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9 Water Resources

Chapter 9 evaluates potential impacts of the Alameda County Mosquito Abatement District's IMMP implementation on water resources. Results of the evaluation are provided at the programmatic level. Section 9.1, Environmental Setting, presents an overview of the physical properties and environmental settings; and contains federal regulations, state regulations, and local ordinances and regulations that are applicable to the Program. Section 9.2, Environmental Impacts and Mitigation Measures, presents the following:

> Environmental concerns and evaluation criteria: A determination of whether the Program alternatives would cause any potentially significant impacts to regional hydrologic resources

> Discussion of methods and assumptions, including findings from the Ecological and Human Health Risk Assessment, which is included as Appendix B

> Discussion of potential impacts of the Program alternatives, and recommendations for mitigation, if required, for those impacts

> Cumulative impacts summary

> A summary of estimated environmental impacts to hydrologic resources

> Monitoring of recommended mitigation measures

9.1 Environmental Setting

9.1.1 California's Hydrologic and Geomorphic Regions

The hydrologic resources of California can be divided into regions based on several hydrologic characteristics. The California Water Plan divides California into 10 hydrologic regions. These regions are delineated based upon the state's major drainage basins. Each region has distinct precipitation characteristics and waterbodies.

Hydrologic regions over the Service Area include portions of the San Francisco Bay and San Joaquin River regions. The Program Area also overlaps a portion of the Central Coast hydrologic region. The District's Service Area (Alameda County) and lands in adjacent counties (Contra Costa, San Joaquin, Stanislaus, and Santa Clara) comprise the District's Program Area, and the hydrologic regions with important water features for the District are shown on Figure 9-1. Description of surface water and groundwater characteristics for the differing hydrologic regions relied on *California Water Plan, Update 2009* and *California Water Plan, Update 2013, Advisory Committee Review Draft* (CDWR 2009a-c, 2013a-d).

9.1.1.1 San Francisco Bay Hydrologic Region

The San Francisco Bay Hydrologic Region (Bay Region) occupies approximately 4,500 square miles, from Tomales Bay in Marin County to southern Santa Clara County, and inland to the confluence of the Sacramento and San Joaquin Rivers near Collinsville. The eastern boundary follows the crest of the Coast Range where the highest peaks are more than 4,000 feet above mean sea level (CDWR 2013b). This region includes portions of Marin, Sonoma, Napa, Solano, San Mateo, Santa Clara, Contra Costa, and Alameda counties.

Principle watersheds in the Bay Region include Tomales Bay, Corte Madera Creek, Novato Creek, Petaluma River, Sonoma Creek, Napa River, Wildcat Creek, San Pablo Creek, Green Valley Creek, Suisun Creek, Walnut Creek, San Mateo Creek, San Francisquito Creek, Guadalupe River, Coyote

Creek, Alameda Creek, San Lorenzo Creek, and San Leandro Creek watersheds. These watersheds drain into Suisun, San Pablo, North San Francisco, and South San Francisco bays, or directly into the Pacific Ocean. For example, the Guadalupe River and Coyote and Alameda creeks drain from the Coast Range and flow northwest into San Francisco Bay. The Napa River originates in the Mayacamas Mountains at the northern end of Napa Valley and flows south into San Pablo Bay. Sonoma Creek begins in mountains within Sugarloaf State Park and flows south through Sonoma Valley into San Pablo Bay.

A large proportion of the counties that surround the San Francisco Bay are urbanized. As a result, many creeks have been confined to underground culverts beneath the developed regions. While many larger creeks remain open, they often have been heavily modified to run in concrete channels to optimize flood conveyance and provide flood protection. Ownership of Bay Area streams is a patchwork of public title, public easements, and private ownership that complicates policies and jurisdiction over, or maintenance responsibility for, urban streams. Many Bay Area stream reaches have, in fact, no established public jurisdiction or maintenance responsibility (RMC 2006).

Tidal marshes occur throughout much of the fringe of the San Francisco Bay, from the lowest extent of vascular vegetation to the top of the intertidal zone (at the maximum height of the tides). Tidal marsh also exists in the tidal reaches of local rivers and streams. Tidal marshland was once more extensive and was estimated to be 190,000 acres; however, development in the region has decreased the amount of tidal marshland to approximately 40,000 acres. A large effort has recently been undertaken to restore these ecosystems. High-quality wetlands have been shown to moderate the effect of floods, improve water quality, help maintain shipping channels, and provide habitat to numerous species (Goals Project 1999).

Like most of Northern California, the climate in the Bay Region largely is governed by weather patterns originating in the Pacific Ocean. About 90 percent of the annual precipitation falls between November and April. The North Bay receives about 20 to 25 inches of precipitation annually. In the South Bay, east of the Santa Cruz Mountains, annual precipitation is only about 15 to 20 inches because of the rain shadow effect. Temperatures in the Bay Region generally are cool, and fog often resides along the coast. The inland valleys receive warmer, Mediterranean-like weather (average summer high temperatures are about 80 degrees Fahrenheit). The gap in the rolling hills at Carquinez Strait allows cool air to flow from the Pacific Ocean into the Sacramento Valley. Most of the interior North Bay and the northern parts of the South Bay are influenced by this marine effect. By contrast, the southern interior portions of the South Bay experience very little marine air movement (CDWR 2013b).

Land use in the Bay Region is diverse. Residents live in urban, suburban, and rural areas. Some of these areas are on natural floodplains, which historically were used for agriculture. Agriculture accounts for 21 percent of the Bay Region's land area, most of which is in the North and Northeast Bay in Napa, Marin, Sonoma, and Solano counties. Santa Clara and Alameda counties also have significant agricultural acreage at the edge of urban development (CDWR 2013b).

The region has many significant water management challenges: sustaining water supply, water quality, and the ecosystems in and around San Francisco Bay; reducing flood damages and adapting to impacts from climate change. Numerous government agencies and water districts deliver, treat, and regulate water in the Bay Region. Many planning organizations identify present and future challenges in the region such as land use, housing, environmental quality, economic development, wetlands, water quality, water reliability, stormwater management, flood protection, watershed management, groundwater management, fisheries, and ecosystem restoration (CDWR 2013b).

Groundwater basins underlie approximately 1,400 square miles or 30 percent of the Bay Region and account for about 15 percent of the region's average annual water supply. The Bay Region has 25 identified groundwater basins, as shown on Figure SFB-3 (CDWR 2013b) The Santa Clara Valley, Livermore Valley, Westside, Niles Cone, Napa-Sonoma Valley, and Petaluma Valley are heavily used groundwater basins (CDWR 2013b).

Figure 9-1 Program Area and California Hydrologic Regions with Major Waterbodies Alameda County Mosquito Abatement District

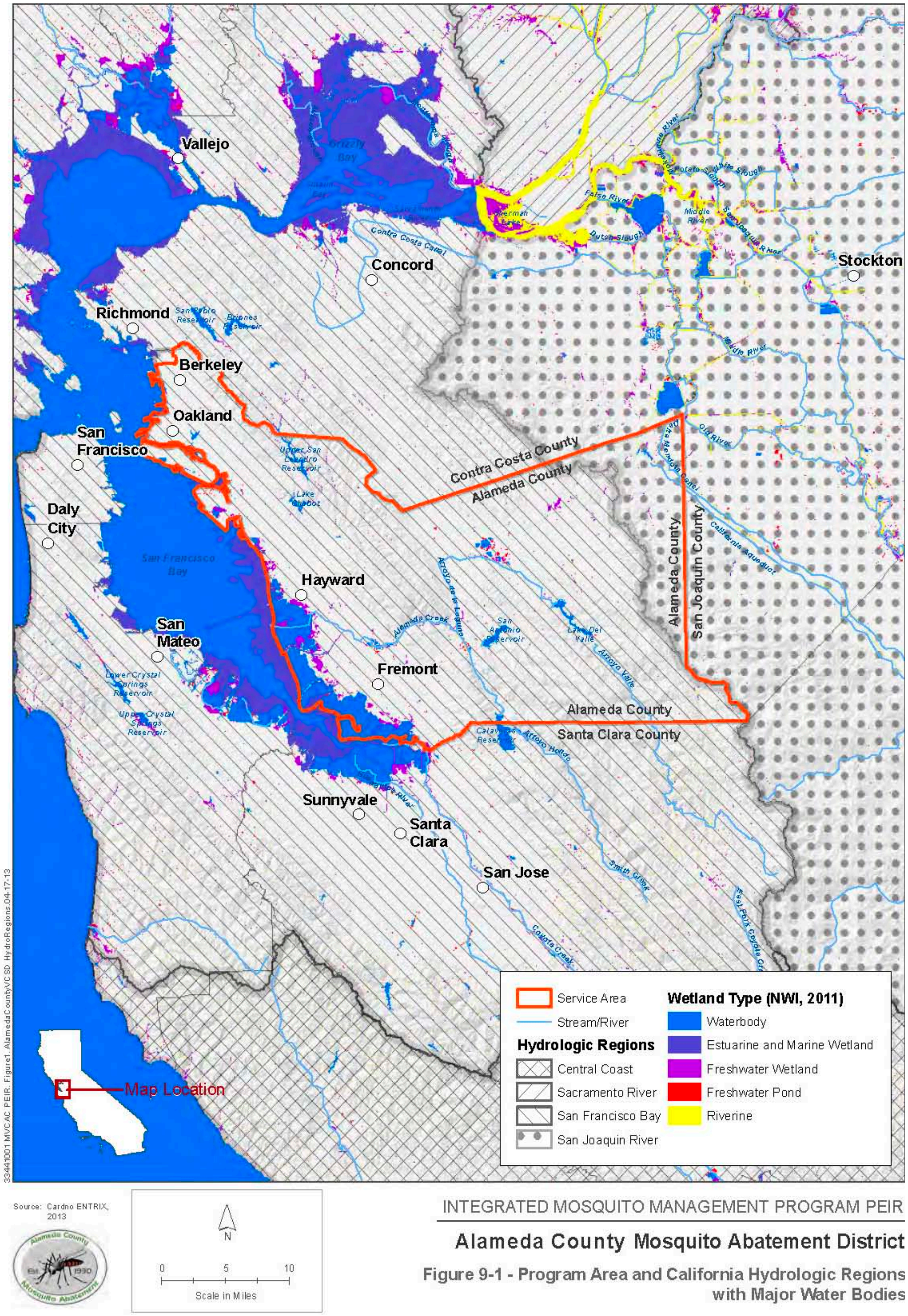

Figure 9-1 BACK

Ongoing surface water quality issues exist in the Bay Region. Pollutants from urban and rural runoff include pathogens, nutrients, sediments, and toxic residues. Some toxic residues are from past human activities such as mining; industrial production; and the manufacture, distribution, and use of agricultural pesticides. These residues include mercury, PCBs, selenium, and chlorinated pesticides. Emerging pollutants in the region include flame retardants and pharmaceuticals.

San Francisco Bay and a number of the streams, lakes, and reservoirs in the Bay Region have elevated mercury levels, as indicated by elevated mercury levels in fish tissue. The major source of the mercury is historic mercury mining and mining activities in the Sierra Nevada and coastal mountains. Large amounts of contaminated sediments were discharged into the Bay from Central Valley streams and local mines in the Bay Area. Significant impaired waterbodies include the Bay, the Guadalupe River in Santa Clara County (from New Almaden Mine discharges), and Walker Creek in Marin County (from Gambonini Mine discharges). The SFBRWQCB has adopted total maximum daily loads (TMDLs) for mercury in the Bay, Guadalupe River, and Walker Creek (CDWR 2013b).

Water agencies in the region have relied on importing water from the Sierra Nevada for nearly a century to supply their customers. Water from the Mokelumne and Tuolumne rivers accounts for about 38 percent of the region’s average annual water supply. Water from the Delta via the federal Central Valley Project and the State Water Project accounts for another 28 percent. Approximately 31 percent of the average annual water supply is from local groundwater and surface water, and 3 percent is from miscellaneous sources. Population growth and concerns over diminishing water quality have led to the development of local surface water supplies, recharge of groundwater basins, and incorporation of conservation guidelines (CDWR 2013b).

Drinking water in the Bay Region ranges from high-quality Mokelumne and Tuolumne river water to variable-quality Delta water, which constitutes about one-third of the domestic water supply. Purveyors that depend on the Delta for all or part of their domestic water supply can meet drinking water standards, but still need to be concerned about microbial contamination, salinity, and organic carbon.

The Bay Region generally receives very little snow, so floodwaters originate primarily from intense rainstorms. The northern portion of the region receives more precipitation and floods more often than the southern portion. Flooding occurs more frequently in winter and spring and can be intense with a short duration in small watersheds with steep terrain. Local flooding tends to occur when large, widespread storms fall on previously saturated watersheds that drain into local valleys. The greatest flood damages occur in the lower reaches of streams when floodwaters spill onto the floodplain and spread through urban neighborhoods (CDWR 2013b).

Drought, overdraft, and pollution have impaired portions of 28 groundwater basins in the Bay Region. The basins face a perpetual threat of contamination from spills, leaks, and discharges of solvents, fuels, and other pollutants. Contamination affects the supply of potable water and water for other beneficial uses. Some municipal, domestic, industrial, and agricultural supply wells have been removed from service due to the presence of pollution, mainly in shallow groundwater zones. Overdraft can result in land subsidence and saltwater intrusion, although active groundwater management has stopped or reversed the saltwater intrusion (CDWR 2013b).

A variety of historical and ongoing industrial, urban, and agricultural activities and their associated discharges have degraded groundwater quality, including industrial and agricultural chemical spills, underground and aboveground tank and sump leaks, landfill leachate, septic tank failures, and chemical seepage via shallow drainage wells and abandoned wells. The region has over 800 groundwater cleanup cases, about half of which are related fuel spills from leaking underground tanks. In many cases, the groundwater is treated and discharged to surface waters via storm drains (CDWR 2013b).

9.1.1.2 Central Coast Hydrologic Region

The Central Coast Hydrologic Region (Central Coast region) extends from southern San Mateo County in the north to Santa Barbara County in the south. This region includes Monterey County and portions of San Mateo and Santa Clara counties.

The Central Coast region has a temperate Mediterranean climate characterized by mild, wet winters and warm, dry summers. West of the Coast Range, the climate of the region is dominated by the Pacific Ocean, characterized by small daily and seasonal temperature changes, and high relative humidity. As distance from the ocean increases, the maritime influence decreases, resulting in a more continental type of climate that generates warmer summers, colder winters, greater daily and seasonal temperature ranges, and lower relative humidity. Average annual precipitation can range from 10 inches per year along the southern valley floors to 50 inches per year on northern coastal mountain peaks.

Geographically, the vegetation and topography of the Central Coast is highly variable and includes redwood forests, foggy coastal terraces, chaparral-covered hills, green cultivated valley floors, stands of oak, warm and cool vineyards, and semiarid grasslands. The lower portions of the northern watersheds, close to Monterey Bay, are more urbanized with residential, commercial, and light industrial land use. Upper watershed land use consists predominantly of rural residential, timber production, open space, some mining, and limited agriculture.

For the Central Coast region, surface water quality parameters of special concern include nitrate, water toxicity, pesticides, fecal coliform, sediment, temperature, and dissolved oxygen. Nitrate enters the waters of the region most commonly as runoff from agricultural fields or through percolation to groundwater. Fecal coliform is an indicator for pathogenic bacteria and enters the waters of the region through stormwater runoff, the presence of cattle and other animals in creeks, and from failing septic systems. Toxicity can be caused by metals, fertilizers, pesticides, petroleum products, and other organic compounds. Regionally, erosion and excessive sedimentation in rivers and streams have led to a decline in anadromous fish habitat for migration and spawning. Common causes of erosion and excessive sedimentation include clearing land for development without adequate stormwater controls, farming too close to creek banks or on steep slopes, and increased stormwater runoff from impervious surfaces (CDWR 2013d).

Among all of California's hydrologic regions, the Central Coast is the most reliant on groundwater for its water supply. Groundwater supplies are locally supplemented by stream diversions, timed releases from regional reservoirs, and some imported surface water. Factors that affect water availability in the region include precipitation, groundwater recharge capacity, groundwater quality degradation, groundwater pumping management styles or practices, surface water and reservoir storage capacity, and annually variable State Water Project and Central Valley Project water deliveries (CDWR 2013d). Seawater intrusion in the northern Salinas Valley has been an issue for decades and is likely associated with seasonal groundwater withdrawals for agriculture in Santa Cruz and Monterey counties (CDWR 2013d).

9.1.1.3 San Joaquin River Hydrologic Region

The San Joaquin River Hydrologic Region is generally located in the northern portion of the San Joaquin Valley. The region includes approximately half of the Sacramento-San Joaquin River Delta, including those areas that are in Contra Costa, Alameda, and San Joaquin counties. The region also contains portions of Alpine, Amador, Benito, El Dorado, Fresno, Sacramento, and San Joaquin counties; and all of Calaveras, Madera, Mariposa, Merced, Stanislaus, and Tuolumne counties. The San Joaquin River is the principal river in the region, and all other streams in the region are tributary to it (CDWR 2013b).

Average annual precipitation varies considerably, ranging from about 22 inches in the north to about 6.5 inches in the southwest. Additionally, snowfall occurs in the higher elevations of the Sierra Nevada. The snow serves as stored water before it melts and is a typically a major contributor to eastern San Joaquin

Valley water supplies. Summers are hot and dry in both the valley and upland areas. Winters are usually mild, but temperatures may at times drop below freezing (CDWR 2013b).

The vegetation and topography also are highly variable, ranging from forested lands in the Sierra Nevada; chaparral communities, oak woodlands, riparian habitat, and grass savannas in the Sierra Nevada and Diablo Range foothills and rangelands; and riparian areas in the Delta and along rivers, streams, lakes, and ponds. The valley floor is primarily in agricultural use but has pockets of urbanized areas. Wetlands are present in private waterfowl hunting areas and federal- and state-managed wildlife refuges and wildlife management areas. Vernal pools are located primarily along the valley's edges. The wetlands, rivers, and upland areas support a number of federal- and state-listed wildlife and plant species (CDWR 2013b).

Many agricultural and municipal users receive water supply from large irrigation districts. Water use is first met by surface water supplies, primarily high-quality water from the tributaries of the San Joaquin River. Where insufficient surface water exists, imported surface water is delivered primarily through the Central Valley Project, but smaller amounts are also delivered from the State Water Project. Local groundwater is pumped where insufficient surface water is available or where needs can be met by groundwater. Each of these water supplies is strained by a variety of factors. Surface water supplies are stressed by increased local demands, environmental requirements, and restoration needs. Imported supplies are increasingly limited due to drought, legal actions, and other compliance requirements. Average annual groundwater extraction also has been shown to frequently exceed the sustainable aquifer yield (CDWR 2013b).

9.1.1.4 Existing Water Quality

Statewide and regional surface water monitoring has identified pesticides in surface waters and sediments throughout the Program Area and vicinity. A query of water quality data available through the California Environmental Data Exchange Network (CEDEN) water quality database revealed detectable quantities of several chemicals that the District will use and several additional chemicals of the same class (i.e., pyrethroids). See Tables 2-1 through 2-4 for a list of all chemicals the District uses.

The following is a summary of CEDEN data from 1993 to 2012 regarding the concentrations of these chemical constituents when detected and the waterbodies in which they were discovered (CEDEN 2013). In addition to the CEDEN data, the list below includes Water Year 2012 Regional Monitoring Coalition pesticide results (BASMAA 2013). The Regional Monitoring Coalition was formed to implement the monitoring program required by the Municipal Regional Stormwater NPDES Permit (Order R2-2009-0074) issued by the San Francisco Bay RWQCB. In consideration of their more frequent usage and potentially greater toxicity compared with other commonly applied pesticides used in this geographic region, monitoring of the class of pesticides known as pyrethroids was conducted by the Regional Monitoring Coalition to explore potential causes of toxicity to *Hyalella azteca* in sediments. Based on monitoring results, BASMAA (2013) concluded that it is likely that pyrethroids caused toxicity in water year 2012.

- Allethrin was detected in sediments of various bays in the region including Central Bay, Grizzly Bay, San Pablo Bay (Pinole Point), San Francisco Bay (Yerba Buena Island), and Suisun Bay. Concentrations ranged from 0.238 to 5.61 micrograms per kilogram (µg/kg) in these bay sediments. Allethrin concentrations within Sacramento River and San Joaquin River sediments ranged from 0.33 to 2.13 µg/kg.
- Lambda-cyhalothrin was detected in Central Bay, Lower South Bay, San Pablo Bay, and South Bay sediments in concentrations ranging from 0.065 to 0.395 µg/kg. Guadalupe Creek, Kirker Creek, Laguna de Santa Rosa, Lagunitas Creek, and Tembladero Slough sediments contained lambda-cyhalothrin concentrations ranging from 1.14 to 6.03 µg/kg. Lambda-cyhalothrin concentrations in the water column of the Hayward Industrial Storm Drain ranged from 3.53 to 6.07 ng/L.
- The concentration of all permethrin isomers detected in the water column of the Hayward Industrial Storm Drain ranged from 1.57 to 285 ng/L. Sunnyvale East Channel, Guadalupe River, and Lower

Marsh Creek sediments contained concentrations ranging from 3.81 to 20.9 µg/kg. Cis- and trans-permethrin isomers were detected in Central Bay, Grizzly Bay, Lower South Bay, San Pablo Bay (Pinole Point), South Bay, and Suisun Bay sediments in concentrations ranging from 0.10 to 1.32 µg/kg. Cis- and trans- isomers were also detected in Coyote Creek, Redwood Creek, San Leandro Creek, and Tembladero Slough sediments in concentrations 0.12 to 25.6 µg/kg. Only the cis- isomer of permethrin was detected in Guadalupe Creek, Laurel Creek, Salinas River, and San Mateo Creek sediments in concentrations ranging from 3.22 to 11.1 µg/kg. Trans-permethrin was the only isomer detected in Lagunitas Creek and the Pajaro River sediments in concentrations ranging from 4.06 to 4.52 µg/kg.

- Phenothrin was detected in Central Bay and San Francisco Bay (Yerba Buena Island) sediments in concentrations ranging from 0.988 to 4.81 µg/kg.

Additional queries were made to the USEPA's ECOTOX database to compare regional water quality data to available ecological toxicity data (See Table 9-1). The toxicology data is expressed in LC_{50}.[1] The LC_{50} value is used as a standard measure of toxicity for evaluation and comparison of chemicals. Chemicals with lower LC_{50} values are more toxic. The LC_{50} values in Table 9-1 are populated from the lowest available constituent concentrations in which a 50 percent die-off for the test species is observed (USEPA 2013a). LC_{50} values are not available for sediment. Freshwater and saltwater values are provided where available.

A 2010 study performed by the CDPR analyzed the presence of pyrethroid insecticides in California's surface waters from urban areas. The most frequently detected pyrethroids were bifenthrin followed by permethrin and cyfluthrin. These pyrethroids are found in many common household insecticides. Bifenthrin and cyfluthrin, which the District does not use, were detected with the highest concentrations in both water and sediment. Detected concentrations of bifenthrin and cyfluthrin exceeded the acute toxicity benchmarks for fish in over 8 percent of the water samples. Over 12 percent of the water samples detected concentrations of cyfluthrin and permethrin which exceeded the acute toxicity benchmarks for aquatic invertebrates (CDPR 2010b).

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[1] LC_{50} refers to the lethal concentration of a chemical (amount of chemical in a volume of food, water or air) that that would kill 50 percent of a group of test animals exposed to the chemical for a defined exposure time.

Table 9-1 Pesticide Concentrations in Surface Water and Sediment throughout the Program Area and Vicinity (1993 to 2012)

Pesticide	Sediment		Water			
	Concentration (µg/kg)	LC_{50} (µg/kg)	Concentration (ng/L)	LC_{50} (ng/L)	Standard Test Species	Exposure Time
Allethrin	0.238 - 5.61	*	NA	1,800	Coho Salmon (*Oncorhynchus kisutch*)	96-hour exposure in Freshwater Medium
Cinerin (Pyrethrin)	NA	*	3.76 - 79.9	920	Scud (*Gammarus fasciatus*)	96-hour exposure to Pyrethrin in Freshwater Medium
				84	Opossum Shrimp (*Americamysis bahia*)	96-hour exposure to Pyrethrin in Saltwater Medium
Lambda-cyhalothrin	0.065 - 6.03	*	3.53 - 6.07	30	Zebra Danio (*Danio rerio*)	72-hour exposure in Freshwater Medium
				3	Opossum Shrimp (*Americamysis bahia*)	96-hour exposure in Saltwater Medium
Permethrin	3.81 - 20.9	*	1.57 - 285	0.007 (umol/L)	Channel Catfish (*Ictalurus punctatus*)	96-hour exposure in Freshwater Medium
				4	Amphipod (*Eohaustorius estuarius*)	48-hour exposure in Saltwater Medium
Cis- and Trans-Permethrin Isomers	0.10 - 25.6	*	*	465	Water Flea (*Ceriodaphnia dubia)*	96-hour exposure to Cis-Permethrin in Freshwater Medium
Phenothrin	0.988 - 4.81	*	*	140	Rainbow Trout (*Oncorhynchus mykiss*)	96-hour exposure in Freshwater Medium
				21	Opossum Shrimp (*Americamysis bahia)*	96-hour exposure in Saltwater Medium

*No Data Available

9.1.2 Regulatory Setting

The Program includes components under the jurisdiction of federal, state, and local agencies. Applicable regulations are summarized below and include aspects related to both surface water and groundwater. The primary focus of this regulatory summary is the water quality aspects related to the Program alternatives. Because the Program will not cause changes to natural precipitation patterns, runoff, or groundwater infiltration, changes to water quantity are not anticipated.

9.1.2.1 Federal

Federal Clean Water Act (33 United States Code Section 1251 et seq.)

The USEPA is the federal agency responsible for water quality management and administers the federal Water Pollution Control Act Amendments of 1972 and 1987, collectively known as the Clean Water Act (CWA). The CWA establishes the principal federal statutes for water quality protection. It was established with the intent "to restore and maintain the chemical, physical, and biological integrity of the nation's water, to achieve a level of water quality which provides for recreation in and on the water, and for the propagation of fish and wildlife." Several key CWA sections guide the regulation of water pollution in the US:

> Section 208, Water Quality Control Plans. This section requires the preparation of local water quality control plans throughout the nation. Each water quality control plan covers a defined drainage area. The primary goal of each water quality control plan is to attain water quality standards established by the CWA and the state governments within the defined area of coverage. Minimum content requirements, preparation procedures, time constraints, and federal grant funding criteria pertaining to the water quality control plans are established in Section 208. The USEPA has delegated preparation of the water quality control plans to the individual states. More information is provided below in the state regulatory setting section.

> Section 303(d) Water Quality Limited Surface Waters. This section requires each state to provide a list of impaired waters that do not meet or are expected not to meet state water quality standards as defined by that section. It also requires the state to develop TMDLs from the pollution sources for such impaired waterbodies. Table 9-2 lists pesticide-impaired surface waters and TMDL status in the Program Area. Because pyrethroids have been implicated in sediment toxicity, those impairments are also included in Table 9-2. See the state regulatory setting section (Section 9.1.2.2) for description of the Diazinon and Pesticide-Related Toxicity in Urban Creeks TMDL.

> Section 401, Water Quality Certifications. This CWA section requires that, prior to the issuance of a federal license or permit for an activity or activities that may result in a discharge of pollutants into waters of the US (see Section 404 discussion, below), the permit applicant must obtain a certification from the state in which the discharge would originate. A state certification indicates that the proposed activity or activities would not result in a violation of applicable water quality standards established by federal or state law, or that no water quality standards apply to the proposed activity. The SWRCB and/or the nine RWQCBs administer the certification program in California.

> Section 402, NPDES. The NPDES requires permits for pollution discharges (except dredge or fill material) into waters of the US, such that the permitted discharge does not cause a violation of federal and state water quality standards. Biological and residual pesticides discharged into surface waters constitute pollutants within the meaning of the CWA and require coverage under an NPDES permit. NPDES permits define quantitative and/or qualitative pollution limitations for the permitted source and control measures that must be implemented to achieve the pollution limitations. Pollution control measures are often referred to as BMPs. In California, NPDES permits are issued by the SWRCB or the RWQCBs.

Table 9-2 Section 303(d) Pesticide and Sediment Toxicity Limited Surface Waters in the Program Area

Waterbody	Pollutants	Primary Stressors	TMDL Completion Dates
Alameda County Mosquito Abatement District			
Oakland Inner Harbor (Fruitvale Site, part of SF Bay, Lower)	Chlordane, Chlordane (sediment), DDT (Dichlorodiphenyltrichloroethane), Dieldrin, Dioxin comounds (including 2,3,7,8-TCDD), Furan Compounds, Invasive Species, Mercury, PCBs (Polychlorinated biphenyls), PCBs (Polychlorinated biphenyls) (dioxin-like), PCBs (Polychlorinated biphenyls) (sediment), Sediment Toxicity, Selenium	Nonpoint Source, Source Unknown, Atmospheric Deposition, Ballast Water, Industrial Point Source, Municipal Point Source, Natural Sources, Resource Extraction, Exotic Species, Unknown Nonpoint Source	2008–2019
San Leandro Bay (part of SF Bay, Lower)	Lead (sediment), Chlordane, PAHs (polycyclic Aromatic Hydrocarbons) (sediment), Dieldrin, Zinc (sediment), Invasive Species, Furan Compounds, Pesticides (sediment), Dioxin compounds (including 2,3,7,8-TCDD), Mercury, Mercury (sediment)	Nonpoint Source, Atmospheric Deposition, Ballast Water, Unknown Source , Industrial Point Source, Municipal Point Source Natural Sources, Resource Extraction	2008–2019
Contra Costa Mosquito and Vector Control District			
Kellogg Creek	Escherichia coli (E. coli), Dissolved Oxygen, Salinity, Sediment Toxicity, Unknown Toxicity	Unknown Source	2021
Kirker Creek	Pyrethroids, Toxicity, Trash	Channelization, Urban Runoff-Erosion and Sedimentation, Surface Runoff, Unknown Source, Illegal Dumping, Urban Runoff/Storm Sewers	2007–2021
Marsh Creek (Marsh Creek Reservoir to San Joaquin River)	Diazinon, Escherichia coli (E. coli), Mercury, Sediment Toxicity, Unknown Toxicity	Agriculture, Unknown Source, Urban Runoff/Storm Sewers, Resource Extraction	2007–2021

Source: SWRCB 2011b

> Section 404, Discharge of Dredge and Fill Material. Section 404 assigns the USACE with permitting authority for proposed discharges of dredged and fill material into waters of the US, defined as "…waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; territorial seas and tributaries to such waters." The USACE typically considers all natural drainages with defined beds and banks to be waters of the US. Section 404 establishes procedures by which the permitting agency is to review, condition, approve, and deny permit requests. Per the regulations, permitting agencies are responsible to conduct public noticing and provide the opportunity for public hearings during the review of each permit request. This responsibility includes informing the USFWS and/or NMFS of each permit request. Consultation with the USFWS and/or NMFS is required for proposed discharges that could affect species protected by the federal Endangered Species Act. Measures that are required by the USFWS and/or NMFS to minimize impacts to federally protected species must be included as conditions of the permit. The USACE also authorizes, with limited application requirements and associated delay, certain activities with minimal adverse effects on the environment, under nationwide permits. Currently, 50 nationwide permits exist, of which about half require preconstruction notification, which USACE reviews to verify the activity qualifies for the nationwide permit.

9.1.2.1.1 Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA was first passed in 1947 to establish labeling provisions and procedures for registering pesticides with the USDA. It was rewritten in 1972 and has since been amended several times. In its current form, FIFRA mandates that USEPA regulate the use and sale of pesticides to protect human health and preserve the environment. Registration with the USEPA assures that pesticides will be properly labeled and that, if used in accordance with specifications, they will not cause unreasonable harm to the environment. Pesticide use in California is also regulated by the CDPR and local County Agricultural Commissioners.

9.1.2.1.2 California Toxics Rule

The USEPA has developed water quality criteria for priority toxic pollutants and other provisions for water quality standards to be applied to inland surface waters, enclosed bays, and estuaries in California. This rule was developed to address a gap in California's water quality standards that was created when the state's water quality control plans containing water quality criteria for priority toxic pollutants were overturned in 1994. The established numerical standards were deemed necessary to protect human health and the environment. The rule includes ambient aquatic life criteria for 23 priority toxic pollutants, ambient human health criteria for 57 priority toxics, and a compliance schedule.

9.1.2.1.3 Safe Drinking Water Act of 1974

The federal Safe Drinking Water Act of 1974 is the main federal law that regulates drinking water quality. The act authorizes the USEPA to set national health-based standards for drinking water to protect against both naturally occurring and man-made contaminants that may be found in drinking water. With the passage of the federal Safe Drinking Water Act of 1974, the USEPA established and enforced mandatory nationwide minimum standards. California adopted its own Safe Drinking Water Act in 1976 that gave California Department of Health Services (now CDPH) responsibility for the administration of the federal Safe Drinking Water Act in California. Under this program, the USEPA has delegated primary responsibility for setting and enforcing drinking water standards to the CDPH.

9.1.2.1.4 Rivers and Harbors Act

The Rivers and Harbors Act (RHA) of 1899 prohibits the unauthorized alteration or obstruction of any navigable waters of the US. As defined by the RHA, navigable waters include all waters that are:

> Historically, presently, or potentially used for interstate or foreign commerce

> Subject to the ebb and flow of tides

Regulations implementing RHA Section 10 are coordinated with regulations implementing CWA Section 404. The RHA specifically regulates:

> Construction of structures in, under, or over navigable waters

> Deposition or excavation of material in navigable waters

> All work affecting the location, condition, course, or capacity of navigable waters

The USACE administers the RHA. If a proposed activity falls under the authority of RHA Section 10 and CWA Section 404, the USACE processes and issues a single permit. For activities regulated only under RHA Section 10, such as installation of a structure not requiring fill, permit conditions may be added to protect water quality during construction.

Program activities are not anticipated to affect any facilities that would be regulated under the RHA.

9.1.2.2 State

9.1.2.2.1 Porter-Cologne Act

The Porter-Cologne Act (California Water Code Section 13000) is the principal law governing water quality regulation in California. It establishes a comprehensive program to protect water quality and the beneficial uses of water. The Porter-Cologne Act applies to surface waters, wetlands, and groundwater, and to both point and nonpoint sources of pollution. Pursuant to the Porter-Cologne Act, it is the policy of the State of California that:

> The quality of all the waters of the state shall be protected.

> All activities and factors affecting the quality of water shall be regulated to attain the highest water quality within reason.

> The state must be prepared to exercise its full power and jurisdiction to protect the quality of water in the state from degradation.

Pursuant to the Porter-Cologne Act, the responsibility for protection of water quality in California rests with the SWRCB. The SWRCB administers federal and state water quality regulations for California's ocean waters and also oversees and funds the state's nine RWQCBs. The RWQCBs prepare water quality control plans, establish water quality objectives, and carry out federal and state water quality regulations and permitting duties for inland waterbodies, enclosed bays, and estuaries within their respective regions. The Porter-Cologne Act gives the SWRCB and RWQCBs broad powers to protect water quality by regulating waste discharge to water and land and by requiring cleanup of hazardous wastes.

9.1.2.2.2 State Antidegradation Policy

The SWRCB adopted the Statement of Policy with Respect to Maintaining High Quality Water in California (Resolution No. 68-16) on October 28, 1968. This policy is generally referred to as the "Antidegradation Policy" and it protects surface water and groundwater where existing water quality is higher than the standards set by the Water Quality Control Plan (or Basin Plan) to protect beneficial use of the waters. Under the Antidegradation Policy, any action that can adversely affect water quality in surface water or groundwater:

> Must be consistent with the maximum benefit to the people of the state.

> Must not unreasonably affect present and anticipated beneficial use of such water.

> Must not result in water quality less than that prescribed in water quality plans and policies.

9.1.2.2.3 Safe Drinking Water Act 1976

California adopted its own Safe Drinking Water Act in 1976 that gave California Department of Health Services the responsibility for the administration of the federal Safe Drinking Water Act in California. This responsibility was then moved to the CDPH. The first approach is to safeguard public welfare by limiting the level of specific contaminants that can impact public health. These limits are identified as Primary MCLs and are specific concentrations that cannot be exceeded for a given constituent. The second approach is a treatment technique that is based on distribution system sampling in comparison to an action level. If the action level is exceeded in more than 10 percent of the samples, then additional treatment is required of the water supplier. Currently, treatment technique limits apply only to copper and lead. CDPH also has established Secondary MCLs that regulate constituents that affect water quality aesthetics (such as taste, odor, or color). Generally, CDPH uses the Secondary MCLs as guidelines.

Another component of the California Safe Drinking Water Act is the requirement of Cal-EPA's Office of Environmental Health Hazard Assessment to develop Public Health Goals (PHGs) for contaminants in California's publicly supplied drinking water. PHGs are concentrations of drinking water contaminants that pose no significant health risk if consumed for a lifetime, based on current risk assessment principles, practices, and methods. This office establishes PHGs pursuant to Health & Safety Code Section 116365© for contaminants with MCLs and for those for which CDPH will be adopting TMDLs. Public water systems use PHGs to provide information about drinking water contaminants in their annual Consumer Confidence Reports. Certain public water systems must provide a report to their customers about health risks from a contaminant that exceeds its PHG and about the cost of treatment to meet the PHG, and hold a public hearing on the report.

9.1.2.2.4 Section 401 Water Quality Certification

CWA Section 401 certification is required for any permit or license issued by a federal agency for any activity that may result in a discharge into waters of the state to ensure that a proposed project will not violate state water quality standards. This water quality certification is part of the 1974 CWA, which allows each state to have input into projects that may affect its waters (USEPA 2013b).

9.1.2.2.5 Water Quality Control Plan

The Water Quality Control Plans (or Basin Plans) of all nine of the RWQCBs and the California Ocean Plan (prepared and implemented by the SWRCB) collectively constitute the State Water Quality Control Plan. These plans are the RWQCB's master water quality control planning documents. They designate beneficial uses and water quality objectives for waters of the state, including surface waters and groundwater and also include programs of implementation to achieve water quality objectives. According to the requirements of the CWA and the California Porter-Cologne Act, each Basin Plan has been designed to support the intentions of the CWA and the Porter-Cologne Act by (1) characterizing the water resources within a region, (2) identifying beneficial uses that exist or have the potential to exist in each waterbody, (3) establishing water quality objectives for each waterbody to protect beneficial uses or allow their restoration, and (4) providing an implementation program that achieves water quality objectives. Implementation program measures include monitoring, permitting, and enforcement activities. The Basin Plans include numeric site-specific water quality objectives and narrative objectives for toxicity, chemical constituents, and tastes and odors. The narrative toxicity objective states: "*All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life*."

9.1.2.2.6 Diazinon and Pesticide-Related Toxicity in Urban Creeks TMDL

Resolution R2-2005-0063 amended the Basin Plan for the San Francisco Bay region to establish a Water Quality Attainment Strategy and TMDL for Diazinon and pesticide-related toxicity in the Bay Area region creeks. As Diazinon use was phased out in 2004, alternatives began to pose water quality concerns and pyrethroids in particular were identified as the likely cause of sediment toxicity in some Bay Area urban creeks. To account for pesticide use changes over time, the Basin Plan amendment includes generic pesticide-related toxicity targets to comply with the narrative toxicity objective. When pesticide-related toxicity occurs in urban creek water, creeks do not meet the narrative toxicity objective as stated above in *Water Quality Control Plan*. When pesticide-related toxicity occurs in sediment, the creeks also do not meet the narrative sediment objective, which states: "Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life." Management actions designed to reduce the impacts of pesticide-related toxicity are outlined within the TMDL and Water Quality Attainment Strategy and are currently underway via Provision C.9 of the Municipal Regional NPDES Permit (BASMAA 2013).

9.1.2.2.7 California Pesticide Regulatory Program

CDPR regulates the sale and use of pesticides in California. CDPR is responsible for reviewing the toxic effects of pesticide formulations and determining whether a pesticide is suitable for use in California through a registration process. Although CDPR cannot require manufacturers to make changes in labels, it can refuse to register products in California unless manufacturers address unmitigated hazards by amending the pesticide label. Consequently, many pesticide labels that are already approved by USEPA also contain California-specific requirements. Pesticide labels are application requirements and include instructions informing users how to make sure the product is applied only to target pests including precautions the applicator should take to protect human health and the environment. For example, product labels may contain such measures as restrictions in applications to certain land uses and weather (i.e., wind speed) parameters.

9.1.2.2.8 Cooperative Agreement between the California Department of Public Health and Local Vector Control Agencies

Due to their public health mission, CDPR's Pesticide Regulatory Program provides special procedures for vector control agencies that operate under a Cooperative Agreement with CDPH. The application of pesticides by vector control agencies is regulated by a special and unique arrangement among the CDPH, CDPR, and County Agricultural Commissioners. CDPR does not directly regulate vector control agencies. CDPH provides regulatory oversight for vector control agencies that are signatory to the Cooperative Agreement. This relationship includes consultation, technical assistance, and the certification of vector control technicians. The Cooperative Agreement governs routine surveillance, prevention, and control activities for vectors and vector-borne diseases. Signatories to the agreement use only pesticides listed by CDPH, maintain pesticide use reports, and ensure that pesticide use does not result in harmful residues on agricultural products. Both CDPH and County Agricultural Commissioners inspect District facilities, training and safety practices documents, staff certifications, continuing education compliance records, and equipment. County Agricultural Commissioners also conduct unannounced field inspections of staff and equipment to document compliance with product label requirements, as well as other regulations and safety practices.

9.1.2.2.9 Pesticide Permits

In response to a Sixth Circuit Court decision in 2009 that the application of pesticides at, near, or over waters of the US that results in discharges of pollutants requires coverage under a NPDES permit, the SWRCB adopted four Pesticide Permits. The following two are applicable to the Program. The Spray Applications Permit is also relevant to the regulatory setting when the District performs pesticide applications for the CDFA and/or USFS.

> Statewide NPDES Vector Control Permit. The Statewide NPDES Permit for biological and residual pesticide discharges to waters of the US from vector control applications (SWRCB Water Quality Order No. 2011-0002-DWQ with amendments; NPDES No. CAG 990004; Vector Control Permit) covers the point source discharge of biological and residual pesticides resulting from direct and spray

applications for vector control. The District completed application requirements, including preparation of a PAP and public notice requirements, and received permit approval on October 31, 2011 (http://www.waterboards.ca.gov/water_issues/programs/npdes/aquatic.shtml). Permitted larvicide active ingredients include monomolecular films, methoprene, *Bacillus thurigiensis* subspecies *isralensis* or *Bti*, *Bacillus sphaericus* or Bs, temephos, petroleum distillates, and spinosad. Permitted adulticide active ingredients include malathion, naled, pyrethrin, deltamethrin, lambda-cyhalothrin, permethrin, resmethrin, sumithrin, prallethrin, the synergist PBO, etofenprox, and N-octyl bicycloheptene dicarboximide (MGK-264). The permit contains a receiving water limitation for malathion and receiving water monitoring triggers for the other active ingredients. Receiving water monitoring triggers are conservatively based on one-tenth of the LC50 from USEPA's Ecotoxicity Database (LC50 is defined in Section 9.1.1.4). To obtain coverage under the permit, each discharger (typically a vector control district) must submit a Notice of Intent, application fee, and PAP, which is subject to approval by the SWRCB following a 30-day public comment period.

The PAP serves as a comprehensive plan developed by the discharger that describes the project, the need for the project, what will be done to reduce water quality impacts, and how those impacts will be monitored. The PAP must include a description of application and target areas, evaluation of available BMPs, and description of BMPs to be implemented. The PAP must include a discussion of the factors influencing the decision to select pesticide applications for vector control, what pesticide products or types expected to be used and any known degradation byproducts. The PAP also includes the methodology used to determine how much pesticide is needed and how this amount was determined, the methods in which pesticides are to be applied, and any adjuvants or surfactants that will be used.

Permittees must comply with the Vector Control Permit Monitoring and Reporting Program (MRP), which encourages formation of monitoring coalitions. Monitoring requirements include background, event, and post-event sampling for visual, physical, and chemical constituents for each type of aquatic pesticide used. Physical measurements and chemical samples are required at six sites in each environmental setting (urban, agricultural/rural, and wetland). Visual monitoring is required during and after pesticide applications, when feasible, to visually asses the area in and around where pesticides are applied for possible adverse incidents. The District is a member of the MVCAC NPDES Permit Coalition, which is responsible for coordinating all physical measurements and conducting all chemical monitoring required under the Vector Control Permit MRP. Chemical monitoring results that exceed the receiving water limitation for malathion or the receiving water monitoring trigger for other active ingredients must be reported to the SWRCB and RWQCB within 24 hours of identification. Within 30 days a written report must be submitted, which includes a description of actions to be taken to prevent recurrence of adverse incidents. Annual reports are required by the MVCAC NPDES Permit Coalition and each member district. Member district annual reports are typically limited to submittal of Pesticide Application Logs, which contain specific application details such as the type of pesticide used, the quantity used, and the location of where the pesticide is used, and review of their PAP. The MVCAC NPDES Permit Coalition annual report includes all physical and chemical monitoring data and makes recommendations for modifications to the MRP, if appropriate.

> <u>Statewide NPDES Aquatic Weed Control Permit</u>. The Statewide General NPDES Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in waters of the US (SWRCB Water Quality Order No. 2013-0002-DWQ with amendments; NPDES No. CAG 990005; Aquatic Weed Control Permit) addresses the discharge of residues resulting from aquatic pesticide applications using products containing 2,4-D, acrolein, copper, diquat, endothall, fluridone, glyphosate, imazapyr, penoxsulam, sodium carbonate peroxyhydrate, and triclopyr-based algaecides and aquatic herbicides, and adjuvants containing ingredients represented by nonylphrnol. The permit contains receiving water limitations for 2,4-D, acrolein, copper, diquat, endothall, fluridone, glyphosate, nonylphenol, toxicity, and dissolved oxygen, and receiving water monitoring triggers for imazapyr and triclopyr triethylamine. To obtain coverage under the permit, a discharger must submit a Notice of Intent, application fee, and

a vicinity map to the appropriate RWQCB. Effluent limitations contained in the Aquatic Weed Control Permit require that the residual algaecides and aquatic herbicides meet applicable water quality standards, require implementation of BMPs, and include requirements to develop and implement an APAP.

The APAP must describe appropriate BMPs, including compliance with all pesticide label instructions, and a monitoring plan that meets the requirements of the permit MRP. Monitoring requirements include background, event, and post-event sampling for visual, physical, and chemical constituents for each type of aquatic pesticide used for each type of site (flowing water and nonflowing water). Annual reports must summarize monitoring data and address the effectiveness of the APAP to reduce or prevent the discharge of pollutants associated with aquatic pesticide applications. Other specific requirements of the APAP include a description of the waterbody(ies) or waterbody systems being controlled and a description of what weed(s) are being controlled and why. The APAP also serves as a discussion of control tolerances (i.e., how much growth can occur before action is necessary) and of the factors influencing the decision to use aquatic pesticides in regards to those tolerances (pros and cons). The types of pesticides and adjuvants that are used and the methodology used to determine the amount of product to be applied are also detailed within an APAP. Finally, the APAP should have a description of application and treatment areas within the system and, if applicable, a list of gates or control structures and their inspection schedule to ensure they are not leaking.

- Statewide NPDES Spray Applications Permit. The Statewide General NPDES Permit for Biological and Residual Pesticide Discharges to Waters of the US from Spray Applications (SWRCB Water Quality Order No. 2011-0004-DWQ; NPDES No. CAG 990007; Spray Applications Permit) addresses spray applications of insecticides and herbicides by CDFA and USFS. Under the permit, CDFA is covered for applications of acetamiprid, aminopyralid, *Bacillus thuringiensis*, subspecies *kurstaki* (*Btk*), carbaryl, chlorsulfuron, clopyralid, cyfluthrin, dinotefuran, glyphosate, imazapyr, imidacloprid, malathion, naled, nuclear polyhedrosis virus (NPV), pheromone, pyrethrins, Spinosad A and D, triclopyr butoxyethyl ester (BEE), and triclopyr triethylamine salt (TEA). USFS is covered for applications of biological control agents, which is a subset of the CDFA active ingredients.

  The permit contains a receiving water limitation for malathion and receiving water monitoring triggers for many of the other active ingredients. To obtain coverage under the permit, the discharger must submit a Notice of Intent, application fee, and a project- or program-specific PAP to the SWRCB. The PAP must describe the application area, appropriate BMPs for each pesticide project, an evaluation of possible alternatives to pesticide use, and a monitoring plan. The PAP must also include an Off-Target Drift Management Plan. Monitoring requirements include background and event monitoring for visual, physical, and chemical parameters at frequencies similar to the Vector Control Permit. Annual reports must summarize sampling results and recommend improvements to the monitoring program, BMPs, and PAP.

9.1.2.3 Local

A compilation of local ordinances and regulations (or chapters within which they can be found) for counties within the District Program Area is provided in Table 9-3. The counties include Alameda,[2] Contra Costa, and Santa Clara counties.

Table 9-3 List of County General Plan Pesticide and Water Quality Policies

County	Name of Code/Plan	Element Title, Chapter and Section
Alameda	Castro Valley General Plan	Natural Hazards and Public Safety, Chapter 10
Alameda	East County Area Plan	Land Use, Public Services and Facilities, Environmental Health and Safety
Alameda	Eden Area General Plan	Land Use – Chapter 3, Public Facilities and Services – Chapter 6
Alameda	Countywide General Plan	Safety Element– Chapter 2, Hazardous Materials
Contra Costa	Contra Costa County General Plan	Conservation Element, Chapter 8, 8-22
Santa Clara	Santa Clara County General Plan	Resource Conservation, C-RC 18, C-RC 20, R-RC 14, R-RC 32

Sources: Alameda County Community Development Agency 2000, 2010, 2012, 2013; Contra Costa County 2005; Santa Clara County 1994

9.1.2.3.1 County Agricultural Commissioners

In addition to federal and state oversight, County Agricultural Commissioners in California also regulate the sale and use of pesticides and issue Use Permits for applications of pesticides that are deemed as restricted materials by CDPR. County Agricultural Commissioners collect pesticide use reports from the District and other users of pesticides, investigate incidents and illnesses, and conduct annual inspections. County Agricultural Commissioners also conduct unannounced field inspections of staff and equipment to document compliance with product label requirements, as well as other regulations and safety practices.

9.2 Environmental Impacts and Mitigation Measures

The water resource impacts evaluation is provided below. The evaluation qualitatively and quantitatively compares the Program's potential water resource impacts to the significance criteria presented in Section 9.2.1, Evaluation Concerns and Criteria. Significant impacts are summarized for each alternative where one or more potential impacts were identified. Mitigation measures are identified for potentially significant but mitigable impacts following the statement of impact. Additional information on the mitigation measures is provided in Section 9.2.1.1.

9.2.1 Evaluation Concerns and Criteria

Impacts are considered significant if the Program actions cause concentrations of Program compounds in receiving waterbodies (surface water or groundwater) to exceed established water quality objectives or other applicable water quality standards or promulgated regulations on the local, state, or federal level. Increased concentrations of potential pollutants associated with Program activities within the Program Area would be related to the application of Program materials or implementation of Program activities in the Program Area.

[2] In Alameda County, the cited area plans are for unincorporated communities.

As discussed previously in this PEIR, the Program Area is distributed across the District (and adjacent counties) rather than in a single particular location. The effects on water resources are largely attributable to the post-application movement of those compounds identified for use under the Program alternatives to surface water and/or groundwater. Some Program activities that do not involve applications of compounds could also affect water resources.

Concerns related to water resources issues that were raised by the public included the following:

- Consideration of CDPH review and approval of mosquito abatement materials and practices proposed for use on watershed lands.
- Need for description and quantification of dredge or fill activities and evaluation of their impacts.
- Impacts of drift from aerial spray and ground applications on waterbodies, watersheds, and drinking water supplies.
- Concern for spread of invasive weeds, erosion and sedimentation

While the first issue is related to Program implementation and coordination with other agencies (who will receive this PEIR), the last three are related to the Physical Control, Vegetation Management, and Chemical Control Alternatives and are addressed in the environmental impact analyses.

This water resource analysis addresses potential impacts to the quality of surface water and groundwater at a programmatic level and does not quantify dredge and fill activities (which could be addressed in the new USACE permit described in Section 2.8.1.3). Because no large-scale consumptive use of water supply is associated with implementation of the Program alternatives, the potential for an impact to water supply would be related to a physical impact to water quality. Additional discussion of the potential for the pesticides to result in exceedance of federal or state agency surface water quality standards or objectives is contained in Section 6.2, Ecological Health Environmental Impacts.

9.2.1.1 Thresholds of Significance

Applicable regulatory and planning standards discussed above can be used to determine appropriate thresholds of significance for this water resource analysis.

The Program activities are evaluated in accordance with the Hydrology and Water Quality Section IX of the CEQA Environmental Checklist Form, Appendix G. Several of the topic areas represented by the questions from the checklist are not affected by the Program activities, as follows:

Would the Program substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	No, Program activities would not impact groundwater supplies or groundwater recharge.
Would the Program substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off site?	No, Program activities would not substantially change or alter drainage amount, timing, or patterns.
Would the Program substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, which would result in flooding on- or off site?	No, Program activities would not substantially change or alter drainage amount, timing, or patterns.

Would the Program create or contribute runoff water, which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	No, Program activities would not create or contribute additional sources of clean or polluted runoff.
Would the Program place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	No, Program activities would not construct any housing.
Would the Program place within a 100-year flood hazard area structures, which would impede or redirect flood flows?	No, Program activities would not create any structures.
Would the Program expose 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?	No, Program activities would not expose people or structures to flooding.
Would the Program lead to inundation by seiche, tsunami, or mudflow?	No, Program activities would not cause inundation by seiche, tsunami, or mudflow.

Topic areas that may be impacted by the Proposed Program include the following:

> Would the Program violate any water quality standards or waste discharge requirements?

> Would the Program otherwise substantially degrade water quality?

For the evaluation of these topic areas, impacts from Program activities on the water quality of surface water or groundwater would be considered potentially significant if the Program implementation or activities could cause chemical concentrations to exceed the following criteria:

> Any discharge to the surface water or groundwater that exceeds NPDES permit receiving water limitations

> Any discharge to the surface water or groundwater that exceeds Basin Plan objectives with a focus on the toxicity objective

> Any discharge to the surface water or groundwater that exceeds the MCLs

> Any discharge to surface water or groundwater that exceeds the California Toxics Rule Criteria Maximum Concentrations for human health or for aquatic life

> Any discharge to surface water or groundwater that degrades the water quality by either affecting beneficial uses or by exceeding any prescribed concentration limits in state water quality plans and policies.

9.2.2 Evaluation Methods and Assumptions

The methodology and assumptions of this water resources impact evaluation for the Program alternatives are provided below.

9.2.2.1 Methodology

The methodology used to prepare this programmatic impact analysis section is as follows:

> Obtain source-specific data for Program-specific chemical constituents.

> Evaluate Ecological and Human Health Risk Assessment (Appendix B) sections related to the Program.

> Compare water quality conditions associated with Program alternatives against threshold criteria.

- Identify water resource impacts and mitigation measures for Program activities that exceed water quality thresholds.

The Human and Ecological Health Risk Assessment Report (Appendix B) reviews and evaluates the pesticide (insecticides and herbicides) active ingredients and adjuvants currently used or proposed for use by the District. Application information, including the target organisms, number of treatments, total amount applied, and specific habitat types was obtained from the District. A comprehensive literature review was conducted to evaluate environmental fate and general toxicity characteristics for the active ingredients. The results of the assessment were used to rank the potential for adverse effects to human health and the environment. Chemical and application characteristics such as the likelihood for nontarget species and habitats, the potential for drift, and the possible transport and fate of the chemical in various media (i.e., air, surface water/groundwater, soil) were considered in the assessment. Those active ingredients that appear to exhibit a higher level of risk than others or that are in prevalent use in current Programs (even though they had lower toxicity) include the following products:

- Methoprene for mosquito control (toxicity to aquatic organisms and insects)
- Etofenprox for mosquito control (toxicity to aquatic organisms)
- Bti for mosquito control (prevalent use; public concerns)
- Pyrethrins for mosquito control (includes PBO synergist)
- Resmethrin for mosquito control (includes PBO synergist)
- Surfactants for mosquito control (contains petroleum distillate)
- Permethrin for mosquito and wasp control (toxicity to aquatic organisms; potential endocrine disruptor)
- Lambda-cyhalothrin for yellow jacket wasp control (high toxicity to aquatic organisms; potential to bioaccumulate in fish; possible endocrine disruptor)
- APEs for weed control (high toxicity to aquatic organisms; moderately bioaccumulative)
- Glyphosate for general weed control (possible endocrine disruptor);

The District is using the following best management practices as control measures to avoid and minimize impacts to water resources (see Table 2-6).

- When walking or using small equipment in marshes, riparian corridors, or other sensitive habitats, existing trails, levees and access roads will be used whenever possible to minimize or avoid impacts to species of concern and sensitive habitats. Specific care will be taken when walking and performing surveillance in the vicinity of natural and manmade ditches or sloughs or in the vicinity of tidal marsh habitat (Table 2-6, BMP A3).
- Properly train all staff, contractors, and volunteer help to prevent spreading weeds and pests to other sites. The District headquarters contains wash rack facilities (including high-pressure washers) to regularly (in many cases daily) and thoroughly clean equipment to prevent the spread of weeds (Table 2-6, BMP A10).
- District will minimize the use of equipment (e.g., ARGOs) in tidal marshes and wetlands. When feasible and appropriate, surveillance and control work will be performed on-foot with handheld equipment. Aerial treatment (helicopter) treatments will be utilized when feasible and appropriate to minimize the disturbance of the marsh during pesticide applications. When ATVs (e.g., ARGOs) are utilized techniques will be employed that limit impacts to the marsh including: slow speeds; slow, several point turns; using existing levees or upland to travel through sites when possible; use existing pathways or limit the number of travel pathways used (Table 2-6, BMP B2).

- District will use reasonable measures to minimize travel along tidal channels and sloughs in order to reduce impacts to vegetation used as habitat (e.g., rail nesting and escape habitat) (Table 2-6, BMP B3).
- When feasible, boats will be used to access marsh areas for surveillance and treatment of mosquitoes to further reduce the risk of potential impacts that may occur when using ATVs to conduct mosquito management activities (Table 2-6, BMP B5).
- Vegetation management work performed will typically be by hand, using handheld tools, to provide access to mosquito habitat for surveillance, and when needed control activities. Tools used include: machetes, small garden variety chain saw, hedge trimmers and "weed-eaters" (Table 2-6, BMP K2).
- Minor trimming of vegetation (e.g., willow branches approximately three inches in diameter or less, blackberry bushes, and poison oak) to the minimum extent necessary will occur to maintain existing paths or create access points through dense riparian vegetation into mosquito habitat. This may include minor trimming of overhanging limbs, brush and blackberry thickets that obstruct the ability to walk within creek channels. Paths to be maintained will not be a cut as a defined corridor but rather a path maintained by selective trimming of overhanging or intrusive vegetation. Paths to be maintained will range in width from 3 to 6 feet across (Table 2-6, BMP K4).
- Downed trees and large limbs that have fallen due to storm events or disease will be cut only to the extent necessary to maintain existing access points or to allow access to mosquito habitats (Table 2-6, BMP K5).
- Every effort will be made to complete vegetation management in riparian corridors prior to the onset of heavy rains. Maintenance work to be done in early spring will be limited to trimming of access routes to new tree shoots, poison oak, blackberries, and downed trees that block these paths (Table 2-6, BMP K6).
- If using heavy equipment for vegetation management, District staff (and contractors) will minimize the area that is affected by the activity and employ all appropriate measures to minimize and contain turbidity. Heavy equipment will not be operated in the water and appropriate containment and cleanup systems will be in place on site to avoid, contain, and clean up any leakage of toxic chemicals (Table 2-6, BMP K9).
- District staff will consult with appropriate resource agencies (USACE, USFWS, CDFW, NMFS, BCDC, Regional Water Quality Control Board) and obtain all required permits prior to the commencement of ditch maintenance or construction within tidal marshes (Table 2-6, BMP L1).
- Staging of equipment will occur on upland sites (Table 2-6, BMP L5).
- Mats or other measures will be taken to minimize soil disturbance (e.g., use of low ground pressure equipment) when heavy equipment is used (Table 2-6, BMP L6).
- All projects will be evaluated prior to bringing mechanical equipment on site, in order to identify and flag sensitive sites, select the best access route to the work site consistent with protection of sensitive areas, and clearly demarcate work areas (Table 2-6, BMP L7).
- Measures will be taken to minimize impacts from mechanical equipment, such as hand ditching as much as possible; reducing turns by track-type vehicles, taking a minimum number of passes with equipment, varying points of entry, driving vehicles at low speed, and not driving on open mud and other soft areas (Table 2-6, BMP L8).
- Discharges of dredged or fill material into tidal waters will be minimized or avoided to the maximum extent possible at the project site and will be consistent with all permit requirements for such activity. No discharge of unsuitable material (e.g., trash) will be made into waters of the United States, and material that is discharged will be free of toxic pollutants in toxic amounts (see section 307 of the

Clean Water Act). Measures will be taken to avoid disruption of the natural drainage patterns in wetland areas (Table 2-6, BMP L9).

- Ditching that drains high marsh ponds will be minimized to the extent possible in order to protect the habitat of native salt pan species (Table 2-6, BMP L11).
- No spoils sidecast adjacent to circulation ditches will exceed 8 inches above the marsh plain to minimize risk of colonization of spoils by invasive, nonnative plants and/or the spoils lines from becoming access corridors for unwanted predators (e.g., dogs, cats, red fox). Sidecast spoil lines exceeding 4 inches in height above the marsh plain will extend no more than 6 feet from the nearest ditch margin. Any spoils in excess of these dimensions will be hydraulically redispersed on site (e.g., by rotary ditcher), or removed to designated upland sites (per conditions of resource agency issued permits). Sidecast spoil lines will be breached at appropriate intervals to prevent local impediments to water circulation (Table 2-6, BMP L12).
- Small ditch maintenance work will be performed by hand, whenever possible, using handheld shovels, pitch forks, etc., and small trimmers such as "weed-eaters". (Note: the majority of small ditch work performed by the District is by hand.) (Table 2-6, BMP L14)
- When feasible, work will be done at low tide (for tidal areas) and times of entry will be planned to minimize disruption to wildlife (Table 2-6, BMP L15).
- In marshes which contain populations of invasive nonnative vegetation such as pepperweed or introduced *Spartina*, sidecast spoils will be surveyed for the frequency of establishment of these species during the first growing season following deposition of the spoils. The results of the surveys will be reported to the USACE, USFWS and CDFW. If it is determined the sidecasting of spoils resulted in a substantial increase in the distribution or abundance of the nonnative vegetation which is detrimental to the marsh, the District will implement appropriate abatement measures after consultation with the USACE, USFWS and CDFW (Table 2-6, BMP L 16).
- When possible (i.e., with existing labor and vehicles), refuse such as tires, plastic, and man-made containers found at the work site will be removed and properly discarded (Table 2-6, BMP L17).
- District staff will conduct applications with strict adherence to product label directions that include approved application rates and methods, storage, transportation, mixing, and container disposal (Table 2-6, BMP M1).
- District will avoid use of surfactants when possible in sites with aquatic nontargets or natural enemies of mosquitoes present such as nymphal damselflies and dragonflies, dytiscids, hydrophilids, corixids, notonectids, ephydrids, etc. Surfactants are a least preferred method but must be used with pupae to prevent adult mosquito emergence. The District will use a microbial larvicide (Bti, Bs) or IGR (e.g., methoprene) instead or another alternative when possible (Table 2-6, BMP M2).
- Materials will be applied at the lowest effective concentration for a specific mosquito species and environmental conditions. Application rates will never exceed the maximum label application rate (Table 2-6, BMP M3).
- To minimize application of pesticides, applications will be determined by surveillance and monitoring of mosquito populations (Table 2-6, BMP M4).
- District staff will follow label requirements for storage, loading, and mixing of pesticides and herbicides. Handle all mixing and transferring of pesticides and herbicides within a contained area (Table 2-6, BMP M5).
- Postpone or cease application when predetermined weather parameters exceed product label specifications, when wind speeds exceed the velocity as stated on the product label, or when a high

chance of rain is predicted and rain is determining factor on the label of the material to be applied (Table 2-6, BMP M6).

> Applicators will remain aware of wind conditions prior to and during application events to minimize any possible unwanted drift to waterbodies, and other areas adjacent to the application areas (Table 2-6, BMP M7).

> Clean containers at an approved site and dispose of at a legal dumpsite or recycle in accordance with manufacturer's instructions if available (Table 2-6, BMP M8).

> Special status Aquatic Wildlife Species:

- A CNDDB search was conducted in 2012 and the results incorporated into Appendix A for this PEIR. District staff communicates with state, federal, and county agencies regarding sites that have potential to support special status species. Many sites where the District performs surveillance and control work have been visited by staff for many years and staff is highly knowledgeable about the sites and habitat present. If new sites or site features are discovered that have potential to be habitat for special status species, the appropriate agency and/or landowner is contacted and communication initiated.
- Use only pesticides, herbicides, and adjuvants approved for aquatic areas or manual treatments within a predetermined distance from aquatic features (e.g., within 15 feet of aquatic features). Aquatic features are defined as any natural or man-made lake, pond, river, creek, drainage way, ditch, spring, saturated soils, or similar feature that holds water at the time of treatment or typically becomes inundated during winter rains.
- If suitable habitat for special status species is found, including vernal pools, and if aquatic-approved pesticide, herbicide, and adjuvant treatment methods have the potential for affecting the potential species, then the District will coordinate with the CDFW, USFWS, and/or National Marine Fisheries Service (NMFS) before conducting treatment activities within this boundary or cancel activities in this area. If the District determines no suitable habitat is present, treatment activities may occur without further agency consultation (Table 2-6, BMP M9).

> District staff will monitor sites post-treatment to determine if the target mosquito population or weeds were effectively controlled with minimum effect to the environment and nontarget organisms. This information will be used to help design future treatment methods in the same season or future years to respond to changes in site conditions (Table 2-6, BMP M10).

> Do not apply pesticides that could affect insect pollinators in liquid or spray/fog forms over large areas (more than 0.25 acres) during the day when honeybees are present and active or when other pollinators are active. Preferred applications of these specific pesticides are to occur in areas with little or no honeybee or pollinator activity or after dark. These treatments may be applied over smaller areas (with hand held equipment), but the technician will first inspect the area for the presence of bees and other pollinators. If pollinators are present in substantial numbers, the treatment will be made at an alternative time when these pollinators are inactive or absent (Table 2-6, BMP M11).

> The District will provide notification to the public (as soon as operationally possible) and/or appropriate agency(ies) when applying pesticides or herbicides for large-scale treatments (e.g., fixed-wing aircraft or helicopters) that will occur in close proximity to homes, heavily populated, high traffic, and sensitive areas. The District infrequently applies or participates in the application of herbicides in areas other than District facilities (Table 2-6, BMP M12).

> Prior to adulticide applications, the location of the application area will be reviewed with respect to the proximity to 303(d) listed impaired waterbodies for pyrethroids or sediment toxicity. If impaired, application of permethrin and resmethrin would not be conducted in these locations (Table 2-6, BMP M13).

> Exercise adequate caution to prevent spillage of pesticides during storage, transportation, mixing or application of pesticides. All pesticide spills and cleanups (excepting cases where dry materials may be returned to the container or application equipment) will be reported to the Field Operations Supervisor and District Manager and recorded in the District safety and incident file (Table 2-6, BMP N1).
> Maintain a pesticide spill cleanup kit and proper protective equipment at the District's Service Yard and in each vehicle used for pesticide application or transport (Table 2-6, BMP N2).
> Manage the spill site to prevent entry by unauthorized personnel. Contain and control the spill by stopping it from leaking or spreading to surrounding areas, cover dry spills with polyethylene or plastic tarpaulin, and absorb liquid spills with appropriate absorbent materials (Table 2-6, BMP N3).
> Properly secure the spilled material, label the bags with service container labels identifying the pesticide, and deliver them to the District/Field Operations Supervisor for disposal (Table 2-6, BMP N4).
> A hazardous spill plan will be developed, maintained, made available, and staff trained on implementation and notification for petroleum-based or other chemical-based materials prior to commencement of mosquito treatment activities (Table 2-6, BMP N5).
> Field-based mixing and loading operations will occur in such a manner as to minimize the risk of accidental spill or release of pesticides (Table 2-6, BMP N6).

9.2.2.2 Assumptions

The following assumptions were used in the assessment of potential water resource impacts from the Program alternatives:

> Site-specific evaluation of water quality impacts are not within the scope of this programmatic evaluation.
> The programmatic evaluation is based on the current proposed mosquito control methods and is subject to change.
> Existing baseline ambient water quality data related to Program chemicals are limited for most areas.
> Mitigation measures for specific locations within the Program Area are not provided.

Assumptions related to the analysis of hazards, toxicity, and exposure for chemical treatment methods are explained below, including the definition of key terms.

9.2.2.2.1 Hazardous Material

A "hazardous material" is defined in California Health and Safety Code Section 25501 (p): as "any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment." "Hazardous materials" include, but are not limited to, "hazardous substances, hazardous waste, and any material that a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment." Any liquid, solid, gas, sludge, synthetic product, or commodity that exhibits characteristics of toxicity, ignitability, corrosiveness, or reactivity has the potential to be considered a "hazardous material."

9.2.2.3 Toxicity and Exposure

Toxicology is the study of a compound's potential to elicit an adverse effect in an organism. The toxicity of a compound is dependent upon exposure, including the specific amount of the compound that reaches an organism's tissues (i.e., the dose), the duration of time over which a dose is received, the potency of the chemical for eliciting a toxic effect (i.e., the response), and the sensitivity of the organism receiving the dose of the chemical. Toxicity effects are measured in controlled laboratory tests on a dose/response scale, whereby the probability of a toxic response increases as dose increases. Exposure to a compound is necessary for potential toxic effects to occur. However, exposure does not, in itself, imply that toxicity will occur. Thus, toxic hazards can be mitigated by limiting potential exposure to ensure that doses are less than the amount that may result in adverse health effects.

The toxicity data included in the numerous tables and charts in this document are generally derived from rigidly controlled laboratory animal studies designed to determine the potential adverse effects of the chemical under several possible routes of exposure. In these studies, the species of interest is exposed to 100 percent chemical at several doses to determine useful information such as the lowest concentration resulting in a predetermined adverse effect (LOAEL) on numerous selected physiological and behavioral systems. The second component of these tests is to determine the highest concentration of chemical that results in no measurable adverse effect (NOAEL).

However, these, and other, coordinated and focused laboratory tests are designed to document the effects of the chemical when a continuous, controlled, exposure exists and do not realistically reflect the likely exposures or toxicity in the District field application scenarios. As such, the toxicity information is intended as an overview of potential issues and guidance for understanding the completely "safe" maximum exposure levels of applications that would not adversely impact humans or nontarget plant and animal species.

Although the regulatory community uses this basic information to provide a relative comparison of the potential for a chemical to result in unwanted adverse effects and this information is reflected in the approved usage labels and MSDSs, in actual practice, the amounts applied in the District's Program Area are substantially less than the amounts used in the toxicity studies. Because of the large safety factors used to develop recommended product label application rates, the amount of chemical resulting in demonstrated toxicity in the laboratory is much higher than the low exposure levels associated with an actual application. The application concentrations consistent with the labels or MSDSs are designed to be protective of the health of humans and other nontarget species (i.e., low enough to not kill them, weaken them, or cause them to fail to reproduce). However, adverse effects may still occur to some non-target organisms.

9.2.3 Surveillance Alternative

Surveillance activities involve monitoring the abundance of adult and larval mosquitoes, field inspection of mosquito habitat, testing for the presence of encephalitis virus-specific antibodies in sentinel chickens or wild birds, and/or response to public service requests regarding nuisance insects. Mosquito populations are monitored through the use of traps, inspections, and sampling in mosquito habitats. Known and suspected habitats are anywhere that water can collect, be stored, or remain standing for more than a few days, including, but not limited to, catch basins, stormwater detention systems, residential communities, parks, ornamental ponds, unmaintained swimming pools, seeps, seasonal wetlands, tidal and diked marshes, wastewater ponds, sewer plants, winery waste/agricultural ponds, managed waterfowl ponds, canals, creeks, tree holes, and flooded basements. If preexisting roads and trails are not available, low ground pressure ATVs may be used to access sites. Offroad access is minimized and used only when roads and trails are not available.

The potential for increased soil erosion during surveillance activities would be minimal. Existing trails, levees, and access roads would be used whenever possible when walking or using small equipment in marshes or other sensitive habitats (Table 2-6, BMP A3). Boats would also be used to access marsh areas during surveillance (Table 2-6, BMP B5). If preexisting roads and trails are not available, low ground pressure ATVs may be used to access sites. Offroad access is minimized and used only when roads and trails are not available.

Surveillance activities do not involve chemical applications to water or soil and require very little interaction with waterbodies to collect samples. With the exception of some adult mosquito traps, pesticides are not required for any of the surveillance techniques. Some adult mosquito traps use a Vapona strip infused with dichlorvos in the bottom of the collection jar; this chemical would be contained in the collection device and would not contact nor interact with the environment. Therefore, no impact would occur to surface water or groundwater.

> **Impact WR-1:** The Surveillance Alternative collection devices would not contact nor interact with the environment. **No impact** would occur to surface water or groundwater.

9.2.4 Physical Control Alternative

Physical control for mosquitoes consists of the management of mosquito-producing habitat (including freshwater marshes and lakes, saltwater marshes, temporary standing water, and wastewater treatment facilities) especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities, etc. Physical controls reduce or eliminate mosquito development sites by improving the habitat value for mosquito predators (i.e., providing deepwater sanctuary for larvivorous fish) or by reducing the habitat value for mosquitoes. Because mosquitoes breed in stagnant standing water, the District attempts to reduce these habitats through vegetation management, increased circulation, steepening banks, changes in water quality, or by reducing the duration that standing water is allowed to persist. The specific method employed is based on site- and project-specific considerations, including whether the activity is conducted to prevent mosquito-producing habitat from forming or in response to existing conditions. Characteristics of the site and waterbody are also considered in planning physical control activities. Vegetation management is based on an IPM approach and is discussed in Section 9.2.5. The District conducts physical control activities, requests/requires landowners and stewards to implement maintenance activities, and advises landowners on source reduction for mosquito habitat. Any requests to landowners and stewards will include a clear statement regarding the need for consultation with resource agencies to determine potential risks to sensitive habitats and special-status species as well as to determine the need for any permits prior to commencement of any work.

Three types of physical control practices are implemented:

1. <u>Maintenance activities</u> include removal of sediments from existing water circulation ditches; repair of existing water control structures, removal of debris in natural channels, clearance of brush for access to streams tributary to wetland areas, and filling of existing, nonfunctional water circulation ditches to achieve required water circulation dynamics and restore ditched wetlands.
2. <u>New construction</u> typically involves the creation of new ditches to enhance tidal flow preventing stagnant water.
3. <u>Cultural practices</u> include requests for changes in vegetation and water management (i.e., irrigation practices), placement of culverts or other engineering works, and making other physical changes to the lands. Any requests will be accompanied by direction to consult with resource agencies prior to commencement of any work.

The District performs these physical control activities in accordance with all appropriate environmental regulations and in a manner that generally maintains or improves habitat values for desirable species. Physical control activities can be relatively minor, typically consisting of up to 10,000 to 20,000 linear feet of ditch maintenance per year, and are often covered by the District's 5-year USACE and BCDC regional wetlands permits (Section 2.8.1.3). Filling or periodically draining artificially ponded areas such as ornamental ponds and irrigation ponds can be cost-effective and environmentally acceptable; however, these methods are not appropriate strategies in natural areas, large permanent waterbodies, or in areas set aside for stormwater or wastewater retention. Consequently, the District does not usually undertake physical control projects in fresh waterbodies including marshes and ponds. In saline and brackish marsh habitat, physical control measures are typically designed to reduce salt-marsh mosquito production through enhancement of the frequency and duration of tidal inundation or through other water management strategies.

Maintenance of existing facilities, construction of new water control facilities, and changes in water management strategies could affect existing drainage patterns and water quality locally. However, the District would implement control measures during ditch maintenance and during construction or repair of tide gates and other water control structures in tidal marshes to avoid disruption to natural drainage patterns (Table 2-6, BMP L9). For example, spoil material sidecast during ditch maintenance would not exceed 8 inches above the marsh plain and the sidecast material would be breached periodically to not impede local runoff (Table 2-6, BMP L12). Because physical control activities would typically be implemented to improve drainage at the site and reduce the duration of standing water in areas that produce mosquitoes, and because control measures would be used to minimize disruption of natural drainage patterns, these activities would not adversely and substantially change or alter drainage amounts, timing, or patterns. Furthermore, permitted projects are typically inspected by resource agency personnel to confirm that permit conditions were met.

Physical controls would likely improve long-term water quality conditions. Physical control activities would be designed to improve drainage or increase water circulation, which can increase dissolved oxygen and reduce water temperatures, improving these water quality conditions locally. Changing water circulation patterns can also increase localized areas of scour due to increased water velocities, particularly near structures. Water control facilities (e.g., tide gates, levees) are designed to minimize scour near the structure for long-term stability. Potential increases in turbidity in the waterbody would be limited to during and immediately after the action and would not extend beyond the vicinity of the area being improved. Changes to groundwater conditions such as water quality or recharge would not occur.

Removal of sediments from existing water circulation ditches during maintenance activities has the potential to temporarily approach or exceed turbidity water quality objectives in nearby downstream receiving waters. However, the physical control activities are short in duration (typically less than 1 day), are localized to site-specific areas, and are transitory in location. Additionally, a majority of small ditch work is performed by hand (Table 2-6, BMP L14), limiting the amount of ground-disturbing activity that could occur when maintaining these areas and other control measures would be used to minimize soil disturbance near waterways (Table 2-6, BMPs L5, L6, and L8). Therefore, this temporary and transitory potential impact to surface water or groundwater is less than significant.

> **Impact WR-2**: The Physical Control Alternative's activities to modify water circulation, remove sediment, and maintain water control facilities to reduce habitat conditions for mosquito production would have a **less-than-significant** impact on water resources and no mitigation is required.

9.2.5 <u>Vegetation Management Alternative</u>

District staff's direct vegetation management generally consists of activities to reduce the mosquito habitat value of sites by improving water circulation or access by fish and other predators, or to allow District staff's access to standing water for inspections and treatment. The District uses hand tools, and potentially other mechanical means, or herbicide applications to thin or remove vegetation. These activities primarily occur in aquatic habitats to assist with the control of mosquitoes but are also implemented in terrestrial habitats to help with access to mosquito producing sources. The District may also perform vegetation management to assist other agencies and landowners with the management of invasive/nonnative weeds. These actions are typically performed under the direction of the concerned agency, which also maintains any required permits.

9.2.5.1 Mechanical Removal of Vegetation

Vegetation management work in riparian areas is typically performed by hand, using handheld tools, prior to the onset of heavy rains (Table 2-6, BMPs K2 and K6). If heavy equipment is needed, control measures will be used to minimize the affected area, minimize and contain turbidity, and avoid, contain, and clean up any leakage of toxic materials (Table 2-6, BMP K9). Mechanical and hand removal of vegetation from aquatic habitats has the potential to temporarily approach or exceed turbidity water quality objectives in downstream receiving waters. However, the vegetation control activities are short in duration (typically less than 1 day), are localized to site-specific areas, and are transitory in location. Therefore, this temporary and transitory potential impact to surface water is less than significant. No impact to groundwater is associated with these activities.

Impact WR-3: Mechanical removal of vegetation from aquatic habitats would have a **less-than-significant** impact to surface water and **no impact** to groundwater resources.

9.2.5.2 Application of Herbicides

Herbicides the District may use are listed in Table 2-1 along with information regarding the timing/season of application, method of application, and types of sites where they might be applied. Section 4.6 of the Ecological and Human Health Risk Assessment (Appendix B) includes descriptions of each herbicide and information on their environmental fate and toxicity. The District has not formerly used any herbicides but reserves the right to use them in the future if needed.

Potential effects from chemical applications of herbicides include low dissolved oxygen, aquatic toxicity to nontarget species, and contributions to instream exceedances of water quality criteria, particularly if applied in previously impacted waterbodies. For example, the water quality objective that establishes a minimum concentration for dissolved oxygen may not be met in some instances, such as when aquatic weeds killed by herbicides decompose rapidly and consume dissolved oxygen in the process. Some herbicide applications also have the potential to approach or exceed the narrative toxicity water quality objective, numeric water quality objective, or receiving water monitoring trigger for the specific active ingredient. Herbicides that are not labeled for aquatic use and are subject to potential spray drift or surface water runoff may cause acute or chronic toxicity.

However, the District would apply all herbicides in strict conformance with label requirements, which have been approved by CDPR for use in California (Table 2-6, BMP M1). Pesticide labels are legal requirements and include instructions telling users how to apply the product and precautions the applicator should take to protect human health and the environment. Herbicide applications would comply with label restrictions on application rates and methods, storage, transportation, mixing, and container disposal (Table 2-6, BMPs M1, M3, M5, M6, and M8). In addition, aquatic herbicides are applied in conformance with the APAP as required by the NPDES Aquatic Weed Control Permit.

The District would implement label requirements and BMPs to reduce adverse effects to surface-water and groundwater resources from applied chemicals during and following herbicide applications. Materials would be applied at the lowest effective concentration for the environmental conditions (Table 2-6, BMP M3). Applicators would be aware of wind conditions, to minimize unwanted drift to waterbodies and adjacent areas, and aware of potential rain, if rain is a determining factor on material application (Table 2-6, BMP M6 and M7). If special status aquatic wildlife species are potentially present, only herbicides and adjuvants approved for aquatic areas would be applied within a predetermined distance from aquatic features (Table 2-6, BMP M9).

The District would also implement hazardous materials and spill management control measures to prevent and reduce potential exposure of spilled chemicals to surface-water and groundwater resources (Table 2-6, BMPs N1 through N6). These measures would require development and implementation of a hazardous spill plan and procedures used to minimize the risk of an accidental spill or release. District control measures also require that mixing and transferring of materials would occur within a contained area (Table 2-6, BMP M5) and materials would be disposed at an approved site (Table 2-6, BMP M8).

District staff would monitor sites post-treatment to determine if the target weeds were effectively controlled with minimum effect to the environment and nontarget organisms. This information would be used to help design future treatment methods in the same season or future years to respond to changes in site conditions (Table 2-6, BMP M10). Implementation of these BMPs would reduce exposure of applied chemicals to surface and groundwater resources during and following application of the material.

Herbicides and adjuvants the District may use are grouped below based on toxicity to fish and aquatic invertebrates. They are discussed in more detail in Appendix B, Ecological and Human Health Risk Assessment.

9.2.5.2.1 Registered Herbicides with Relatively Low Toxicity to Fish and Aquatic Invertebrates

Imazapyr is a systemic, nonselective, pre- and post-emergent herbicide used for the control of a broad range of terrestrial and aquatic weeds, including terrestrial annual and perennial grasses, broadleaf herbs, woody species, and riparian and emergent aquatic species. Imazapyr is water-soluble, can run off to surface waterbodies, and degrades in clear, open water. However, it is persistent in soil and leaches to groundwater. It has low toxicity to fish and aquatic invertebrates. Based upon imazapyr's toxicity and environmental fate, and using BMP application techniques, these products should not result in adverse effects.

Glyphosate is a nonselective, post-emergent, and systemic herbicide registered for use in agricultural and nonagricultural areas. It is used to control emergent foliage, but is not effective on submerged or mostly submerged foliage. Glyphosate is highly water-soluble, but binds tightly to soil and sediments. It has a low tendency to run off when applied to land because of strong adsorption to soil particles and it has a low potential to move to groundwater. Glyphosate degrades in soil in about a month. It has low toxicity to fish and aquatic invertebrates. Using BMP approaches, applications of glyphosate can be used safely when an adequate buffer to water sources is maintained.

Sulfometuron methyl is a broad-spectrum herbicide used for pre-emergence and post-emergence control of annual, biennial, and perennial grasses and broadleaf weeds. It effectively retards or stops root and shoot development. Sulfometuron methyl has a low tendency to sorb to sediments and has the potential to leach to groundwater and/or reach surface water during runoff events. It typically degrades in a few weeks and has low toxicity to fish and invertebrates. Based upon sulfometuron methyl's toxicity and environmental fate, these products should not result in adverse effects when using BMP application techniques.

The District would apply all herbicide formulations in strict conformance with their APAPs (if applicable) and label requirements, which have been approved by CDPR for use in California. Standard BMP application techniques, implementation of District BMPs, maintaining adequate buffer zones, and using care during herbicide applications would minimize adverse effects. In areas where downstream waterbodies are impacted by an unknown toxicity, application of these herbicides would have a less-than-significant impact to surface water or groundwater resources when applied in accordance with label instructions, District BMPs, and based on the infrequency of District use.

> **Impact WR-4:** Application of the herbicides imazapyr, glyphosate, and sulfometuron methyl, would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.5.2.2 Registered Herbicides with Moderate Toxicity to Fish or Aquatic Invertebrates

Triclopyr is used for the control of woody plants and annual and perennial broadleaf weeds. It is absorbed by leaves and roots and is moved throughout the plant into the foliage. Triclopyr is highly soluble, is moderately persistent in soil (with sorption to soil increasing with time), but degrades rapidly in clear, open water. It is moderate to highly toxic to fish, but is practically nontoxic to invertebrates. Based upon triclopyr's toxicity and environmental fate, and using recommended BMP application techniques, and implementation of District BMPs, this product should not result in adverse effects.

The District would apply all herbicide formulations in strict conformance with their APAPs (if applicable) and label requirements, which have been approved by CDPR for use in California. Standard BMP application techniques, implementation of District BMPs, maintaining adequate buffer zones, and using care during herbicide applications would minimize adverse effects and substantially avoid degradation of water quality. This active ingredient degrades rapidly in clear, open water. In areas where downstream waterbodies are impacted by an unknown toxicity, application of this herbicide would have a less-than-significant impact to surface water and groundwater resources when applied in accordance with label instructions, District BMPs, and based on the infrequency of District use.

> **Impact WR-5:** Application of the herbicide triclopyr would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.5.2.3 Adjuvants with High Toxicity to Fish or Aquatic Invertebrates

APEs were identified in Appendix B, Ecological and Human Health Risk Assessment as having high toxicity to fish or other aquatic organisms. APEs include a broad range of chemicals that act as adjuvants. APEs bind strongly to aquatic particles in river and coastal environments and are persistent in sediments. Nonylphenol and short-chain nonylphenol ethoxylates are moderately bioaccumulative and extremely toxic to aquatic organisms. The USEPA has recently recommended that nonylphenol and short-chain ethoxylates be evaluated further due to their widespread use (past and present), persistence, and possible estrogen-mimicking behavior.

The District would apply APEs in strict conformance with their APAPs (if applicable) and label requirements, which have been approved by CDPR for use in California. Standard BMP application techniques, implementation of District BMPs, maintaining adequate buffer zones, and using care during herbicide applications would minimize adverse effects and substantially avoid degradation of water quality. In areas where downstream waterbodies are impacted by an unknown toxicity, application of these herbicides would have a less-than-significant impact to surface water and groundwater resources when applied in accordance with label instructions, District BMPs, and based on the infrequency of District use.

> **Impact WR-6:** For APEs, application of these herbicides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.5.2.4 Adjuvants with Unknown Toxicity to Fish or Aquatic Invertebrates

Polydimethylsiloxane fluids are typically silicone defoamers that are added to solutions to minimize buildup of foam as herbicides and adjuvants are being mixed in the spray tanks. These fluids are insoluble in water. High molecular weight polydimethylsiloxanes typically sorb to particulate matter when in water and become associated with soil and sediments. Degradation is slow on moist soils but rapid on dry soil. These chemicals appear to be relatively nontoxic to most organisms, but data are lacking. Although some information is lacking regarding polydimethylsiloxanes' toxicity and environmental fate, these products should not result in adverse effects when used in accordance with recommended BMP application techniques.

Oil adjuvants (modified vegetable oils and methylated seed oils) can increase the penetration of oil-soluble herbicides into plants. Little is known of the environmental fate of these adjuvants. Modified vegetable oils and methylated seed oils are essentially nontoxic to most organisms, including plants. Although some information is lacking regarding the toxicity and environmental fate of these oils, these products should not result in adverse effects when using BMP application techniques.

The District would apply all herbicide formulations in strict conformance with their APAPs (if applicable) and label requirements, which have been approved by CDPR for use in California. Due to the lack of reported, documented effects of these adjuvants, proper application of methods using BMP application techniques and District BMPs should not result in adverse effects. In areas where downstream waterbodies are impacted by an unknown toxicity, application of these chemicals would have a less-than-significant impact to surface water and groundwater resources when applied following label instructions, District BMPs, and based on the infrequency of District use.

> **Impact WR-7:** Application of polydimethylsiloxanes, modified vegetable oils, and methylated seed oils would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.6 Biological Control Alternative

Biological control of mosquitoes involves the intentional use of vector pathogens, parasites, and predators to reduce the mosquito population. It is one of the principal components of the IPM approach followed by Mosquito and Vector Control Association of California member agencies, in which the emphasis is on source reduction and control of mosquitoes in their immature stages. Mosquito pathogens that are commercially available include the bacterial pathogen Bs. Mosquito parasites are not generally available commercially for mosquito control at present. Mosquito predators are represented by insects, fish, birds, and bats that consume larval or adult mosquitoes as prey. Although the District supports the presence of a variety of species, only mosquitofish (*Gambusia affinis*) are commercially available to use at present.

Mosquitofish are stocked at the District holding tanks and wastewater discharge has the potential to convey nutrients, sediments, and other potential pollutants. The wastewater is discharged to a sanitary sewer, where the potential pollutants may be removed by the wastewater treatment plant. Because the volume and frequency of discharges are relatively minor (300 gallon once a week), the impact of this alternative to surface water and groundwater is less than significant.

> **Impact WR-8:** The Biological Control Alternative's production of mosquitofish limits wastewater discharges to the sanitary sewer. Therefore, the production of mosquitofish would have a **less-than-significant** impact on surface water and groundwater resources and no mitigation is required.

Because mosquitofish may potentially impact red-legged frog and tiger salamander populations, use of mosquitofish is limited to man-made water features such as ornamental fish ponds, water troughs, water gardens, fountains, and unmaintained swimming pools where their migration into habitats used by special-status species is limited.

Currently, no commercial biological control agents or products are available for wasp and yellow jacket control.

Because the potential environmental impacts of mosquito pathogens the District applies are generally similar to those of chemical pesticide applications, these chemicals are evaluated under the Chemical Control Alternative (Section 9.2.7).

High populations of mosquitofish in a waterbody could increase nutrient concentrations, causing algal blooms and a subsequent drop in dissolved oxygen. However, because mosquitofish use is limited to man-made water features that are hydrologically isolated from receiving waters, their impact to surface water is less than significant. Because the connection between these man-made waterbodies and natural surface waters or groundwater is limited or nonexistent, the impact of this alternative is less than significant.

> **Impact WR-9:** The Biological Control Alternative's use of mosquitofish is limited to man-made water features that are hydrologically-isolated from receiving waters. Therefore, the use of mosquitofish would have a **less-than-significant** impact on surface water and groundwater resources and no mitigation is required.

9.2.7 Chemical Control Alternative

Chemical control consists of the application of chemicals to directly reduce populations of vectors that pose a risk to public health (herbicides are discussed in Section 9.2.5, Vegetation Management

Alternative.). The majority of chemical control tools are used for mosquito abatement. As part of their IPM program, the District prioritizes the least toxic materials available for control of the larval stages, focusing on bacterial larvicides, growth regulators, and surface films rather than organophosphate (OPs) pesticides or pyrethroids. Control of adult mosquitoes may become necessary under some circumstances, such as in the event of a disease outbreak (documented presence of infectious virus in active host-seeking adult mosquitoes), or lack of access to larval sources and habitats leading to the emergence of large numbers of biting adult mosquitoes. OP insecticides may be used in rotation with pyrethrins or pyrethroids to avoid the development of resistance. The active ingredients currently used for control of adult mosquitoes have been deliberately selected for lack of persistence and minimal effects on nontarget organisms when applied in accordance with label guidelines for ULV mosquito control.

The District may also use insecticides to control populations of ground-nesting yellow jackets. This activity is generally triggered by access needs to mosquito sources rather than as a result of regular surveillance activities. The District does not treat yellow jacket nests that are located inside or on a structure. Likewise, encounters with honeybee swarms or hives are directed to the County Agricultural Commissioner's Office for a referral list of beekeepers. If a District technician deems it appropriate to treat stinging insects, they will apply the insecticide directly within the nest to avoid drift or harm to other organisms.

Potential effects from chemical applications of pesticides include increased aquatic toxicity for nontarget species and contributions to instream exceedances of water quality criteria. For example, some chemical applications have the potential to approach or exceed the narrative toxicity water quality objectives, numeric water quality objectives, or receiving water monitoring triggers for the specific active ingredient, particularly if applied in previously impacted waterbodies.

However, the District applies all chemicals in strict conformance with label requirements, which have been approved by CDPR for use in California (Table 2-6, BMP M1). Pesticide labels are application requirements and include instructions informing users how to apply the product and precautions the applicator should employ to protect human health and the environment. Pesticide applications would comply with label restrictions on application rates and methods, storage, transportation, mixing, and container disposal (Table 2-6, BMPs M1, M3, M5, M6, and M8). In addition, chemicals are applied in conformance with the PAP as required by the NPDES Vector Control Permit.

The District would implement label requirements, any applicable federal and state requirements, and District BMPs to reduce adverse effects to surface water and groundwater resources from the applied chemicals prior to, during, and following pesticide applications. To minimize the amount of pesticides, pesticide applications would be informed by surveillance and monitoring of vector populations (Table 2-6, BMP M4). Materials would be applied at the lowest effective concentration for the environmental conditions (Table 2-6, BMP M3). Applicators would be aware of wind conditions to minimize unwanted drift to waterbodies and adjacent areas, and aware of potential rain when rain is a determining factor on material application (Table 2-6, BMP M6 and M7). Pesticides that could affect insect pollinators would not be applied in liquid or spray/fog forms over large areas (more than 0.25 acre) during the day when honeybees are present and active or when other pollinators are active (Table 2-6, BMP M11). If special status aquatic wildlife species are potentially present, only pesticides and adjuvants approved for aquatic areas would be applied within a predetermined distance from aquatic features (Table 2-6, BMP M9). Prior to adulticide applications, the location of the application area will be reviewed with respect to the proximity to 303(d) listed impaired waterbodies for pyrethroids or sediment toxicity. If impaired, application of permethrin and resmethrin would not be conducted in these locations (Table 2-6, BMP M9).

The District would also implement hazardous materials and spill management control measures to prevent and reduce potential exposure of spilled chemicals to surface-water and groundwater resources (Table 2-6, BMPs N1 through N6). These measures would require development and implementation of a hazardous spill plan and procedures used to minimize the risk of an accidental spill or release. District control measures also require that mixing and transferring of materials would occur within a contained area (Table 2-6, BMP M5) and materials would be disposed at an approved site (Table 2-6, BMP M8).

District staff would monitor sites post-treatment to determine if the target mosquito populations were effectively controlled with minimum effect to the environment and nontarget organisms. This information would be used to help design future treatment methods in the same season or future years to respond to changes in site conditions (Table 2-6, BMP M10). Implementation of these BMPs would reduce exposure of applied chemicals to surface and groundwater resources during and following application of the material.

All chemical active ingredients and adjuvants the District currently uses or proposes to use are reviewed and evaluated in the Ecological and Human Health Risk Assessment (Appendix B). The following sections evaluate groups of chemicals based on their target organism or life stage.

9.2.7.1 Mosquito Larvicides

Larvicides are used to manage immature life stages of mosquitoes including larvae and pupae in aquatic habitats. Temporary aquatic habitats are usually targeted because permanent waterbodies generally support natural mosquito predators such as fish. The larvicides are applied using ground application equipment and rotary aircraft. Applications may be repeated at any site at recurrence intervals ranging from annually to weekly.

9.2.7.1.1 Biological Agents

Bs is a bacterial larvicide that is applied to mosquito producing sources such as irrigation ditches, floodwater, standing ponds, woodland pools, pastures, tidal water, fresh- or saltwater marshes, and stormwater retention areas. It damages and paralyzes the gut of mosquito larvae that ingest the spores. Although dormant Bs spores may persist in the environment for several weeks to months and the δ-endotoxins generally persist for 2 to 4 weeks following application, the δ-endotoxins degrade rapidly in sunlight and are degraded by soil microorganisms. Bs does not percolate through the soil and readily binds to sediments. It is highly selective for mosquitoes and is not toxic to nontarget species, including birds, mammals, fish, and invertebrates in amounts that effectively control mosquito larvae. For these reasons, Bs should not result in adverse effects to surface water or groundwater.

Bti is applied in a similar manner and often in combination with Bs. Bti toxins may persist in soil for several months, yet a half-life for typical Bti products on foliage is approximately 1 to 4 days due to rapid degradation in sunlight. Toxicity is minimal to nonexistent to nontarget avian, freshwater fish, freshwater aquatic invertebrates, estuarine and marine animals, arthropod predators/parasites, honeybees, annelids, and mammalian wildlife at the label use rates of registered Bti active ingredients. For these reasons, Bti should not result in adverse effects to surface water or groundwater.

Spinosad is a biologically derived insecticide produced from the fermentation of *Saacharopolyspora spinosa*, a naturally occurring soil organism. It activates the central nervous system of insects through interaction with neuroreceptors and causes mortality through continuous stimulation of the insect nervous system. Spinosad degrades quickly in sunlight in both aqueous and soil environments. It adsorbs strongly to soil particles where it is quickly metabolized by soil microorganisms under aerobic conditions and is therefore unlikely to leach into groundwater. Spinosad is practically nontoxic to birds and mammals but is slightly to moderately toxic to fish and most aquatic invertebrates. However, low amounts typically used for mosquito control would not likely pose a significant risk to potential ecological receptors. For these reasons, spinosad should not result in adverse effects to surface water or groundwater. The District would apply all biological pathogen larvicides in strict conformance with their PAP and the label requirements, which have been approved by CDPR for use in California.

Proper application methods using BMPs described in Section 9.2.7 should not result in adverse effects and use of these larvicides would have a less-than-significant impact to surface water and groundwater resources.

> **Impact WR-10:** Application of the biological agents Bs, Bti, and spinosad would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.1.2 Hydrocarbon Esters

Methoprene is an insect growth regulator that is applied at very low concentrations for mosquito control in the form of briquettes, pellets, granules, and liquid. It consists of two enantiomers: S-methoprene and R-methoprene, with S-methoprene being the biologically active enantiomer. Fate and transport characteristics of the s-enantiomer and the mixture are similar, but toxicity differs. Methoprene readily binds to suspended solids in the water column and soils. It rapidly degrades by photolysis and is metabolized in soil under both aerobic and anaerobic conditions. Although it may exhibit toxicity to fish and aquatic invertebrates, as well as nontarget insects including moths, butterflies, and beetles, methoprene is considered the least toxic of all larvicide alternatives.

These products would have a less-than-significant impact to surface water or groundwater resources when District BMPs are implemented and materials are applied in accordance with the recommended BMP application techniques described in their PAP and product label requirements.

> **Impact WR-11:** Application of methoprene would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.1.3 Surfactants

The monomolecular film used in California for the control of mosquito larvae is alpha-isooctadecyl-omega-hydroxypoly (oxyethylene). Monomolecular films spread a thin film on the surface of the water that makes it difficult for mosquito larvae, pupae, and emerging adults to attach to the water's surface, causing them to drown. It also disrupts larval respiration. Reported half-lives of monomolecular films in water range from 5 to 22 days. It may temporarily impact nontarget surface-breathing insects but has no observable effects to amphibians, fish, or other aquatic organisms. These products should not result in adverse water quality conditions in surface water or groundwater when used in accordance with approved BMP application requirements and techniques.

Specially derived aliphatic solvents (e.g., mineral oils and aliphatic petroleum hydrocarbons) are used to form a coating on top of water to drown larvae, pupae, and emerging adult mosquitoes. Petroleum distillates can be more effective than monomolecular films but break down much more rapidly (2 to 3 days). They have low water solubility and high sorption to organic matter. They are practically nontoxic to most nontarget organisms. Using BMP application techniques, these products should not result in adverse effects to water quality conditions in surface water or groundwater.

The District would avoid use of surfactants, when possible, in sites with aquatic nontarget species or natural enemies of mosquitoes present such as nymphal damselflies and dragonflies, dytiscids, hydrophilids, corixids, notonectids, and ephydrids. Although surfactants can be used with pupae, microbial larvicides (e.g., Bti, Bs) or insect growth regulators (e.g., methoprene) are often used with other earlier life stages (Table 2-6, BMP M2).

The District would apply all surfactant larvicides in strict conformance with their PAP and the label requirements, which have been approved by CDPR for use in California. Proper application using BMPs described in Section 9.2.7 should not result in adverse effects and use of these chemicals would have a less-than-significant impact to surface water or groundwater resources.

> **Impact WR-12:** Application of surfactant larvicides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.1.4 Temephos

Temephos is the only OP larvicide potentially used and may be used in rotation with bacterial pathogens to prevent resistance. Temephos is not labeled for use in agricultural lands or pasture and the District limits its use to man-made sources such as tire piles, utility vaults, and cemetery urns. It provides effective control in water with high levels of decaying organic matter. Temephos is extremely hydrophobic with low solubility and, therefore, is unlikely to leach to groundwater. It adsorbs rapidly to organic material in water and binds strongly to soils where it breaks down via photolysis and microbial degradation. It is slightly to moderately toxic to mammals and fish, but only when applied at rates much higher than needed for mosquito larval control. However, it is highly toxic to nontarget aquatic invertebrates.

Temephos has not been used by the District since 2011. Although there are no plans currently to use temephos, the District reserves the right to use it in the future if needed. When District BMPs are implemented and materials are applied in strict conformance with label requirements and the District's PAP, use of temephos would have a less-than-significant impact on surface water or groundwater resources.

> **Impact WR-13:** Application of temephos would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.2 Mosquito Adulticides

The use of adulticides to control mosquitoes is a last resort method of control in the District's IMM program. Adulticides would only be applied when other tools are not available and when specific criteria are met, including species composition, population density, proximity to human populations, and/or human disease risk. The active ingredients currently in use or proposed for use have been deliberately selected for lack of persistence and minimal effects on nontarget organisms when applied in strict conformance to label instructions for ULV mosquito control. Adulticides are applied using ground application equipment or rotary aircraft or other aircraft and following strict conformance with label requirements and BMPs described in the District's PAP and in Section 9.2.7.

9.2.7.2.1 Pyrethrins and Pyrethroids

The District may use pyrethrins and pyrethroids to control adult mosquitoes and yellow jacket wasps. Pyrethrins are naturally occurring products distilled from the flowers of Chrysanthemum species. Pyrethroids are synthetic compounds that are chemically similar to the pyrethrins, but have been modified to increase their stability and activity against insects, while minimizing their effect on nontarget organisms. First generation or "Type I" photosensitive pyrethroids include d-allethrin, permethrin, phenothrin (sumithrin), prallethrin, resmethrin, and tetramethrin. Typically, these pyrethroids are used around residential areas. The newer second-generation pyrethroids are mostly "Type II" pyrethroids. The active ingredients that fall into this group include deltamethrin and lambda-cyhalothrin. Type II pyrethroids are more toxic than Type I pyrethroids because they are less photosensitive and persist longer in the environment. Etofenprox is a synthetic pyrethroid-like chemical, differing in structure from pyrethroids in that it lacks a carbonyl group and has an ether moiety, whereas pyrethroids contain ester moieties. Pyrethrins and pyrethroids act by causing a persistent activation of the sodium channels on insect neurons.

Pyrethrins and pyrethroids quickly adsorb to suspended solids in the water column and partition into the sediment. They adsorb strongly to soil surfaces, and are generally considered immobile in soils and, therefore, are unlikely to leach to groundwater (USEPA 2006c). These materials are relatively nontoxic to mammals and birds, but are highly toxic to fish and invertebrates. The major route of degradation is through photolysis in both water and soil. Pyrethrins and pyrethroids may be persistent in environments free of light, and pyrethroids as a class have been implicated in 303(d) listings of sediment toxicity in urban creeks (BASMAA 2013). However, the ULV applications common to mosquito control and the limited use at yellow jacket nests encourage dissipation rather than persistence in the environment.

Insecticides containing pyrethrins and pyrethroids usually also contain PBO as a synergist. PBO interferes with the insect's ability to detoxify pyrethrins and pyrethroids, thus enhancing the product's effectiveness. PBO has low toxicity to mammals but is a possible endocrine disruptor and is included in the final list of chemicals for screening under USEPA's Endocrine Disruptor Screening Program. It is moderately to highly toxic to fish and is highly toxic to aquatic invertebrates. PBO is moderately mobile in soil and water but degrades rapidly in the environment by photolysis and through metabolism by soil microbes. Although it degrades rapidly, release of PBO to the environment may "activate" persistent pyrethroids that are already present in the sediment. However, PBO would have a less-than-significant impact on surface water or groundwater when District BMPs are implemented and materials are applied using ULV techniques, label requirements, and BMPs described in the District's PAP.

> **Impact WR-14:** Application of the synergist PBO would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

The District may apply pyrethrins in terrestrial and aquatic environments for wide-area mosquito abatement using ULV techniques. They also may be used locally to treat yellow jacket nests. Pyrethrins quickly adsorb to suspended solids in the water column and adsorb strongly to soil surfaces making them immobile in soils and unlikely to leach into groundwater. They degrade via photolysis and are likely to persist under anaerobic conditions. Pyrethrins have low to moderate acute toxicity to mammals but are practically nontoxic to birds. They are very highly toxic to freshwater fish and invertebrates. Several studies have shown that pyrethrins applied using ULV techniques do not accumulate in water or sediment following repeated applications. These studies also determined that no toxicity is associated when exposure is limited to the amounts used when following ULV protocols for mosquito control (Lawler et al. 2008; Amweg et al. 2006). Pyrethrins would have a less-than-significant impact on surface water or groundwater when District BMPs are implemented and materials are applied using ULV techniques, in accordance with label requirements, and using BMPs as described in the District's PAP.

> **Impact WR-15:** Application of pyrethrins would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Allethrins are Type I synthetic pyrethroids that are usually combined with synergists such as PBO. Although the District has not used allethrins in the past, they could be used in the future if needed. They are typically applied as an aerosol to yellow jacket wasp ground nests. Any material that gets into the air is rapidly degraded by photolysis in less than 8 hours. The toxicity of allethrin varies depending on which of its four isomers are present. Allethrins are highly toxic to fish and invertebrates but degrade too quickly to result in adverse effects to surface water or groundwater when District BMPs are implemented and materials are used according to label and PAP requirements. Use of allethrins would have a less-than-significant impact on surface water or groundwater.

> **Impact WR-16:** Application of allethrins would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Permethrin is a Type I synthetic pyrethroid that is usually combined with synergists such as PBO to control adult mosquitoes using ULV techniques and for yellow jacket control. Although the District has not used permethrin in the past, it could be used in the future if needed. It is hydrophobic and tends to partition to soil and sediment. Its primary degradation pathways include photolysis and aerobic metabolism and it may be persistent in environments free of light. Permethrin is slightly toxic to humans and has been included in the final list of chemicals for screening under USEPA's Endocrine Disruptor Screening Program. It has low toxicity to mammals and is practically nontoxic to birds, but is very highly toxic to fish, aquatic invertebrates, and honeybees. However, permethrin has a strong repellent effect in the environment, which reduces toxic effects to bees under field conditions (Appendix B) and District

BMPs require that pesticides that could affect insect pollinators would not be applied in liquid or spray/fog forms over large areas (more than 0.25 acre) during the day when honeybees are present and active or when other pollinators are active (Table 2-6, BMP M11). When applied in accordance with ULV label instructions, studies have shown rapid dissipation, low persistence, and no observed aquatic fish and invertebrate toxicity following aerial ULV applications2[3] (Appendix B). When applied directly to ground nests of yellow jacket wasps, the product is used with careful and strict BMP techniques such as applications in very small, localized areas and the product is used in strict conformance with label requirements such as aquatic habitat buffer zones. Prior to adulticide applications, the location of the application area will be reviewed with respect to the proximity to 303(d) listed impaired waterbodies for pyrethroids or sediment toxicity. If impaired, application of permethrin would not be conducted in these locations (Table 2-6, BMP M13).

Permethrin use is restricted to situations when it is absolutely necessary and in ULV applications that are designed to degrade rapidly and, thus, reduce the potential for impacts to nontarget ecological receptors. When District BMPs are implemented and when materials are applied according to the District's PAP using ULV techniques, the application of permethrin would have a less-than-significant impact on surface water or groundwater.

Impact WR-17: Application of permethrin would have a **less-than-significant** impact to surface-water and groundwater resources and no mitigation is required.

Phenothrin (or sumithrin) is a Type I synthetic pyrethroid that is usually combined with synergists such as PBO to control adult mosquitoes and yellow jacket wasps. Although the District has not used phenothrin in the past, it could be used in the future if needed. Phenothrin has low solubility and a relatively high affinity for binding to soil. It degrades through photolysis in water and aerobic metabolism in soil but is moderately persistent under aerobic conditions and persistent under anaerobic conditions. Phenothrin is not toxic to mammals or birds but is highly toxic to fish and freshwater invertebrates. When District BMPs are implemented and materials are applied locally (for yellow jacket control) or in ULV applications (for mosquito control) according to the District's PAP, phenothrin would not result in adverse effects to surface water or groundwater. Use of phenothrin would have a less-than-significant impact on surface water or groundwater.

Impact WR-18: Application of phenothrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Prallethrin is a Type I synthetic pyrethroid. The only prallethrin-containing product registered for mosquito control in California is Duet, which also contains phenothrin and PBO. Prallethrin may also be intermittently used to target yellow jacket nests. Although the District has not used prallethrin in the past, it could be used in the future if needed. Prallethrin readily sorbs to soils and sediments and degrades quickly via photolysis in both water and soil. It is not toxic to mammals or birds but is highly toxic to fish and nontarget aquatic invertebrates. When applied locally (for yellow jacket control) or in ULV applications (for mosquito control) according to the District's PAP, prallethrin would not result in adverse effects to surface water or groundwater. Use of prallethrin would have a less-than-significant impact on surface water or groundwater.

Impact WR-19: Application of prallethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Resmethrin is a Type I synthetic pyrethroid that is usually combined with synergists such as PBO to control adult mosquitoes using ULV techniques. Resmethrin has a high affinity to bind to soils, sediments,

[3] Although one study found higher levels of permethrin on the surface microlayer of the waterbody, corresponding water samples did not contain detected residues, and higher surface microlayer concentrations were not correlated with toxic effects in the waterbody.

and organic carbon and it degrades rapidly when exposed to light. When not subject to photolysis, it may be environmentally persistent. Resmethrin has low toxicity to mammals but has been included in the final list of chemicals for screening under USEPA's Endocrine Disruptor Screening Program. It is moderately toxic to birds and highly toxic to fish and aquatic invertebrates.

Despite its relatively high toxicity and potential for persistence, studies have shown rapid dissipation, low persistence, and no observed aquatic fish and invertebrate toxicity following aerial ULV application (Appendix B). Prior to adulticide applications, the location of the application area will be reviewed with respect to the proximity to 303(d) listed impaired waterbodies for pyrethroids or sediment toxicity. If impaired, application of resmethrin would not be conducted in these locations (Table 2-6, BMP M13). When District BMPs are implemented and materials are applied according to the District's PAP using ULV techniques, the application of resmethrin would have a less-than-significant impact on surface water or groundwater.

Impact WR-20: Application of resmethrin would have a **less-than-significant** impact to groundwater resources and no mitigation is required.

Tetramethrin is a Type I synthetic pyrethroid that the District may use in very localized applications for the control of yellow jacket wasps. Although the District has not used tetramethrin in the past, it could be used in the future if needed. It is slightly mobile in soil but decomposes rapidly by photolysis and hydrolysis and is not considered persistent in the environment. Tetramethrin is practically nontoxic to birds and terrestrial mammals but meets the criteria for classification as a possible human carcinogen. It is highly toxic to fish, aquatic invertebrates, and honeybees. When used according to label requirements and BMP application techniques that limit its release to aquatic systems, tetramethrin would not result in adverse effects to surface water or groundwater. Use of tetramethrin would have a less–than-significant impact on surface water or groundwater.

Impact WR-21: Application of tetramethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Deltamethrin is a longer lasting Type II synthetic pyrethroid that kills adult mosquitoes and yellow jacket wasps on contact and through ingestion. Although the District has not used deltamethrin in the past, it may be used as a barrier application in mosquito resting areas and migratory stops in the future. These treatments do not use ULV techniques but are usually applied as large liquid droplets with a sprayer during daylight hours. The primary objective of barrier treatment is the temporary prevention of reinfestation. Deltamethrin is low to moderately toxic to humans and may cause prenatal damage. It is practically nontoxic to birds but is very highly toxic to fish and nontarget aquatic invertebrates. For this reason, it is not used in aquatic environments. It binds to soils and sediments and may be persistent in the environment. When District BMPs are implemented and materials are used according to label requirements and BMP application techniques, deltamethrin would not result in adverse effects to surface water or groundwater. Use of deltamethrin would have a less-than-significant impact on surface water or groundwater.

Impact WR-22: Application of deltamethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Lambda-cyhalothrin is a Type II synthetic pyrethroid that the District may use for yellow jacket wasp control in very localized settings. Although the District has not used lambda-cyhalothrin in the past, it could be used in the future if needed. It is extremely hydrophobic and rapidly adsorbs to soils and sediments. Its primary degradation pathways include photolysis and aerobic metabolism and it may be persistent in the absence of light. Lambda-cyhalothrin is moderately toxic to mammals, has low toxicity to birds, and is highly toxic to fish, aquatic invertebrates, and honeybees. It also has the potential to bioaccumulate in fish. However, when District BMPs are implemented and materials are used according to label requirements and BMP application techniques that limit its release to the soil surface and aquatic systems, lambda-cyhalothrin would not result in adverse effects to surface water or groundwater. Use of lambda-cyhalothrin would have a less-than-significant impact on surface water or groundwater.

> **Impact WR-23:** Application of lambda-cyhalothrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Etofenprox is a pyrethroid-like insecticide that may be used as a mosquito adulticide or for the control of yellow jacket wasps and is available in formulations that do not contain PBO. It is virtually insoluble in water and stable to hydrolysis but is rapidly degraded by photolysis. Residues of etofenprox are not likely to persist in the environment. It has low toxicity to mammals but is highly toxic to fish and aquatic invertebrates. Based on toxicity and environmental fate, etofenprox would not result in adverse effects to surface water or groundwater when District BMPs are implemented and materials are applied following label requirements and BMPs described in the District's PAP. Use of etofenprox would have a less-than-significant impact on surface water or groundwater.

> **Impact WR-24:** Application of etofenprox would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.2.2 Organophosphates

Naled is an OP insecticide and may be used in rotation with pyrethrins or pyrethroids to avoid the development of resistance. Naled is the most commonly used material for this purpose. Although the District has not used naled in the past, it could be used in the future if needed.

Naled has low water solubility but is mobile in soils with low organic matter content. It is moderately toxic to mammals, fish, and aquatic invertebrates but degrades readily in water, under sunlight, in soil under aerobic and anaerobic conditions, in air, and on plants. Dichlorvos, a breakdown product of naled, and itself a registered pesticide, may be present in toxic concentrations after naled is no longer detectable. Dichlorvos is very highly toxic to birds and freshwater fish and insects, including honeybees. It has high water solubility and degrades primarily through volatilization and aerobic soil metabolism. With a half-life of about 0.9 day, the degradation of dichlorvos is rapid but slower than that of its parent naled (USEPA 2006d). It does not persist in surface water and, because of breakdown by soil micro-organisms, is unlikely to leach to groundwater. Naled and other OPs are important chemicals that help control resistance of alternative products such as pyrethrins and pyrethroids. Due to the toxicity of its breakdown product dichlorvos, but its importance in the District's IMMP, use of naled is significant and unavoidable. There is no feasible mitigation.

> **Impact WR-25:** Due to the toxicity of its breakdown product, but its importance in the District's IMMP, the application of naled is considered a **significant and unavoidable** impact to surface and groundwater resources.

9.2.7.3 Yellow Jacket Abatement

Pyrethrins and pyrethroids may be applied direct to yellow jack wasp nest openings. The active ingredients the District may use are described under Mosquito Adulticides (Section 9.2.7.2).

9.2.8 <u>Cumulative Impacts</u>

Cumulative impacts to water resources are discussed in Section 13.7. In summary, a few of the receiving waters in the Program Area are already included on the CWA 303(d) list as impaired by pyrethroids, pesticides, or sediment toxicity, with the likely cause being the use of common household insecticides containing pyrethroids by members of the public, not mosquito control activities the District conducts. Where receiving waters have been designated as impaired by pyrethroids, pesticides, or sediment toxicity, the potential exists for a significant cumulative impact. However, the implementation of District BMPs minimizes use of more toxic and persistent pyrethroids (permethrin and resmethrin) and will not apply them in a manner that could affect 303(d) listed waters. Therefore, **the District's use of any**

pyrethroid is contributing in less-than-significant incremental amounts to an existing cumulatively considerable impact to water resources in the Program Area. No additional impacts were identified in association with the chemical and nonchemical Program alternatives, and **no additional cumulative impacts are anticipated to occur** (i.e., the District's less-than-significant contributions are not triggering a new cumulative impact).

9.2.9 Environmental Impacts Summary

Table 9-4 provides a summary of the identified impacts for each subgroup of practices and chemicals included in the Program. Concerning the OP naled, the impact is significant and unavoidable.

Table 9-4 Summary of Alternative Water Resources Impacts

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control
Effects on Water Resources					
Impact WR-1: The Surveillance Alternative collection devices would not contact nor interact with the environment. **No impact** would occur to surface water or groundwater.	N	na	na	na	na
Impact WR-2: The Physical Control Alternative's activities to modify water circulation, remove sediment, and maintain water control facilities to reduce habitat conditions for mosquito production would have a **less-than-significant** impact on water resources and no mitigation is required.	na	LS	na	na	na
Impact WR-3: Mechanical removal of vegetation from aquatic habitats would have a **less-than-significant** impact to surface water and **no impact** to groundwater	na	na	LS, N	na	na
Impact WR-4: Application of the herbicides imazapyr, glyphosate, and sulfometuron methyl, would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	LS	na	na
Impact WR-5: Application of the herbicide triclopyr would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	LS	na	na
Impact WR-6: For APEs, application of these herbicides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	LS	na	na
Impact WR-7: Application of polydimethylsiloxanes, modified vegetable oils, and methylated seed oils would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	LS	na	na
Impact WR-8: The Biological Control Alternative's production of mosquitofish limits wastewater discharges to the sanitary sewer. Therefore, the production of mosquitofish would have a **less-than-significant** impact on surface water and groundwater resources and no mitigation is required.	na	na	na	LS	na
Impact WR-9: The Biological Control Alternative's use of mosquitofish is limited to man-made water features that are hydrologically-isolated from receiving waters. Therefore, the use of mosquitofish would have a **less-than-significant** impact on surface water and groundwater resources and no mitigation is required.	na	na	na	LS	na

Table 9-4 Summary of Alternative Water Resources Impacts

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control
Impact WR-10: Application of the biological agents Bs, Bti, and spinosad would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-11: Application of methoprene would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required**.**	na	na	na	na	LS
Impact WR-12: Application of surfactant larvicides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation **is** required.	na	na	na	na	LS
Impact WR-13: Application of temephos would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-14: Application of the synergist PBO would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-15: Application of pyrethrins would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-16: Application of allethrins would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-17: Application of permethrin would have a **less-than-significant** impact to surface-water and groundwater resources and no mitigation is required**.**	na	na	na	na	LS
Impact WR-18: Application of phenothrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-19: Application of prallethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-20: Application of resmethrin would have a **less-than-significant** impact to groundwater resources and no mitigation is required**.**	na	na	na	na	LS

Table 9-4 Summary of Alternative Water Resources Impacts

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control
Impact WR-21: Application of tetramethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-22: Application of deltamethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-23: Application of lambda-cyhalothrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-24: Application of etofenprox would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS
Impact WR-25: Due to the toxicity of its breakdown product but its importance in the District's IMMP, the application of naled is considered a **significant and unavoidable** impact to surface and groundwater resources.	na	na	na	na	SU

LS = Less-than-significant impact
N = No impact
na = Not applicable
SM = Potentially significant but mitigable impact
SU = Significant and unavoidable impact

9.2.10 Mitigation and Monitoring

The District implements label requirements and District BMPs to reduce adverse effects to surface-water and groundwater resources from the applied chemicals during and following pesticide applications. The District applies all chemicals in strict conformance with label requirements that have been approved by CDPR for use in California, including restrictions on application rates and methods, storage, transportation, mixing, and container disposal. As applicable, insecticides are applied in conformance with the PAP, as required by the Vector Control Permit, and herbicide formulations would be applied in conformance with the APAP, as required by the Aquatic Weed Control Permit. The District also implements hazardous materials and spill management control measures to prevent and reduce potential exposure of spilled chemicals to surface-water and groundwater resources.

Because none of the impacts to water resources were potentially significant but mitigable, no mitigation is required. However, the District will continue surveillance and monitoring on a routine basis. Sites are monitored post-treatment to determine if the target mosquito population or weeds were effectively controlled with minimum effect to the environment and nontarget organisms. This information is used to help design future treatment methods in the same season or future years to respond to changes in site conditions.

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