techniques.

Section 404 establishes a permit program, administered by the United States Army Corps of Engineers (USACE), to regulate the discharge of dredge or fill materials into waters of the U.S., including wetlands. Activities in waters of the U.S. that are regulated under this program include fills for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and conversion of wetlands to uplands for farming and forestry. CWA Section 404 permits are issued by USACE.

Section 10 of the Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act, administered by USACE, requires permits for all structures (such as riprap) and activities (such as dredging) in navigable waters of the U.S.

Executive Order 11990 - Protection of Wetlands

This Executive Order is an overall wetlands policy for all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. This Executive Order requires that when a construction project involves wetlands, a finding must be made by the federal agency that there is no practicable alternative to such construction, and that the proposed action includes all practicable measures to minimize impacts to wetlands resulting from such use.

Executive Order 11988 - Floodplain Management

Executive Order 11988 directs federal agencies to avoid to the extent practicable and feasible short- and long-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Further, this Executive Order requires the prevention of uneconomic, hazardous, or incompatible use of floodplains; protection and preservation of the natural and beneficial floodplain values; and consistency with the standards and criteria of the National Flood Insurance Program (NFIP).

Federal Highway Administration regulations require that a local hydraulic study and risk assessment be performed where a planned facility or action would encroach on a base floodplain or support incompatible floodplain development. When the hydraulic study indicates significant encroachment, findings must be made that it is the only practicable alternative. The hydraulic study and risk assessment protocol are set forth in the Caltrans Highway Design Manual (Caltrans 2010). This manual provides guidance and procedures whenever an encroachment permit is anticipated.

National Flood Insurance Act

The U.S. Congress passed the National Flood Insurance Act (NFIA) in 1968 and the Flood Disaster Protection Act in 1973 to restrict certain types of development on floodplains and to provide for a national flood insurance program (NFIP). The purpose of these acts is to reduce the need for large, publicly funded flood control structures and disaster relief. The NFIP is a federal program administered by the Flood Insurance Administration of FEMA. It enables individuals who have property (a building or its contents) within the 100-year floodplain to purchase insurance against flood losses. Community participation and eligibility, flood hazard identification, mapping, and floodplain management aspects are administered by state and local programs and support directorate within FEMA. FEMA works with the states and local communities to identify flood hazard areas and publishes a flood hazard boundary map of those areas. Floodplain mapping is an ongoing process in the Bay Area and flood maps must be regularly updated for both major rivers and tributaries as land uses and development patterns change.

State Regulations

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act established the State Water Resources Control Board and divided the state into nine regions, each overseen by a regional water quality control board (RWQCB). The nine regional boards have the primary responsibility for the coordination and control of water quality within their respective jurisdictional boundaries. Under the Porter-Cologne Water Quality Control Act, water quality objectives are limits or levels of water quality constituents or characteristics established for the purpose of protecting beneficial uses. The Act requires the RWQCBs to establish water quality objectives while acknowledging that water quality may be changed to some degree without unreasonably affecting beneficial uses. Designated beneficial uses, together with the corresponding water quality

objectives, also constitute water quality standards under the federal Clean Water Act. Therefore, the water quality objectives form the regulatory references for meeting state and federal requirements for water quality control.

Each RWQCB is required to prepare and update a Basin Plan for their jurisdictional area. Pursuant to the CWA NPDES program, the RWQCB also issues permits for point source discharges that must meet the water quality objectives and must protect the beneficial uses defined in the Basin Plan.

Construction General Permit

The California Construction Stormwater Permit (Construction General Permit)[7], adopted by the State Water Resources Control Board, regulates construction activities that include clearing, grading, and excavation resulting in soil disturbance of at least one acre of total land area. The Construction General Permit authorizes the discharge of stormwater to surface waters from construction activities. It prohibits the discharge of materials other than stormwater and authorized non-stormwater discharges and all discharges that contain a hazardous substance in excess of reportable quantities established at 40 Code of Federal Regulations 117.3 or 40 Code of Federal Regulations 302.4, unless a separate NPDES Permit has been issued to regulate those discharges.

The Construction General Permit requires that all developers of land where construction activities will occur over more than one acre do the following:

- Complete a Risk Assessment to determine pollution prevention requirements pursuant to the three Risk Levels established in the General Permit;
- Eliminate or reduce non-stormwater discharges to storm sewer systems and other waters of the Nation;
- Develop and implement a Stormwater Pollution Prevention Plan (SWPPP), which specifies Best Management Practices that will reduce pollution in stormwater discharges to the Best Available Technology Economically Achievable/Best Conventional Pollutant Control Technology standards; and
- Perform inspections and maintenance of all BMPs.

In order to obtain coverage under the NPDES Construction General Permit, the Legally Responsible Person must electronically file all Permit Registration Documents with the SWRCB prior to the start of construction. Permit Registration Documents must include:

- Notice of Intent;
- Risk Assessment;
- Site Map;

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[7] *General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities,* Order No. 2009-0009-DWQ, as amended by Order No. 2010-0014-DWQ, National Pollutant Discharge Elimination System No. CAS000002.

- SWPPP;
- Annual Fee; and
- Signed Certification Statement.

Typical BMPs contained in Stormwater Pollution Prevention Plans are designed to minimize erosion during construction, stabilize construction areas, control sediment, control pollutants from construction materials, and address post construction runoff quantity (volume) and quality (treatment). The Stormwater Pollution Prevention Plan must also include a discussion of the program to inspect and maintain all BMPs.

Caltrans NPDES Permit

Caltrans was originally issued a statewide NPDES permit (Order 99-06-DWQ) in 1999, which requires Caltrans to regulate nonpoint source discharge from its properties, facilities, and activities. The Caltrans permit requires development of a program for communication with local agencies, and coordination with other MS4 programs where those programs overlap geographically with Caltrans facilities. As part of the permit, Caltrans is required to create and annually update a Stormwater Management Plan (SWMP) that is used to outline the regulation of pollutant discharge caused by current and future construction and maintenance activities. SWMP requirements apply to discharges from Caltrans stormwater conveyances, including catch basins and drain inlets, curbs, gutters, ditches, channels, and storm drains. The SWMP applies to discharges consisting of stormwater and non-stormwater resulting from the following:

- Maintenance and operation of state-owned highways, freeways, and roads;
- Maintenance facilities;
- Other facilities with activities that have the potential for discharging pollutants;
- Permanent discharges from subsurface dewatering;
- Temporary dewatering; and
- Construction activities.

The discharges addressed by the SWMP flow through municipal stormwater conveyance systems or flow directly to surface water bodies in the state. These surface water bodies include creeks, rivers, reservoirs, lakes, wetlands, lagoons, estuaries, bays, and the Pacific Ocean and tributaries.

This SWMP applies to the oversight of outside agencies' or non-Caltrans entities' (third parties) activities performed within Caltrans' MS4 to ensure compliance with stormwater regulations. Non-Caltrans activities include highway construction and road improvement projects, as well as residential use and business operations on leased property.

The SWMP must be approved by the SWRCB and, as specified in the permit, it is an enforceable document. Compliance with the permit is measured by implementation of the SWMP. Caltrans' policies, manuals, and other guidance related to stormwater are intended to facilitate implementation of the SWMP. Caltrans also requires all contractors to prepare and implement a program to control water pollution effectively during the construction of all projects.

In lieu of the more recently adopted General Construction Permit as described above, Caltrans continues to modify its current policies and procedures to be consistent with the new permit.

Cobey-Alquist Floodplain Management Act

The Cobey-Alquist Floodplain Management Act (California Water Code 8400-8415) and Executive Order B-39-77 give support to the National Flood Insurance Program. The Act encourages local governments to plan, adopt, and enforce land use regulations for floodplain management, in order to protect people and property from flooding hazards. The Act also identifies requirements that jurisdictions must meet in order to receive State financial assistance for flood control. In 2002, the California Floodplain Management Task Force created and recommended a proposed revised Executive Order for the State's consideration.

California Department of Fish and Wildlife

The California Department of Fish and Wildlife is responsible for conserving, protecting, and managing California's fish, wildlife, and native plant resources. To meet this responsibility, the Fish and Game Code (Section 1602) requires an entity to notify the Department of any proposed activity that may substantially modify a river, stream, or lake. Notification is required by any person, business, state or local government agency, or public utility that proposes an activity that will:

- Substantially divert or obstruct the natural flow of any river, stream or lake;
- Substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake; or
- Deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake.

The notification requirement applies to any work undertaken in or near a river, stream, or lake that flows at least intermittently through a bed or channel. This includes ephemeral streams, desert washes, and watercourses with a subsurface flow. It may also apply to work undertaken within the flood plain of a body of water.

Regional and Local Regulations

McAteer-Petris Act / San Francisco Bay Conservation and Development Commission

The McAteer-Petris Act is a provision under California law that preserves San Francisco Bay from indiscriminate filling. The Act established the San Francisco Bay Conservation and Development Commission (BCDC) as the agency charged with preparing a plan for the long-term use of the Bay and regulating development in and around the Bay while the plan was being prepared. The San Francisco Bay Plan, completed in January 1969, includes policies on 18 issues critical to the wise use of the bay, ranging from ports and public access to design considerations and weather. The McAteer-Petris Act authorizes BCDC to incorporate the policies of the Bay Plan into state law. The Bay Plan has two features: policies to guide future uses of the bay and shoreline, and maps that apply these policies to the bay and shoreline. BCDC conducts the regulatory process in accordance with the Bay Plan policies and maps, which guide the protection and development of the bay and its tributary waterways, marshes, managed wetlands, salt ponds, and shoreline.

General Plan Safety Elements

Government Code Section 65302, as amended (2007 Cal. Stat. 369) requires that on or after January 1, 2009, the updated safety elements of general plans must incorporate significantly enhanced geographic data, goals, and policies related to flood hazards. This enhanced assessment of flood hazards will include, but is not limited to: flood mapping information from multiple agencies including FEMA, the Army Corps of Engineers, the Office of Emergency Services, the Department of Water Resources, and any applicable regional dam, levee, or flood protection agencies; historical data on flooding; an inventory of existing and planned development (including transportation infrastructure) in flood zones; and new policies that comprehensively address existing and future flood risk in the planning area.

Impact Analysis

SIGNIFICANCE CRITERIA

Implementation of the proposed Plan would have a potentially significant adverse impact on water resources in the Bay Area if it would:

Criterion 1: Violate any water quality standards or waste or stormwater discharge requirements.

Criterion 2: Substantially interfere with or reduce rates of groundwater recharge due to the increased amount of impervious surfaces, such that there would be a net deficit in aquifer volume or a lowering of the groundwater table.

Criterion 3: Increase erosion by altering the existing drainage patterns of a site, contributing to sediment loads of streams and drainage facilities, and thereby affecting water quality.

Criterion 4: Increase non-point pollution of stormwater runoff due to litter, fallout from airborne particulate emissions, or discharges of vehicle residues, including petroleum hydrocarbons and metals, that would impact the quality of receiving waters.

Criterion 5: Increase non-point-source pollution of stormwater runoff from construction sites due to discharges of sediment, chemicals, and wastes to nearby storm drains and creeks.

Criterion 6: Increase rates and amounts of runoff due to additional impervious surfaces, higher runoff values for cut-and-fill slopes, or alterations to drainage systems that could cause potential flood hazards and effects on water quality.

Criterion 7: Place within a 100-year flood hazard area structures which would impede or redirect flows.

Criterion 8: Expose people to a significant risk of loss, injury, or death involving flooding (including flooding as a result of the failure of a levee or dam), seiche, tsunami, or mudflow.

METHOD OF ANALYSIS

This is a program-level analysis of potential impacts associated with hydrological resources in the Bay Area. Impacts are determined for the proposed Plan as a whole, including land use development projects and specific transportation projects involving new construction as compared to existing conditions (2010). Projects and proposed new land uses are analyzed based upon their location relative to surface

water bodies, 100-year floodplains, and impaired water bodies. Those projects that conflict with these resources in terms of water quality and also quantity are determined to potentially result in significant hydrologic impacts.

SUMMARY OF IMPACTS

Impacts on water resources are associated with future land development and with transportation improvements under the proposed Plan that could have the potential to impact water quality, reduce groundwater recharge, alter drainage patterns, create higher erosion rates, increase non-point pollution, increase runoff, and increase exposure to floods. Under the proposed Plan, future land development is focused in Priority Development Areas (PDAs), meaning new development will largely occur in urbanized areas already covered by impervious surfaces. However, some new development in PDAs, as well as much development outside of PDAs including transportation projects, is likely to result in creation of additional impervious surfaces. The resulting changes in drainage patterns can have effects both as a potential source of new pollution in stormwater runoff and increased runoff volumes and rates. Increased runoff could also lead to increased flooding hazards if infrastructure is not sized to accommodate the additional flows or exacerbate existing problem areas.

Projects that do not include the construction of infrastructure, such as land designation changes (e.g., General Plan revision or rezoning), alteration of bus line schedules or routes, local road maintenance, wheelchair curb ramps, or traffic light coordination would utilize existing transportation infrastructure and would not alter drainage patterns. Other projects would involve new development in areas served by existing infrastructure and may need to accommodate changes in drainage patterns. Potential changes to short or long-term stormwater runoff originating from these activities are therefore negligible. The creation of new impervious surfaces associated with construction projects and the subsequent changes to the quality and volume of stormwater runoff could result in water quality impacts.

Exposure to seiches, tsunamis, and mudflow as a result of the proposed Plan is anticipated to be minimal.

Direct Impacts

Implementation of the proposed Plan could result in both short-term and long-term impacts on water resources. Short-term impacts would be temporary and generally related to construction activities, which could result in erosion of disturbed soils and sedimentation effects on receiving water bodies. Long-term effects would be related to the intensification of regional urban uses associated with the creation of new impervious surfaces through residential and non-residential development, expansion of roadways, and other proposed transportation improvements. Runoff from new structures and facilities could increase non-point-source pollutant concentrations in stormwater regionally, as well as in groundwater basins through infiltration. The creation of new impervious surfaces could also decrease the amount of precipitation that filters into the ground. In addition to water quality impacts, the proposed Plan may also affect flooding, as increased runoff associated with paving may contribute to downstream flooding hazards and some projects are located in 100-year flood hazard areas.

Indirect Impacts

The projected population increase in the Bay Area will result in more residents and increased travel on all modes of transportation. As a result, there would be an increased risk of exposure of people and property to the potentially damaging effects of flooding if not managed appropriately. Long-term effects on water

quality of receiving waters could also adversely affect beneficial uses of hydrological resources in the Planning Area. In general, the indirect impacts from the proposed Plan are essentially the same as the direct impacts outlined above.

IMPACTS AND MITIGATION MEASURES

Impact

2.8-1: Implementation of the proposed Plan could violate water quality standards or waste or stormwater discharge requirements.

Impacts of Land Use Projects

Land development under the proposed Plan would likely result in incremental increases in the amount of impervious surfaces in the region, such as new paved areas, building rooftops, parking lots, etc. This increase in the amount of impervious surface has the potential to generate additional stormwater pollution in runoff during storm events and could therefore present the potential for accumulation and release of petroleum hydrocarbons, lubricants, sediments, and metals (generated by the wear of automobile parts), which if not managed appropriately could violate water quality standards. The management of landscaped areas would also present the potential for increased runoff and infiltration of herbicides and pesticides into groundwater.

These types of common urban pollutants could be transported in runoff, washed by rainwater from rooftops and landscaped areas into onsite and local drainage networks, and potentially adversely affecting the quality of receiving surface waters or groundwater.

Pollutant concentrations in runoff from a site depend on numerous factors, including:

- Land use conditions;
- Implementation of best management practices (BMPs);
- Site drainage conditions;
- Intensity and duration of rainfall; and
- Climatic conditions preceding a rainfall event.

In general, existing local stormwater management plans and policies and State Water Board requirements, which implement federal Clean Water Act requirements, would prevent these potential impacts from rising to a level of significance through regulations that minimize the creation of pollution generating surfaces. Clean Water Act Section 402 NPDES MS4 Phase I and Phase II permits, which cover all jurisdictions as well as large institutional users, require stormwater management plans, which in turn require source and treatment control measures. In many cases, stormwater drainage control/LID measures and compliance with RWQCB Municipal Regional Stormwater Permit Order No. 2011-0083 Provision C.3 (Provision C.3) may already be required by local jurisdictions as standard conditions of approval for building permit applications.

Because individual projects under the proposed Plan have the potential to adversely affect water quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described below.

Impacts of Transportation Projects

Transportation projects would include a variety of improvements such as new express lanes, auxiliary lanes, roadway widening, increased transit service, and other maintenance and rehabilitation projects that would increase the amount of impervious surface in the region. Transportation projects would require similar drainage control measures as those described above for land use projects, including LID measures. Projects such as the creation of express lanes, or repaving projects where there is no substantial change in the drainage patterns or exposure to stormwater pollutants, would have no effect on water quality in stormwater runoff. New impervious surfaces required for streets or highways could have minor effects on the receiving waters, water that filters into the ground, and groundwater basins, all of which could be affected by pollutants in the runoff from proposed future projects.

Because individual projects under the proposed Plan have the potential to adversely affect water quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described below.

Combined Effects

The combined effects of the land use and transportation projects would likely result in a net increase of impervious surfaces that would have the potential to increase stormwater pollutants in runoff. Therefore, the proposed Plan would have a potentially significant (PS) impact. Mitigation Measure 2.8(a) is discussed below.

Mitigation Measures

Implementing agencies and/or project sponsors shall consider implementation of mitigations measures including but not limited to those identified below.

2.8(a) To reduce the impact associated with potential water quality standards violations or waste or stormwater discharge requirement violations, implementing agencies shall require project sponsors to comply with the State, and federal water quality regulations for all projects that would alter existing drainage patterns in accordance with the relevant regulatory criteria including but not limited to the National Pollution Discharge Elimination System (NPDES) program, Provision C.3, and any applicable Stormwater Management Plans. Erosion control measures shall be consistent with NPDES General Construction Permit requirements including preparation and implementation of a Stormwater Pollution Prevention Plan, and final drainage plans shall be consistent with the San Francisco Regional MS4 NPDES permit or any applicable local drainage control requirements that exceed or reasonably replace any of these measures to project receiving waters from pollutants.

Implementing agencies shall require project sponsors to commit to best management practices (BMPs) that would minimize or eliminate existing sources of polluted runoff during both construction and operational phases of the project. Implementing agencies shall require projects to comply with design guidelines established in the Bay Area Stormwater Management Agencies Association's *Using Start at the Source to Comply with Design Development Standards* and the California Stormwater Quality Association's *California Stormwater Best Management Practice Handbook for New Development and Redevelopment* to minimize both increases in the volume and rate of stormwater runoff, and the amount of pollutants entering the storm drain system. For the purposes of this mitigation, less than significant means consistent with federal, state, and local regulations and laws related to water quality or stormwater management.

Mitigation measures that shall be considered by implementing agencies and/or project sponsors where feasible based on project-and site-specific considerations include, but are not limited to:

Construction

- Limiting excavation and grading activities to the dry season (April 15 to October 15) to the extent possible in order to reduce the chance of severe erosion from intense rainfall and surface runoff, as well as the potential for soil saturation in swale areas.
- Regulating stormwater runoff from the construction area through a stormwater management/erosion control plan that may include temporary on-site silt traps and/or basins with multiple discharge points to natural drainages and energy dissipaters if excavation occurs during the rainy season. This control plan should include requirements to cover stockpiles of loose material, divert runoff away from exposed soil material, locate and operate sediment basin/traps to minimize the amount of offsite sediment transport, and removing any trapped sediment from the basin/ trap for placement at a suitable location on-site, away from concentrated flows, or removal to an approved disposal site.
- Providing temporary erosion control measures until perennial revegetation or landscaping is established and can minimize discharge of sediment into receiving waterways.
- Providing erosion protection on all exposed soils either by revegetation or placement of impervious surfaces after completion of grading. Revegetation shall be facilitated by mulching, hydroseeding, or other methods and initiated as soon as possible after completion of grading and prior to the onset of the rainy season (by October 15).
- Using permanent revegetation/landscaping, emphasizing drought-tolerant perennial ground coverings, shrubs, and trees.
- Ensuring BMPs are in place and operational prior to the onset of major earthwork on the site. The construction phase facilities shall be maintained regularly and cleared of accumulated sediment as necessary.
- Storing hazardous materials such as fuels and solvents used on the construction sites in covered containers and protected from rainfall, runoff, and vandalism. A stockpile of spill cleanup materials shall be readily available at all construction sites. Employees shall be trained in spill prevention and cleanup, and individuals should be designated as responsible for prevention and cleanup activities.

Operation

- Designing drainage of roadway and parking lot runoff, wherever possible to run through grass median strips which are contoured to provide adequate storage capacity and to provide overland flow, detention, and infiltration before runoff reaches culverts, or into detention basins. Facilities such as oil and sediment separators or absorbent filter systems should be designed and installed within the storm drainage system to provide filtration of stormwater prior to discharge and reduce water quality impacts whenever feasible.
- Implementing an erosion control and revegetation program designed to allow re-establishment of native vegetation on slopes in undeveloped areas as part of the long-term sediment control plan.

- Using alternate discharge options to protect sensitive fish and wildlife populations in areas where habitat for fish and other wildlife would be threatened by transportation facility discharge. Maintenance activities over the life of the project shall include use of heavy-duty sweepers, with disposal of collected debris in sanitary landfills to effectively reduce annual pollutant loads where appropriate. Catch basins and storm drains shall be cleaned and maintained on a regular basis.
- Using Integrated Pest Management techniques (methods that minimize the use of potentially hazardous chemicals for landscape pest control and vineyard operations) in landscaped areas. The handling, storage, and application of potentially hazardous chemicals shall take place in accordance with all applicable laws and regulations.

Significance after Mitigation

As required by Provision C.3, new development in the region that would introduce 10,000 or more square feet of new impervious surfaces must incorporate LID strategies—such as stormwater reuse, onsite infiltration, and evapotranspiration—as initial stormwater management strategies. Secondary methods that could be incorporated include the use of natural, landscape based stormwater treatment measures, as identified by Provision C.3. Stormwater treatment measures may also be required in the final design plans in accordance with local stormwater management plans. The treatment measures may vary from "local" improvements at individual building sites to "area wide" concepts such as stormwater treatment wetlands with large open space areas. Treatment control measures may include use of vegetated swales and buffers, grass median strips, detention basins, wet ponds, or constructed wetlands, infiltration basins, and other measures. Filtration systems may be either mechanical (e.g., oil/water separators) or natural (e.g., bioswales and settlement ponds).

Redevelopment projects may result in improved water quality compared to existing conditions where existing development was constructed under older, less stringent stormwater requirements. Selection and implementation of LID measures (such as those required by NPDES Provision C.3) would occur on a project-by-project basis depending on project size and stormwater treatment needs as required to meet NPDES or any other local permitting requirements.

Such stormwater quality measures are also required for Regulated Projects-Special Land Use Category (uncovered parking structures, restaurants, auto service, and auto gasoline facilities) that would construct 5,000 or more square feet of uncovered parking lots that are stand-alone or part of any other development project. In addition, Provision C.3 of the regional NPDES permit requires that projects with more than one acre of impervious surface submit a hydromodification plan to demonstrate that development would not increase long-term runoff rates on a property beyond existing conditions.

Transportation projects that fall under Caltrans jurisdiction would be covered by the Caltrans NPDES Stormwater Program. As described in the Regulatory Setting section above, this NPDES permit regulates all stormwater discharges from Caltrans-owned conveyances, maintenance facilities and construction activities. Caltrans also has a Stormwater Management Plan that describes the procedures and practices used to reduce or eliminate the discharge of pollutants to storm drainage systems and receiving waters. Guidance documents have also been developed by Caltrans to implement stormwater BMPs in the design, construction and maintenance of highway facilities.

Transportation projects where local agencies are the lead agency are subject to local and State regulations for post-construction runoff management requirements. The NPDES permit requirements described

above also apply to transportation impacts (project design including general site design control measures, LID features, treatment control measures, ordinances and regulations to reduce the discharge of sediments and other pollutants).

To the extent that an individual project adopts all feasible mitigation measures described above, the impact would be less than significant (LS). Projects taking advantage of CEQA Streamlining provisions of SB 375 (Public Resources Code sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measure(s) described above to address site-specific conditions. Further, because the measure is tied to existing regulations that are law and binding on responsible agencies and project sponsors, it is reasonable to determine that they would be implemented. Therefore, with the incorporation of mitigation measure 2.8(a), the impact is found to be less than significant with mitigation (LS-M).

Impact

2.8-2: Implementation of the proposed Plan could substantially interfere with or reduce rates of groundwater recharge due to the increased amount of impervious surfaces, such that there could be a net deficit in aquifer volume or a lowering of the groundwater table.

Impacts of Land Use Projects

Regional development associated with the proposed Plan may result in the addition of new impervious surface areas. Increasing the total area of impervious surfaces can result in a reduction in the amount of precipitation infiltrating into underlying groundwater resources. Infiltration rates can vary widely and largely depend on the characteristics of the exposed overlying soils and vegetation. In general, sandy soils have higher infiltration rates and can contribute to significant amounts of ground water recharge; clay soils tend to have lower percolation potentials; and impervious surfaces such as pavement substantially reduce infiltration capacity.

Most future land development under the proposed Plan is anticipated to occur within PDAs. In general, the PDAs are located in urbanized areas and likely to already be widely covered by impervious surfaces, although some development may be located on areas that are currently permeable (e.g., open space, vacant lots, etc.), both inside and outside of PDAs.

Many PDAs—as well as much of the non-PDA development expected—are located within developed areas (e.g., San Francisco, much of Contra Costa, San Mateo, and Alameda counties) where groundwater is not used as a water supply source but is considered by the RWQCB as a potential resource. In the Planning Area, groundwater use only accounts for about five percent of the total water usage. Generally, where groundwater is used for supply purposes the water accessed is relatively deep and associated designated groundwater recharge areas are not available for future development. However, for the bulk of the Planning Area, many of the aquifers are relatively thin and intrusion of brackish Bay water has affected water quality that precludes use of the aquifers as a reliable water supply resource. The larger groundwater basins in the region, including Santa Clara Valley, Napa-Sonoma Valley, and Petaluma Valley, do represent areas where groundwater supplies are an important source of water supply that would generally be more sensitive to alterations in groundwater recharge.

As new development and redevelopment occurs, on-site drainage plans would be designed to retain, capture and convey increased runoff in accordance with the local city or county design standards (e.g.,

Alameda Countywide Clean Water Program, Contra Costa Clean Water Program, Santa Clara Clean Water Program, etc.) and State requirements such as Provision C.3 site control features. These requirements generally require or encourage the use of LID features such as vegetated swales, permeable paving, use of landscaping for infiltration, and other measures that would retain runoff as much as possible and allow for onsite infiltration.

Therefore, considering the existing level of development, the fact that groundwater use only accounts for five percent of the total water usage, and the regulatory framework that currently exists for new development, the potential to interfere with groundwater recharge from implementation of the proposed Plan at the regional and local level is considered less than significant (LS) for Impact 2.8-2. No mitigation is required.

Impacts of Transportation Projects

As stated in Impact 2.8-1, the proposed transportation projects may result in some increases in impervious surfaces. However, many of the proposed transportation facilities already are located on or adjacent to existing highways, streets, and roads in which most of the surfaces are already paved or impervious. In addition, extensive storm drainage systems present in these areas currently intercept rainfall and runoff waters, thus limiting the amount of groundwater recharge that occurs. Local agency standards (e.g., Alameda Countywide Clean Water Program, Contra Costa Clean Water Program, Santa Clara Clean Water Program, as well as any City drainage control requirements) and Caltrans standards, combined with State and federal regulations and BMPs, require drainage studies for transportation projects. These studies address drainage issues, including incorporation of infiltration systems where appropriate to limit offsite runoff volumes.

Therefore, considering that most of the transportation projects would occur on existing impervious surfaces, only five percent of water usage comes from groundwater supplies, and the existing regulatory requirements, the potential to interfere with groundwater recharge from implementation of the proposed Transportation projects at the regional and local level is considered less than significant (LS) for Impact 2.8-2. No mitigation is required.

Combined Effects

The combined effects of land development and transportation projects would likely increase the total amount of impervious surfaces in the region and as a result reduce the amount of precipitation that is available for groundwater recharge. However, existing regulatory requirements at the local, State, and federal level include measures to minimize any increases in offsite stormwater runoff through encouraging onsite infiltration, which would minimize the potential reduction in groundwater recharge. Therefore, the proposed Plan would have a less than significant impact (LS). No mitigation is required.

Mitigation Measures

None required.

Impact

2.8-3: Implementation of the proposed Plan could increase erosion by altering the existing drainage patterns of a site, contributing to sediment loads of streams and drainage facilities, and thereby affecting water quality.

Impacts of Land Use Projects

As noted above, implementation of the proposed Plan would result in new development concentrated within PDAs. New development will not necessarily substantially alter the existing drainage pattern, especially in urbanized areas where the PDAs are generally located. Some development will also occur outside of PDAs, and in some cases outside of urbanized areas. The proposed growth in either urbanized or non-urbanized areas would not result in substantially increased rates of stormwater runoff in a manner that could result in substantial erosion or siltation because of federal, State, and local regulations described above under Impact 2.8-1.

The potential for increased erosion is typically highest during the construction phase of development or redevelopment when underlying soils or vegetated soils can become exposed to the effects of wind and water erosion. If not protected, these exposed soils can cause sedimentation of stormwater runoff that adversely affects receiving waters. In order to receive an NPDES Construction General Permit (as described below in Impact 2.8-5 and in the Regulatory Setting), project proponents must develop a stormwater pollution prevention plan with appropriate erosion control BMPs that are proven measures designed to minimize sedimentation of stormwater runoff.

In general, the PDAs are located within urbanized areas that are already currently urbanized, where it is unlikely that there would be substantial exposed soil that is subject to erosion. Areas outside of PDAs would still be required to adhere to erosion control requirements and drainage control requirements such as those administered under the NPDES program. NPDES MS4 permittees must develop standard urban runoff mitigation plans and manuals that continue to control stormwater runoff once projects are constructed such that sedimentation is minimized. Local stormwater management plans and manuals specify BMPs and additional regulations to mitigate runoff, further reducing the likelihood of substantial erosion or siltation.

In addition, NPDES Provision C.3 requirements address post-construction drainage control requirements that address not only the water quality of stormwater runoff but also reducing the volume of offsite flows, which can be effective in reducing the sedimentation effects of downstream receiving waters. The requirements are intended to address nonpoint source pollution through implementation of BMPs, regulatory based encouragement of BMPs, and adopted effluent limits. Project proponents are required to plan, design, and develop sites to: (1) Protect areas that provide important water quality benefits, necessary to main riparian and aquatic biota, and/or are particularly susceptible to erosion and sediment loss; (2) Limit increases of impervious areas; (3) Limit land disturbance activities such as clearing and grading, and cut-and-fill to reduce erosion and sediment loss; (4) Limit disturbance of natural drainage features and vegetation; and (5) Reduce erosion and, to the extent practicable, retain sediment on site during and after construction.

For some projects, NPDES permits and regulations include hydromodification requirements where project proponents must study the potential impacts of proposed channelization and channel modification, and then develop and implement plans to protect against undesirable impacts, including erosion.

At the regional and local level, implementation of the proposed Plan would result in new development and redevelopment that would have the potential to disturb underlying soils and result in changes to existing drainage patterns. Because individual projects under the proposed Plan have the potential to

adversely affect water quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Impacts of Transportation Projects

Not all of the transportation projects would involve earthwork activities and some, such as changes to HOV and HOT lane designations, would have no changes to drainage patterns when compared to existing conditions. Transportation projects that would have the potential to alter drainage patterns, such as road widening or construction of other additional impervious surfaces, would be subject to local, regional and state requirements such as local Stormwater Drainage Master Plans, regional MS4 permit requirements and any Caltrans drainage requirements that would include BMPs and drainage requirements that minimize exposed soils and the potential for offsite transport of sediments.

Because individual transportation projects have the potential to adversely affect water quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Combined Effects

The combined effects of the land development and transportation projects would have the potential to result in changes in the existing drainage patterns. Because individual projects under the Plan have the potential to adversely affect water quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Mitigation Measures

Implement Mitigation Measure 2.8(a).

Significance After Mitigation

To the extent that an individual project adopts all feasible mitigation measures described above, the impact would be less than significant (LS). Projects taking advantage of CEQA Streamlining provisions of SB 375 (Public Resources Code sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measure(s) described above to address site-specific conditions. Further, because the measure is tied to existing regulations that are law and binding on responsible agencies and project sponsors, it is reasonable to determine that they would be implemented. Therefore, with the incorporation of mitigation measure 2.8(a), the impact is found to be less than significant with mitigation (LS-M).

Impact

2.8-4: Implementation of the proposed Plan could increase non-point pollution of stormwater runoff due to litter, fallout from airborne particulate emissions, or discharges of vehicle residues, including petroleum hydrocarbons and metals that would impact the quality of receiving waters.

Impacts of Land Use Projects

Development associated with implementation of the proposed Plan would result in a net increase in the area of paved and other impervious surfaces (structures, rooftops, parking lots, etc.). Construction of the proposed projects combined with an increase in overall regional traffic could increase non-point pollutant

concentrations in stormwater regionally. These nonpoint source pollutants could include oil and grease, petroleum hydrocarbons, and metals that would be transported by stormwater runoff to receiving water bodies.

As discussed above, operational phases of new development and redevelopment generally require drainage control measures in accordance with local, State, and federal regulatory requirements. These requirements include measures to limit the potential sources of pollution in non-point stormwater runoff sources as well as point sources. Post-construction measures that are required under Provision C.3 of the regional NPDES MS4 permit would include implementation of LID drainage control features. These source control measures could include incorporation of permeable paving, vegetated swales, rooftop gardens, infiltration retention basins, and other features that have proven successful in minimizing pollution of stormwater runoff and protecting receiving waters. For redevelopment projects, implementation of LID source control drainage features could represent an improvement over existing stormwater drainage infrastructure. Without such measures, new development and redevelopment could create new sources of non-point pollution in stormwater runoff.

Because individual projects under the proposed Plan have the potential to adversely affect water quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Impacts of Transportation Projects

Transportation projects under the proposed Plan would result in a net increase in the area of paved surfaces (roads, transit stations, park and ride lots, etc.). Construction of the proposed projects combined with increased overall regional traffic could increase non-point pollutant concentrations in stormwater regionally. The paving required for highway projects could also have minor effects on the amount of surface water that filters into the ground, and groundwater basins could be affected by pollutants in the runoff from proposed transportation facilities. These non-point pollutants could include oil and grease, petroleum hydrocarbons, and metals that could be transported by stormwater runoff to receiving water bodies. As new roads, lanes, or other new impervious surfaces are added to accommodate projected additional vehicular traffic, the potential also increases for associated stormwater pollutants to enter receiving waters of the Bay Area.

As mentioned above, and in Impact 2.8-1, operational phases of new transportation projects generally require drainage control measures in accordance with local, state, and federal regulatory requirements. These requirements include measures to limit the potential sources of pollution from both non-point and point sources of stormwater runoff. The NPDES permit requirements described in the land use discussion above also apply to transportation impacts (project design including general site design control measures, treatment control measures, ordinances and regulations to reduce the discharge of sediments and other pollutants, SWPPP including BMPs). Because individual projects under the proposed Plan have the potential to adversely affect water quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Combined Effects

The combined effects of the land development and transportation projects would likely result in a net increase of impervious surfaces which would have the potential to increase stormwater pollutants in runoff. Because individual projects under the proposed Plan have the potential to adversely affect water

quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Mitigation Measures

Implement Mitigation Measure 2.8(a).

Significance After Mitigation

To the extent that an individual project adopts all feasible mitigation measures described above, the impact would be less than significant (LS). Projects taking advantage of CEQA Streamlining provisions of SB 375 (Public Resources Code sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measure(s) described above to address site-specific conditions. Further, because the measure is tied to existing regulations that are law and binding on responsible agencies and project sponsors, it is reasonable to determine that they would be implemented. Therefore, with the incorporation of mitigation measure 2.8(a), the impact is found to be less than significant with mitigation (LS-M).

Impact

2.8-5: Implementation of the proposed Plan could increase non-point-source pollution of stormwater runoff from construction sites due to discharges of sediment, chemicals, and wastes to nearby storm drains and creeks.

Impacts of Land Use Projects

Construction and grading activities associated with development of the proposed Plan could require temporary disturbance of underlying soils through excavation, soil stockpiling, boring, and/or grading activities that strip existing vegetation or pavement prior to commencing with construction of proposed improvements. These activities could result in exposure of soil to runoff, potentially causing erosion and entrainment of sediment and contaminants in the runoff. Soil stockpiles and excavated areas could be exposed to runoff and, if not managed properly, the runoff could cause erosion and increased sedimentation and pollutants in stormwater. The potential for chemical releases is present at most construction sites given the types of materials used, including fuels, oils, paints, and solvents. Once released, these substances could be transported to the receiving waters in stormwater runoff, potentially incrementally reducing water quality.

All development within the region that would disturb one acre or more would be required to prepare and implement a SWPPP, in accordance with the NPDES General Construction Permit, which would greatly diminish potential impacts because only small projects would be exempt from this requirement. The SWPPP could include BMP erosion control measures such as those listed in Mitigation Measure 2.8(a) above.

Because individual projects under the proposed Plan have the potential to adversely affect water quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Impacts of Transportation Projects

Transportation projects that disturb more than one acre would be required to adhere to the same NPDES General Construction Permit requirements as land development projects discussed above. The

permit requirements include preparation and implementation of a SWPPP detailing BMPs that would be employed to control onsite stormwater drainage during construction. Components of SWPPPs typically include project risk determination (categorized into Risk Levels 1, 2 and 3), visual inspection requirements, identification of sampling locations, collection and handling procedures (for Risk Level 2 and Risk Level 3 projects), and specifications for BMPs to be implemented during project construction for the purpose of minimizing the discharge of pollutants in stormwater from the construction area. Projects that fall under Caltrans jurisdiction are also required to adhere to the Caltrans NPDES permit.

Because individual transportation projects have the potential to adversely affect water quality at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Combined Effects

Impacts related to land development and transportation projects have the potential to adversely affect water quality at a project-specific level, and therefore impacts are considered potentially significant (PS). Both land development and transportation projects would be subject to the same regulatory requirements, which would apply to all projects that meet the one acre threshold of disturbance.

Mitigation Measures

Implement Mitigation Measure 2.8(a).

Significance After Mitigation

To the extent that an individual project adopts all feasible mitigation measures described above, the impact would be less than significant (LS). Projects taking advantage of CEQA Streamlining provisions of SB 375 (Public Resources Code sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measure(s) described above to address site-specific conditions. Further, because the measure is tied to existing regulations that are law and binding on responsible agencies and project sponsors, it is reasonable to determine that they would be implemented. Therefore, with the incorporation of mitigation measure 2.8(a), the impact is found to be less than significant with mitigation (LS-M).

Impact

2.8-6: Implementation of the proposed Plan could increase rates and amounts of runoff due to additional impervious surfaces, higher runoff values for cut-and-fill slopes, or alterations to drainage systems that could cause potential flood hazards and effects on water quality.

Impacts of Land Use Projects

Implementation of the proposed Plan could result in new development that would increase the total amount of impervious surfaces. While many PDAs are located in urbanized areas with substantial areas of existing impervious surfaces, some new development may also occur outside of PDAs, and new development or redevelopment (both within and outside of PDAs) could result in a net increase in such impervious surfaces. Increases in impervious surfaces would have the potential to increase rates and amounts of stormwater runoff, compared to existing conditions that could exceed the capacity of current systems. However, local and State drainage control requirements would apply to most improvements where both rates and volumes of runoff would be required to be meet minimum thresholds such that

potential flood hazards as well as effects on water quality are minimized. Once constructed, the NPDES Provision C.3 requirements for new development would include source control measures in site designs to address both soluble and insoluble stormwater runoff pollutant discharges. In some cases, adherence to these requirements may result in improved retention of stormwater rates and volumes, compared to existing conditions, through implementation of LID drainage control measures.

Because individual projects under the proposed Plan have the potential to adversely affect capacity of existing drainage systems at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Impacts of Transportation Projects

Transportation projects would be required to adhere to the same regulatory requirements as described above for land use projects where new impervious surfaces are constructed or replaced. Projects that fall under Caltrans jurisdiction would adhere to the Caltrans Stormwater Program, which includes measures to control stormwater volumes as well as stormwater quality.

Drainage systems are designed on a site-specific basis in accordance with the findings of the studies and the regulations of the applicable local flood control agencies and flood control design criteria. Adherence to local and State regulations would help prevent substantial alterations to the existing drainage pattern of the site or area and avoid substantial increases in the rate or amount of surface runoff in a manner that would result in on- or off-site flooding, or substantial siltation or erosion.

Transportation projects where local agencies are the lead agency are subject to local and State regulations for construction and non-construction runoff prevention. The NPDES permit requirements described in the land use discussion above also apply to transportation impacts. The regional MS4 NPDES permit would also apply to transportation projects, unless under Caltrans jurisdiction. Caltrans regulations combined with federal and State regulations require that engineered conveyances integrate energy dissipation protection, streambank erosion protection, and other design controls to minimize erosion or the transport of sediment or silt to downstream areas. The Caltrans Highway Design Manual requires that: road storm drain systems are designed to safely drain the 25-year return interval storm; cross-culverts are designed to safely drain the 10-year interval storm; and the headwater depth for the 100-year interval storm must not overtop freeways.

Because individual projects under the proposed Plan have the potential to adversely affect capacity of existing drainage systems at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Combined Effects

There are many different watersheds and subwatersheds within the region with different susceptibilities to increases in stormwater runoff. All projects implemented under the proposed Plan would be required to adhere to the appropriate local and State requirements that are designed to ensure that flooding conditions are not exacerbated and water quality is not affected. Because individual projects under the proposed Plan have the potential to adversely affect capacity of existing drainage systems at a project-specific level, these impacts are considered potentially significant (PS). Mitigation measure 2.8(a) is described above.

Mitigation Measures

Implement Mitigation Measure 2.8(a).

Significance After Mitigation

To the extent that an individual project adopts all feasible mitigation measures described above, the impact would be less than significant (LS). Projects taking advantage of CEQA Streamlining provisions of SB 375 (Public Resources Code sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measure(s) described above to address site-specific conditions. Further, because the measure is tied to existing regulations that are law and binding on responsible agencies and project sponsors, it is reasonable to determine that they would be implemented. Therefore, with the incorporation of mitigation measure 2.8(a), the impact is found to be less than significant with mitigation (LS-M).

Impact

2.8-7: Implementation of the proposed Plan could place within a 100-year flood hazard area structures which would impede or redirect flows.

Impacts of Land Use Projects

Despite efforts to improve regional drainage control infrastructure, there are locations throughout the Planning Area that are susceptible to flooding during heavy storm events. **Figure 2.8-3** shows 100-year flood hazard areas that are located within the region.

While the majority of growth under the proposed Plan will take place outside these hazard areas, there are areas within PDAs that have been mapped as being in the 100-year flood hazard zone (see Appendix G). Development outside of the PDAs is widely dispersed but would also include areas located within 100-year flood zone areas. Siting structures in flood zones can result in direct impacts on new development related to flooding where substantial damage can occur. In addition, structures that impede flood flows can cause a backwater effect by potentially raising flood levels, causing more severe flooding impacts to existing vulnerable areas or by exposing new areas that would not have previously flooded to new flooding impacts.

A total of 139 of the PDAs intersect 100-year flood zone areas as mapped by FEMA. The North San José PDA shows the most intersection with mapped 100-year flood zones with approximately 1,120 acres (which can include existing surface waters and open channels). For most of these PDAs within flood zones, the amount of area that is considered part of the 100-year flood zone is relatively small and accounts for fewer than 20 acres (see Appendix G). As a result, most of the land development associated with the proposed Plan would likely be located outside of the 100-year flood zone.

Any developments proposed within the 100-year flood zone would be required to meet local, State and federal flood control design requirements. In general, local jurisdictions have flood control policies that require new construction in flood-prone areas to be built to flood-safe standards, such as ensuring that ground levels of living spaces are elevated above anticipated flood elevations. Local jurisdictions also often require adequate storm drainage capacities and retention such that new development does not exacerbate any existing problem areas. At the regional scale, the proposed Plan could increase the amount of housing in flood hazard areas, but state regulations (e.g., Cobey-Alquist Floodplain Management Act), in combination with local floodplain ordinances and federal regulations (such as NFIP), would minimize

the risk associated with housing in these areas. In addition, many current ongoing improvements to flood protection infrastructure, such as the Guadalupe River Park and Flood Protection Project, should help alleviate flood conditions.

Without these floodplain development requirements, continuing flood protection programs, and the drainage requirements as described above, impacts related to proposed development within the 100-year floodplain from implementation of the proposed Plan at the regional and local level would be considered potentially significant (PS). Mitigation measure 2.8(b) is described below.

Impacts of Transportation Projects

Some of the transportation projects included in the proposed Plan intersect areas mapped within the 100-year flood hazard area, thus potentially increasing the ability to obstruct or exacerbate floodwaters. According to a GIS comparison of all the mapped linear transportation projects and the designated 100-year flood zones in the Planning Area, a total of 170 projects are located within or partially within the flood hazard areas (see Appendix G). However, most of these linear projects only intersect in relatively small geographical areas and total a little over 210 acres for the entire region, according to GIS data. Those projects that do intersect could involve support structures or other above ground improvements in the floodway that could potentially obstruct floodwaters at some locations. Placement of structures within a floodplain can displace floodwaters and alter the base flood elevations in the surrounding areas. As described under the land use discussion above, structures can form a backwater effect, resulting in an increase in the flood elevation level upstream and in neighboring areas.

Drainage areas could also be altered by highway corridors, in which floodwaters could be detained by medians and along the roadside. Proposed bridge supports could block debris in waterways, creating obstructions and further elevating upstream flood levels.

The regulatory requirements listed under land use also apply to transportation improvements. Local, State and federal floodplain requirements combined with ongoing flood protection projects would minimize the potential impact of the transportation projects at the regional and local level. Without such measures, the potential impacts would be considered potentially significant (PS). Mitigation Measure 2.8(b) is provided below.

Combined Effects

Land development and transportation projects would be subject to implementation of local, State, and federal flood protection regulations. Without such measures, individual projects located within the 100-year flood zone would be subject to potentially significant (PS) impacts related to flooding. Mitigation Measure 2.8(b) is provided below.

Mitigation Measures

Implementing agencies and/or project sponsors shall consider implementation of mitigations measures including but not limited to those identified below.

2.8(b) To reduce the impact of flood hazards, implementing agencies shall conduct or require project-specific hydrology studies for projects proposed to be constructed within floodplains to demonstrate compliance with Executive Order 11988, the National Flood Insurance Program, National Flood Insurance Act, Caltrans Highway Design Manual, Cobey-Alquist Floodplain Management Act, as well as

any further Federal Emergency Management Agency (FEMA) or State requirements that are adopted at the local level. These studies shall identify project design features or mitigation measures that reduce impacts to either floodplains or flood flows to a less than significant level such as requiring minimum elevations for finished first floors, typically at least one foot above the 100-year base flood elevation, where feasible based on project- and site-specific considerations. For the purposes of this mitigation, less than significant means consistent with these federal, State, and local regulations and laws related to development in the floodplain. Local jurisdictions shall, to the extent feasible, appropriate, and consistent with local policies, prevent development in flood hazard areas that do not have demonstrable protections.

Significance after Mitigation

To the extent that an individual project adopts all feasible mitigation measures described above, the impact would be less than significant (LS). Projects taking advantage of CEQA Streamlining provisions of SB 375 (Public Resources Code sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measure(s) described above to address site-specific conditions. Further, because the measure is tied to existing regulations that are law and binding on responsible agencies and project sponsors, it is reasonable to determine that they would be implemented. Therefore, with the incorporation of mitigation measure 2.8(a), the impact is found to be less than significant with mitigation (LS-M).

Impact

2.8-8: Implementation of the proposed Plan could expose people to a significant risk of loss, injury, or death involving flooding (including flooding as a result of the failure of a levee or dam), seiche, tsunami, or mudflow.

Impacts of the environment on a project or plan (as opposed to impacts of a project or plan on the environment) are beyond the scope of required CEQA review. "[T]he purpose of an EIR is to identify the significant effects of a project on the environment, not the significant effects of the environment on the project." (*Ballona Wetlands Land Trust v. City of Los Angeles* (2011) 201 Cal.App.4th 455, 473.) The impacts discussed in this section related to increased exposure of people or structures to risks associated with flooding are the effects of preexisting environmental hazards, as explicitly found by the court in the *Ballona* decision, and therefore "do not relate to environmental impacts under CEQA and cannot support an argument that the effects of the environment on the project must be analyzed in an EIR." (*Id.* at p. 474.) Nonetheless, an analysis of these impacts is provided for informational purposes.

Impacts of Land Use Projects

There are a total of 267 dams located within the Planning Area that fall under the jurisdiction of the State of California or are owned and operated by a federal agency. The California Department of Water Resources, Division of Safety of Dams (DSOD) oversees the design, construction, and annual inspection of dams statewide. DSOD imposes strict standards for the design, maintenance, and monitoring of dams under its jurisdiction to ensure that they meet static and seismic standards to prevent catastrophic failure. Periodically, some of these dams will receive modifications, such as the San Pablo Dam, which has recently undergone a seismic upgrade to increase its stability and minimize the potential for liquefaction to cause any slump or failure of the embankment. DSOD requirements for siting, engineering, construction, and monitoring of dams are continually improved as knowledge increases as to how and why dams fail. Since 1950, there have been nine dam failures statewide, with one of the incidents resulting in three deaths. The most recent failure of a dam causing flooding hazards occurred in 1965,

though a partial failure of a spillway gate at Folsom Lake Dam occurred in 1995. Based on these statistics, dam failure is a relatively low likelihood event.

Counties are required by State regulation to map potential dam inundation areas and prepare emergency plans and procedures for preparing and responding to a dam breach as part of their Multi-Hazard Mitigation Plans (Cal. Code Regs., tit. 19 § 2575). Additionally, the Federal Energy Regulatory Commission is required to approve local Emergency Action Plans for dams with the potential to cause massive damage. Emergency Action Plans outline notification procedures for people and property owners within a potential inundation area. Due to the large number of dams within the Planning Area, many of the proposed development areas both in and outside of the PDAs would likely be located within one or more inundation areas. There is no policy or regulatory requirement restricting development within potential dam inundation areas largely due to the continued maintenance and oversight which results in a relatively low risk for damage or injury.

Substantial precipitation, major storm events, or seismic events have the potential to cause any of the many levees in the Planning Area to fail. Specific projects developed under the proposed Plan may create structures or obstructions to flood flows from levee failures. However, any projects constructed within areas subject to flooding due to levee failure, as mapped by FEMA, must be built in compliance with standard building codes and federal, State, and local regulations. Specifically, the State and federal regulations for 100-year flood protection assess the adequacy of protection, including from levees. The proposed land uses, when implemented locally, must comply with these state and federal regulations.

In addition, the following regulations would further reduce potential exposure of people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam: California Building Code, State and federal regulations to control stormwater runoff and limit drainage pattern alteration described under Impacts 2.8-6 and 2.8-7, and State real estate disclosure laws requiring notification to new property owners for property that lies within any dam inundation area and/or floodplain.

Tsunamis are a series of large waves created by an underwater disturbance such as an earthquake, landslide, volcanic eruption, or meteorite. In general, a tsunami can move hundreds of miles per hour in the open ocean and reach land with waves as high as 100 feet or more. Most of the PDAs are located inland, although the Planning Area includes Pacific Ocean coastline as well as the San Francisco Bay shoreline, where the potential for inundation due to tsunami exists. A total of 51 tsunamis have been recorded or observed within the San Francisco Bay since 1850.[8,9] Of these, only the tsunamis generated by the 1960 Chile earthquake and the 1964 Alaska earthquake caused damage in San Francisco Bay. The 1964 tsunami event caused the most damage of these events and had a recorded amplitude of approximately 3.7 feet (1.1 meters) at the Presidio in San Francisco. According to newspaper articles in the San Francisco Chronicle (March 29, 1964) and Marin Independent Journal (March 30, 1964), damage in San Francisco Bay was largely isolated to small boats.

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[8] This total does not include the more recent March 2011 earthquake in Japan, which produced a small but noticeable tsunami wave that entered the San Francisco Bay, but caused no reported damage.

[9] California Geological Survey (CGS), *Tsunamis*, www.consrv.ca.gov/cgs/geologic_hazards/tsunami/pages/about_tsunamis.aspx, compiled in 2005.

Given the history of tsunamis in San Francisco Bay, which has never reported any significant damage from tsunamis, the risk of a tsunami exceeding the height observed in 1964 within the Planning Area is considered low (CGS, 2005). The potential hazard related to tsunamis within the Bay Area has been analyzed in regional studies and mapped, and generally shows more risk for coastal areas that are adjacent to the Pacific Ocean than for internal Bay shoreline areas where tsunami waves would be expected to attenuate after passing through the narrow Golden Gate.

According to the United States Geological Survey, a seiche is a standing wave in an enclosed or partly enclosed body of water. Seiches are normally caused by an earthquake or high wind activity and can affect harbors, bays, lakes, rivers and canals. However, no seismically induced seiche waves have been documented in San Francisco Bay throughout history, which may be due to the size of the Bay such that waves that would cause damage are not produced.

Mudflows are characterized by a downhill movement of soft wet earth and debris, made fluid by rain or melted snow and often building up great speed. Mudflows occur on steep slopes where vegetation is not sufficient to prevent rapid erosion but can occur on gentle slopes if other conditions are met. Other factors are heavy precipitation in short periods and an easily erodible source material. Mudflows can be generated in any climatic regime but are most common in arid and semiarid areas and can be associated with volcanic events. Considering the geologic context of the Planning Area and the developed nature of the region, the potential for mudslides to affect land development would be considered very low. See *Chapter 2.7: Geology and Seismicity*, where landslides are discussed.

Therefore, considering the existing regulatory framework, physical context of the Planning Area and proposed areas of improvements, the land use impacts associated with implementation of the proposed Plan at the regional and local level are considered less than significant (LS).

Impacts of Transportation Projects

Some of the transportation projects included in the proposed Plan would be placed within the 100-year flood hazard area and potential inundation areas from the 267 dams located within the Planning Area, potentially exposing people or structures to a significant risk of loss, injury or death involving flooding from failure of a dam or levee, seiches, tsunamis, or mudflows. In addition, improvements located in the immediate vicinity of shoreline areas may be exposed to inundation from tsunami or seiche waves. As noted above, new transportation structures proposed within a floodplain or inundation areas would be required to adhere to State and federal regulations described under the land use discussion which would mitigate against potential exposure of people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam. The majority of the transportation projects are otherwise located outside of shoreline areas that might be exposed to seiche or tsunami inundation. However, as discussed above, there is no documented history of significant damage from either tsunamis or seiches and the highest risk areas are generally limited to coastal areas of the Pacific Ocean.

Therefore, considering the existing regulatory framework, physical context of the Planning Area and proposed areas of improvements, the impacts associated with implementation of the proposed transportation projects at the regional and local level are considered less than significant (LS).

Combined Effects

Flooding risks from dam failure, tsunamis, seiches or mudflows are generally dependent on physical location and would not be increased by combining land use and transportation projects due to their evaluation on a case by case basis. In general, transportation projects are only temporarily affected by dam failure, tsunamis, seiches or mudflows that can limit use and access of existing roadways. However, land use projects can suffer more long term effects. However, as noted above, these events are considered a relatively low risk. Land development and transportation projects will both be subject to implementation of local, State, and federal floodplain regulations and project level review on an individual project basis that would ensure there is no potential for adverse effects from flooding from failure of levee or dam, tsunamis, seiches or mudflows. Therefore, considering the existing regulatory framework, physical context of the Planning Area and proposed areas of improvements, potential impacts related to Impact 2.8-8 would be less than significant (LS).

Mitigation Measures

None required.

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