4 Biological Resources – Aquatic

This chapter evaluates the potential impacts of the Program alternatives on aquatic resources. These results are provided at a programmatic level. Section 4.1, Environmental Setting, presents an overview of the aquatic resources in the Program Area and vicinity.

Section 4.2, Environmental Impacts and Mitigation Measures, presents the following:

> Environmental concerns and evaluation criteria to determine whether the Program alternatives would cause significant impacts to aquatic resources

> Evaluation methods and assumptions

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

> Cumulative impacts

> A summary of environmental impacts

This chapter depends heavily on the information provided in Appendix A, *Biological Resources Technical Report*, Appendix B, *Human and Ecological Health Assessment Report*, and Chapter 6, Ecological Health. Terrestrial resources are addressed in Chapter 5, Biological Resources - Terrestrial.

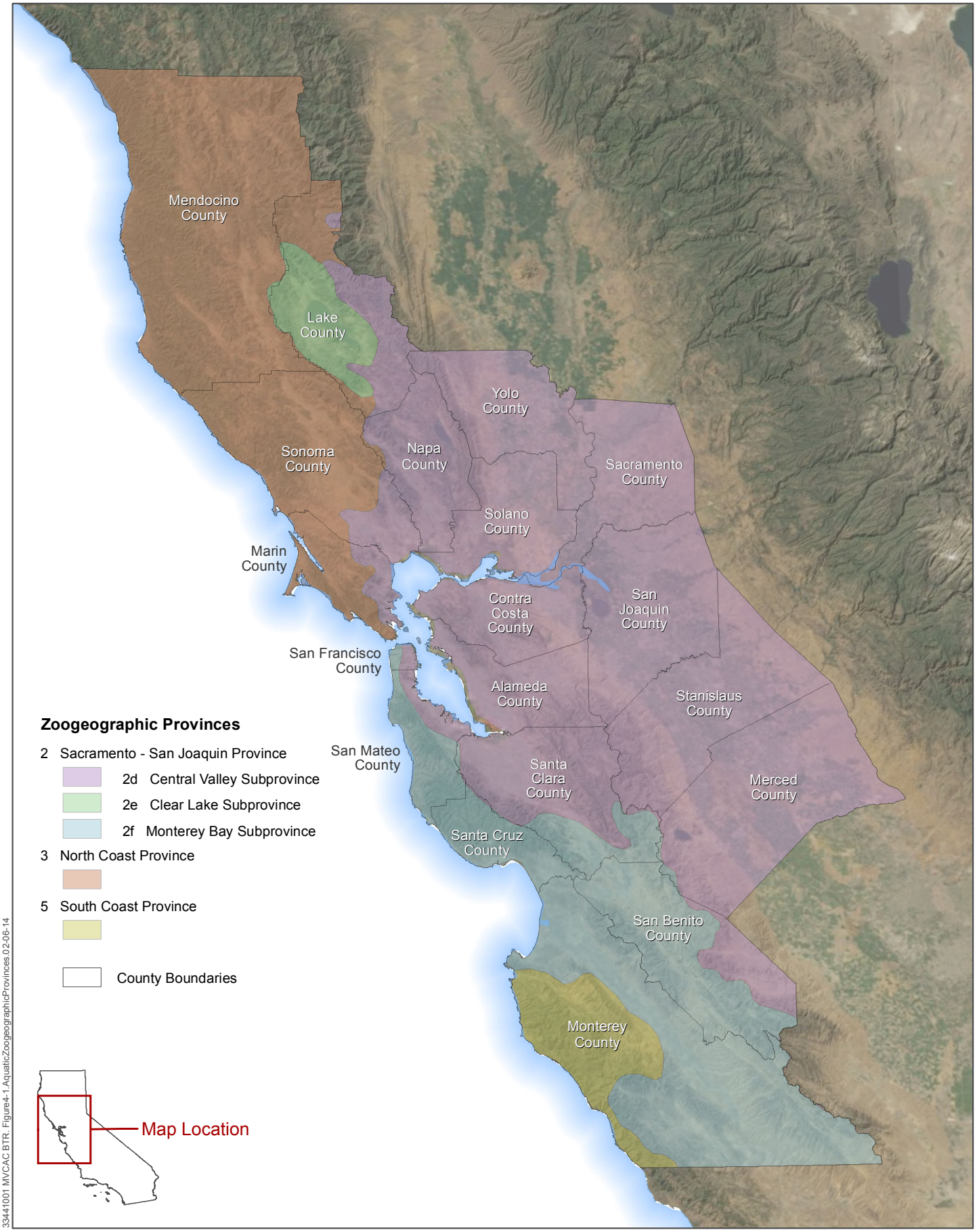
4.1 Environmental Setting

Section 4.1.1 identifies the zoogeographic provinces in the Marin/Sonoma Mosquito and Vector Control District's (District) Program Area, Section 4.1.2 describes the special-status aquatic species that have the potential to occur within the Program Area, and Section 4.1.3 provides an overview of federal, state, and local ordinances and regulations pertinent to these resources that are applicable to the Program. Section 4.1.4 identifies the Habitat Conservation Plans (HCCPs) and Natural Community Conservation Plans (NCCPs) in the Program Area. Special-status species are those that are listed as endangered, threatened, or candidate species under the federal Endangered Species Act, endangered or threatened under the California Endangered Species Act, or listed as species of special concern by the State of California.

4.1.1 Aquatic and Wetland Resources within the Program Area

The Program will be implemented within the District, located in Marin and Sonoma counties. The Program Area addressed in this PEIR also includes the four adjacent counties of Mendocino, Lake, Napa, and Solano. This area encompasses a range of aquatic habitats and a diverse array of fish, amphibians, aquatic reptiles, and other species that live a substantial portion of their lives in the water and breed in aquatic environments. Birds and mammals are included as terrestrial species and discussed in Chapter 5. The six Program Area counties where activities and treatments would be implemented are shown on Figure 4-1. The zoogeographic provinces are described in Appendix A.

This Page Intentionally Left Blank



33441001 MVCAC BTR. Figure4-1.AquaticZoogeographicProvinces.02-06-14

N

0 20 40

Scale in Miles

Source: Chris Mari van Dyck, 2000

INTEGRATED VECTOR MANAGEMENT PROGRAM

Aquatic Zoogeographic Provinces

Figure 4-1

To facilitate the evaluation of impacts and impact avoidance measures by habitat type, a consistent set of habitat types was developed for wetland areas (Table 4-1). Wetland habitat types were based on those developed as part of the Bayland Ecosystem Habitat Goals Project (Goals Project 1999). To better capture the habitats potentially affected by the Program alternatives, habitat types from both the Goals Project and the San Francisco Estuary Project are used, as reflected in the Goals Project document (1999). Marine/Brackish Open Water and Tidal Flat habitat types defined in the San Francisco Bay system would not be treated under the Program and are not discussed further in this document. The last two categories in the table are artificial habitats that were not addressed in the Goals Project, but are important for consideration in the PEIR impact evaluations. In the case of Artificial Containers, Temporary Standing Waters and Ornamental Ponds, these habitats would not be expected to support special-status species. Within the Water and Wastewater Management category, water treatment facilities and onsite wastewater treatment (septic) systems would not be expected to support substantial populations of special-status species, but water discharged from these facilities may support special-status species in downstream or downgradient areas. These species may move into these facilities from adjacent wetlands and waterways. Flood channels and ditches may provide seasonal habitat for special-status species depending on the length of time these channels carry water and the characteristics of these channels.

Table 4-1 Aquatic and Wetland Habitat Types

Creeks and Rivers	Areas of flowing freshwater, although most downstream reaches may be influenced by tides.
Riparian Corridor	The trees, shrubs and other vegetation that grow along the edges of creeks and rivers. This vegetation is typically dependent on water from the river and forms an ecotone between the river and the surrounding uplands. May extend to broader riparian forest, where such exist.
Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	Areas of still water that typically remain wet throughout the year.
FW Marsh/Seeps	Freshwater areas that support reeds, rushes and other vegetation typical of wetlands.
Seasonal Wetlands (includes Vernal Pools)	Areas that support standing water for part of the year, but dry out during the summer months.
Lagoon	Area behind the mouth of a river or stream that has been closed off by sand or other material, but is at least sporadically subject to tidal action.
Tidal Marsh and channels	Vegetated wetland area subject to tidal action. Occurs along San Pablo Bay and Carquinez Strait. Includes both salt and brackish marshes. Includes tidal channels that carry water into and away from the marsh during the tidal cycle.
Tidal Flats	Mud flats exposed during low tide that do not hold water throughout the day and do not support substantial vegetation. Occurs between MLLW and Mean Tide Level (MTL).
Open Water (Marine/Brackish)	Continuously inundated areas of San Pablo Bay and Carquinez Strait area. Exposed to current and wave action. Occurs below Mean Lower Low Water (MLLW).
Water and Wastewater Management Facilities	Constructed channels, ponds and other facilities designed for the management of water or wastewater. May include natural or artificial bottoms. Includes flood control channels, agricultural and roadside ditches, retention basins, treatment ponds, winery waste ponds, wastewater treatment facilities, septic systems and all associated facilities.
Artificial Containers, Temporary Standing Waters and Ornamental Ponds	Artificial habitats that have little likelihood of supporting native plants and wildlife, including pots, ornamental ponds, tires, stormwater retention basins.

Source: Goals Project 1999

Each of these habitat types may be affected by one or more of the Program alternatives, as indicated in Table 4-2. The Program alternatives are described in Chapter 2 and the BMPs that would be applied to avoid and minimize potential impacts are provided in Table 2-6 (and repeated herein in Table 4-6 by habitat type).

Table 4-2 Wetland and Aquatic Habitat Types Potentially Affected by each Program Alternative

	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical Control/Trapping
Creeks and Rivers	X	X	X		X	
Riparian Corridor	X		X		X	X
Ponds and Lakes	X	X	X		X	
FW Marsh/Seeps	X	X	X		X	
Seasonal Wetlands (includes Vernal Pools)	X	X	X		X	
Lagoon	X	X	X			
Tidal Marsh and channels	X	X	X		X	
Water and Wastewater Management Facilities	X	X	X	X[1]	X	X
Artificial Containers, Temporary Standing Waters and Artificial Ponds	X	X	X	X[1]	X	

[1] Biological controls would not be applied in natural or artificial water bodies capable of supporting the breeding or aquatic rearing of California red-legged frog or California a tiger salamander. CRLF prefer still water, more than 0.7 m deep, bounded by dense shrubby vegetation (will, cattails and bulrush; Jennings and Haynes 1994). Tiger salamander are a lowland species (<200 ft msl) that breed in rain pools or vernal pools (lasting more than 10 weeks), that lack fish or bullfrog predators. Although historical breeding habitat for California tiger salamanders is natural vernal pools and ponds, they also use modified ephemeral or permanent ponds and manmade features such as constructed ponds or livestock ponds and have been reported in roadside ditches containing areas of seasonal wetlands. (USFWS 2014). Typically, breeding pools have moderate to high levels of turbidity. California tiger salamanders rarely use ponds with clear water. These locations must be within 1.6 km (1 mile) of suitable upland habitat, which consists of small mammal burrows, where juveniles and adults live and grow. If there is doubt whether a specific area would support breeding or aquatic rearing of these species, the District would contact the regulatory agencies prior to employing this alternative.

4.1.2 Special-Status Species

A number of special-status species are found in the Program Area and vicinity. Plant species are listed for the District in Table 4-3, while animal species are listed in Table 4-4. These tables also show the habitat types these species are likely to use. Because some species occur in both wetland and upland habitat types, all habitat types are included in this table. Upland habitat types are described in Chapter 5.

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
pink sand-verbena *Abronia umbellata* var. *breviflora*	1B.1	Coastal dunes and coastal strand. Foredunes and interdunes with sparse cover. Abronia umbellata var. Breviflora is usually the plant closest to the ocean. 0-12 m.	X	X						X										
Blasdale's bent grass *Agrostis blasdalei*	1B.2	Coastal dunes and coastal strand. Foredunes and interdunes with sparse cover. Abronia umbellata var. Breviflora is usually the plant closest to the ocean. 0-12 m.	X	X						X										
Henderson's bent grass *Agrostis hendersonii*	3.2	Coastal dunes and coastal strand. Foredunes and interdunes with sparse cover. Abronia umbellata var. Breviflora is usually the plant closest to the ocean. 0-12 m.		X						X										
grass alisma *Alisma gramineum*	2B.2	Coastal dunes and coastal strand. Foredunes and interdunes with sparse cover. Abronia umbellata var. Breviflora is usually the plant closest to the ocean. 0-12 m.		X						X										
Franciscan onion *Allium peninsulare* var. *franciscanum*	1B.2	Coastal dunes and coastal strand. Foredunes and interdunes with sparse cover. Abronia umbellata var. Breviflora is usually the plant closest to the ocean. 0-12 m.	X	X						X										
Sonoma alopecurus *Alopecurus aequalis* var. *sonomensis*	FE, 1B.1	Coastal dunes and coastal strand. Foredunes and interdunes with sparse cover. Abronia umbellata var. Breviflora is usually the plant closest to the ocean. 0-12 m.	X							X										
Napa false indigo *Amorpha californica* var. *napensis*	1B.2	Coastal dunes and coastal strand. Foredunes and interdunes with sparse cover. Abronia umbellata var. Breviflora is usually the plant closest to the ocean. 0-12 m.	X	X						X										
bent-flowered fiddleneck *Amsinckia lunaris*	1B.2	Coastal dunes and coastal strand. Foredunes and interdunes with sparse cover. Abronia umbellata var. Breviflora is usually the plant closest to the ocean. 0-12 m.	X	X						X										
scabrid alpine tarplant *Anisocarpus scabridus*	1B.3	Coastal dunes and coastal strand. Foredunes and interdunes with sparse cover. Abronia umbellata var. Breviflora is usually the plant closest to the ocean. 0-12 m.		X						X										
slender silver moss *Anomobryum julaceum*	4.2	Broadleafed upland forest, lower montane coniferous forest, north coast coniferous forest. Moss which grows on damp rocks and soil; acidic substrates. Usually seen on roadcuts. 100-1000 m.	X		X	X														
dimorphic snapdragon *Antirrhinum subcordatum*	4.3	Chaparral, lower montane coniferous forest. Generally on serpentine or shale in foothill woodland or chaparral on S- and W-facing slopes. 185-800 m.		X	X		X		X											
McDonald's rockcress *Arabis macdonaldiana*	FE, SE, 1B.1	Lower montane coniferous forest, upper montane coniferous forest. Rocky outcrops, ridges, slopes, and flats on serpentine. 135-1455 m.		X	X				X											

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Baker's manzanita *Arctostaphylos bakeri* ssp. *bakeri*	1B.1	Broadleafed upland forest, chaparral. Entire species State-listed Rare. Often on serpentine. This is the State-listed Rare taxon, also known as A. Bakeri in Title 14. 75-230 m.	X			X	X		X											
The Cedars manzanita *Arctostaphylos bakeri* ssp. *sublaevis*	1B.2	Chaparral, closed-cone coniferous forest. Entire species listed state rare. In serpentine chaparral and sargent cypress woodland; typically in canyons and on slopes. 275-600 m.	X		X		X		X											
Sonoma canescent manzanita *Arctostaphylos canescens* ssp. *sonomensis*	1B.2	Chaparral, lower montane coniferous forest. Sometimes found on serpentine. 180-1675 m.	X	X	X		X		X											
Vine Hill manzanita *Arctostaphylos densiflora*	SE, 1B.1	Chaparral. Acid marine sand. 50-100 m.	X				X													
Konocti manzanita *Arctostaphylos manzanita* ssp. *elegans*	1B.3	Chaparral, cismontane woodland, lower montane coniferous forest. Volcanic soils. 395-1400 m.	X	X	X	X	X													
Mt. Tamalpais manzanita *Arctostaphylos montana* ssp. *montana*	1B.3	Chaparral, valley, and foothill grassland. Serpentine slopes in chaparral and grassland. 160-760 m.	X				X	X	X											
pygmy manzanita *Arctostaphylos nummularia* ssp. *mendocinoensis*	1B.2	Closed-cone coniferous forest. Acidic, sandy-clay soils in dwarf coniferous forest. 90-200 m.		X	X															
Rincon Ridge manzanita *Arctostaphylos stanfordiana* ssp. *decumbens*	1B.1	Chaparral. Highly restricted endemic to red rhyolites in Sonoma county. 75-310 m.	X	X			X													
Raiche's manzanita *Arctostaphylos stanfordiana* ssp. *raichei*	1B.1	Chaparral, lower montane coniferous forest. On periphery of McNab cypress grove on serpentine. Slopes and ridges. 450-1000 m.		X	X		X		X											
Marin manzanita *Arctostaphylos virgata*	1B.2	Broadleafed upland forest, closed-cone coniferous forest, chaparral, north coast coniferous forest. Only known from about 20 eos in Marin County. On sandstone or granitic soil. 60-700 m.	X		X	X	X													
Humboldt milk-vetch *Astragalus agnicidus*	SE, 1B.1	Broadleafed upland forest, redwood forest. Disturbed openings in partially timbered forest lands; also along ridgelines; south aspects. 575-750 m.		X	X	X														

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Clara Hunt's milk-vetch *Astragalus claranus*	FE, ST, 1B.1	Cismontane woodland, valley and foothill grassland, chaparral. Open grassy hillsides, esp. On exposed shoulders in thin, volcanic clay soil moist in spring. 75-235 m.	X	X		X	X	X												
coastal marsh milk-vetch *Astragalus pycnostachyus* var. *pycnostachyus*	1B.2	Coastal dunes, coastal salt marshes. Mesic sites in dunes or along streams or coastal salt marshes. 0-30 m.	X							X		X					X			
Jepson's milk-vetch *Astragalus rattanii* var. *jepsonianus*	1B.2	Cismontane woodland, valley and foothill grassland, chaparral. Commonly on serpentine in grassland or openings in chaparral. 320-700 m.	X	X		X	X	X	X											
alkali milk-vetch *Astragalus tener* var. *tener*	1B.2	Alkali playa, valley, and foothill grassland, vernal pools. Low ground, alkali flats, and flooded lands; in annual grassland or in playas or vernal pools. 1-170 m.	X	X				X								X				
San Joaquin spearscale *Atriplex joaquinana*	1B.2	Chenopod scrub, alkali meadow, valley and foothill grassland. In seasonal alkali wetlands or alkali sink scrub with distichlis spicata, frankenia, etc. 1-250 m.		X			X	X												
big-scale balsamroot *Balsamorhiza macrolepis*	1B.2	Valley and foothill grassland, cismontane woodland. Sometimes on serpentine. 35-1000 m.	X	X		X		X	X											
Sonoma sunshine *Blennosperma bakeri*	FE, SE, 1B.1	Vernal pools, valley and foothill grassland. Vernal pools and swales. 10-100 m.	X					X								X				
Point Reyes blennosperma *Blennosperma nanum* var. *robustum*	1B.2	Coastal prairie, coastal scrub. On open coastal hills in sandy soil. 10-145 m.	X	X			X	X												
Snow Mountain rockcress *Boechera ultraalsa*	1B.1	Upper montane coniferous forest. Rocky sites. 1800 m.		X	X															
rattlesnake fern *Botrypus virginianus*	2B.2	Bogs and fens, lower montane coniferous forest, meadows and seeps, riparian forest. 715-1355 m.		X	X												X	X		
watershield *Brasenia schreberi*	2B.3	Freshwater marshes and swamps. Aquatic from water bodies both natural and artificial in California.		X													X			
narrow-anthered brodiaea *Brodiaea leptandra*	1B.2	Broadleafed upland forest, chaparral, lower montane coniferous forest. 110-915 m.	X	X	X	X														
Indian Valley brodiaea *Brodiaea rosea*	SE, 1B.1	Closed-cone coniferous forest, chaparral, cismontane woodland, valley and foothill grassland, meadows. Serpentine gravelly creek bottoms, and in meadows and swales. 335-1450 m.		X	X	X		X	X											

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Thurber's reed grass *Calamagrostis crassiglumis*	2B.1	Coastal scrub, freshwater marsh. Usually in marshy swales surrounded by grassland or coastal scrub. 10-45 m.	X	X			X	X									X			
leafy reed grass *Calamagrostis foliosa*	4.2	Coastal bluff scrub, north coast coniferous forest. Rocky cliffs and ocean-facing bluffs. 0-1220 m. State-listed rare. Element occurrences archived; CNPS list 4.		X	X		X													
round-leaved filaree *California macrophylla*	1B.1	Cismontane woodland, valley and foothill grassland. Clay soils. 15-1200 m.	X	X		X		X												
The Cedars fairy-lantern *Calochortus raichei*	1B.2	Closed-cone coniferous forest, chaparral. On serpentine. Usually on shaded slopes, but also on barrens and talus. 200-490 m.	X		X		X		X											
Tiburon mariposa-lily Calochortus tiburonensis	FT, ST, 1B.1	Valley and foothill grassland. On open, rocky, slopes in serpentine grassland. 50-150 m.	X					X	X											
small-flowered calycadenia *Calycadenia micrantha*	1B.2	Chaparral, valley and foothill grassland, meadows and seeps, lower montane coniferous forest. Rocky talus or scree; sparsely vegetated areas. Occasionally on roadsides; sometimes on serpentine. 5-1500 m.		X	X		X	X	X								X			
Butte County morning-glory *Calystegia atriplicifolia* ssp. *buttensis*	4.2	Lower montane coniferous forest. Dry, mostly open slopes. 600-1200 m.		X	X															
Mt. Saint Helena morning-glory *Calystegia collina* ssp. *oxyphylla*	4.2	Chaparral, lower montane coniferous forest, valley and foothill grassland. On serpentine barrens, slopes, and hillsides. 280-1010 m.	X	X	X		X	X	X											
coast range bindweed *Calystegia collina* ssp. *tridactylosa*	1B.2	Chaparral, cismontane woodland. Rocky, gravelly openings in serpentine. 0-600 m.		X		X	X		X											
coastal bluff morning-glory *Calystegia purpurata* ssp. *saxicola*	1B.2	Coastal dunes, coastal scrub. 15-105 m.	X	X			X			X										
swamp harebell *Campanula californica*	1B.2	Bogs and fens, closed-cone coniferous forest, coastal prairie, meadows, freshwater marsh, n coast coniferous forest. Bogs and marshes in a variety of habitats; uncommon where it occurs. 1-405 m.	X	X	X			X									X			
seaside bittercress *Cardamine angulata*	2B.1	North coast coniferous forest, lower montane coniferous forest. Wet areas, streambanks. 65-915 m.	X		X													X		

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
California sedge *Carex californica*	2B.3	Bogs and fens, closed-cone coniferous forest, coastal prairie, meadows, marshes and swamps. Meadows, drier areas of swamps, marsh margins. 90-250 m.		X	X			X									X			
bristly sedge *Carex comosa*	2B.1	Marshes and swamps. Lake margins, wet places; site below sea level is on a delta island. -5-1005 m.	X	X											X		X			
porcupine sedge *Carex hystericina*	2B.1	Marshes and swamps. Wet places, such as stream edges. 610-915 m.		X													X	X		
Klamath sedge *Carex klamathensis*	1B.2	Meadows and seeps, chaparral, cismontane woodland. Serpentine. 1000-1140 m.		X			X	X	X								X			
lagoon sedge *Carex lenticularis* var. *limnophila*	2B.2	Bogs and fens, marshes and swamps, north coast coniferous forest. Lakeshores, beaches. 0-6 m.		X	X					X					X		X			
bristle-stalked sedge *Carex leptalea*	2B.2	Bogs and fens, meadows, marshes and swamps. Mostly known from bogs and wet meadows. 0-790 m.	X					X									X			
livid sedge *Carex livida*	2A	Bogs and fens. Historically known from a sphagnum bog in California. 120 m.		X													X			
Lyngbye's sedge *Carex lyngbyei*	2B.2	Marshes and swamps (brackish or freshwater). 0 m.	X	X													X			
deceiving sedge *Carex saliniformis*	1B.2	Coastal prairie, coastal scrub, meadows and seeps, marshes and swamps (coastal salt). Mesic sites. 3-230 m.	X	X			X	X									X			
green yellow sedge *Carex viridula* ssp. *viridula*	2B.3	Bogs and fens, marshes and swamps (freshwater), north coast coniferous forest. Mesic sites. 0-1600 m.		X	X												X			
Tiburon paintbrush *Castilleja affinis* var. *neglecta*	FE, ST, 1B.2	Valley and foothill grassland. Rocky serpentine sites. 75-400 m.	X	X				X	X											
Humboldt Bay owl's-clover *Castilleja ambigua* var. *humboldtiensis*	1B.2	Coastal salt marsh. In coastal saltmarsh with spartina, distichlis, salicornia, jaumea. 0-3 m.	X	X								X								
Mead's owls-clover *Castilleja ambigua* var. *meadii*	1B.1	Vernal pools, meadows and seeps. Soils of volcanic origin and tend to have high clay content and be gravelly. 450-475 m.		X				X								X	X			
Point Reyes paintbrush *Castilleja leschkeana*	1A	Marshes and swamps (coastal). 0-10 m.	X														X			

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Oregon coast paintbrush *Castilleja litoralis*	2B.2	Coastal bluff scrub, coastal dunes, coastal scrub. Sandy sites. 15-100 m.		X			X			X										
Mendocino Coast paintbrush *Castilleja mendocinensis*	1B.2	Coastal bluff scrub, coastal scrub, coastal prairie, closed-cone coniferous forest, coastal dunes. Often on sea bluffs or cliffs in coastal bluff scrub or prairie. 0-160 m.	X	X	X		X	X		X										
pink creamsacs *Castilleja rubicundula* var. *rubicundula*	1B.2	Chaparral, meadows and seeps, valley and foothill grassland. Openings in chaparral or grasslands. On serpentine. 20-900 m.		X			X	X	X								X			
Pitkin Marsh paintbrush *Castilleja uliginosa*	SE, 1A	Freshwater marsh. Last known remaining plant died in 1987; was known from overgrown freshwater marsh. 60 m.	X														X			
Rincon Ridge ceanothus *Ceanothus confusus*	1B.1	Closed-cone coniferous forest, chaparral, cismontane woodland. Known from volcanic or serpentine soils, dry shrubby slopes. 75-1065 m.	X	X	X	X	X		X											
Calistoga ceanothus *Ceanothus divergens*	1B.2	Chaparral, cismontane woodland. Rocky, serpentine, or volcanic sites. 165-950 m.	X	X		X	X		X											
Vine Hill ceanothus *Ceanothus foliosus* var. *vineatus*	1B.1	Chaparral. Sandy, acidic soil in chaparral. 45-85 m.	X				X													
Mt. Vision ceanothus *Ceanothus gloriosus* var. *porrectus*	1B.3	Closed-cone coniferous forest, coastal prairie, coastal scrub, valley and foothill grassland. Low shrub in a variety of habitats on pt. Reyes; sandy soils. 25-305 m.	X		X		X	X												
Mason's ceanothus *Ceanothus masonii*	1B.2	Chaparral. Serpentine ridges or slopes in chaparral or transition zone. 230-500 m.	X				X		X											
holly-leaved ceanothus *Ceanothus purpureus*	1B.2	Chaparral. Rocky, volcanic slopes. 120-640 m.	X	X			X													
Sonoma ceanothus *Ceanothus sonomensis*	1B.2	Chaparral. Sandy, serpentine, or volcanic soils. 210-800 m.	X	X					X											
pappose tarplant *Centromadia parryi* ssp. *parryi*	1B.2	Coastal prairie, meadows and seeps, coastal salt marsh, valley and foothill grassland. Vernally mesic, often alkaline sites. 2-420 m.	X	X				X				X					X			
dwarf soaproot *Chlorogalum pomeridianum* var. *minus*	1B.2	Chaparral, valley and foothill grassland. Serpentine. 240-970 m.	X	X			X	X	X											

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Point Reyes salty bird's-beak *Chloropyron maritimum* ssp. *palustre*	1B.2	Cismontane woodland, valley and foothill grassland. Often in grassy areas with blue oaks in foothill woodland. 300-330 m.	X			X		X												
soft salty bird's-beak *Chloropyron molle* ssp. *molle*	FE, 1B.2	Coastal salt marsh. In coastal salt marsh with distichlis, salicornia, frankenia, etc. 0-3 m	X	X								X								
San Francisco Bay spineflower *Chorizanthe cuspidata* var. *cuspidata*	1B.2	Coastal bluff scrub, coastal dunes, coastal prairie, coastal scrub. Closely related to c. Pungens. Sandy soil on terraces and slopes. 5-550 m.	X				X	X		X										
woolly-headed spineflower *Chorizanthe cuspidata* var. *villosa*	1B.2	Coastal scrub, coastal dunes, coastal prairie. Sandy places near the beach. 3-60 m.	X				X	X		X										
Howell's spineflower *Chorizanthe howellii*	FE, ST, 1B.2	Coastal dunes, coastal prairie, coastal scrub. Sand dunes, sandy slopes, and sandy areas in coastal prairie. 0-35 m.		X				X		X										
robust spineflower *Chorizanthe robusta* var. *robusta*	FE, 1B.1	Cismontane woodland, coastal dunes, coastal scrub. Sandy terraces and bluffs or in loose sand. 3-120 m.	X			X	X			X										
Sonoma spineflower *Chorizanthe valida*	FE, SE, 1B.1	Coastal prairie. Sandy soil. 10-50 m.	X					X												
Bolander's water-hemlock *Cicuta maculata* var. *bolanderi*	2B.1	Marshes, fresh or brackish water. 0-200 m.	X									X					X			
Franciscan thistle *Cirsium andrewsii*	1B.2	Coastal bluff scrub, broadleaved upland forest, coastal scrub. Sometimes serpentine seeps. 0-135 m.	X			X	X		X								X			
Mt. Tamalpais thistle *Cirsium hydrophilum* var. *vaseyi*	1B.2	Broadleafed upland forest, chaparral, meadows and seeps. Serpentine seeps and streams in chaparral and woodland. 240-620 m.	X			X	X	X	X					X			X			
Whitney's farewell-to-spring *Clarkia amoena* ssp. *whitneyi*	1B.1	Coastal bluff scrub, coastal scrub. 10-100 m.		X			X													
Raiche's red ribbons *Clarkia concinna* ssp. *raichei*	1B.1	Coastal bluff scrub. Highly exposed rocky bluffs with a near-vertical slope. 0-100 m.	X				X													
Vine Hill clarkia *Clarkia imbricata*	FE, SE, 1B.1	Chaparral, valley and foothill grassland. Acidic, sandy soil. 50-75 m.	X				X	X												

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
round-headed Chinese-houses *Collinsia corymbosa*	1B.2	Coastal dunes. 0-20 m.		X						X										
San Francisco collinsia Collinsia multicolor	1B.2	Closed-cone coniferous forest, coastal scrub. On decomposed shale (mudstone) mixed with humus. 30-250 m.	X		X		X													
Oregon goldthread *Coptis laciniata*	2B.2	North coast coniferous forest, meadows and seeps. Mesic sites such as moist streambanks. 0-1000 m.		X	X			X						X			X			
Pennell's bird's-beak *Cordylanthus tenuis* ssp. *capillaris*	FE, 1B.2	Closed-cone coniferous forest, chaparral. In open or disturbed areas on serpentine within forest or chaparral. 45-230 m.	X		X		X		X											
bunchberry *Cornus canadensis*	2B.2	North coast coniferous forest, bogs and fens, meadows and seeps.		X	X												X			
serpentine cryptantha *Cryptantha dissita*	1B.2	Chaparral. Serpentine outcrops. 330-730 m.	X	X			X		X											
deep-scarred cryptantha *Cryptantha excavata*	1B.3	Cismontane woodland. Sandy, gravelly, dry streambanks. 100-500 m.		X		X														
Jepson's dodder *Cuscuta jepsonii*	1B.2	North coast coniferous forest. Streamsides. 1200-2300 m.		X	X									X						
Peruvian dodder *Cuscuta obtusiflora* var. *glandulosa*	2B.2	Marshes and swamps (freshwater). Freshwater marsh. 15-280 m.	X														X			
Mendocino dodder *Cuscuta pacifica* var. *papillata*	1B.2	Coastal dunes. Interdune depressions. Annual parasitic vine observed on gnaphalium, silene and lupinus. 0-50 m.	X	X						X										
Baker's larkspur *Delphinium bakeri*	SE, 1B.1	Coastal scrub, grasslands. Only site occurs on nw-facing slope, on decomposed shale. Historically known from grassy areas along fencelines too. 90-205 m.	X				X	X												
golden larkspur *Delphinium luteum*	FE, 1B.1	Chaparral, coastal prairie, coastal scrub. North-facing rocky slopes. 0-100 m.	X				X	X												
western leatherwood *Dirca occidentalis*	1B.2	Broadleafed upland forest, chaparral, closed-cone coniferous forest, cismontane woodland, north coast coniferous forest, riparian forest, riparian woodland. On brushy slopes, mesic sites; mostly in mixed evergreen and foothill woodland communities. 30-550 m.	X		X	X	X											X		

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
dwarf downingia *Downingia pusilla*	2B.2	Valley and foothill grassland (mesic sites), vernal pools. Vernal lake and pool margins with a variety of associates. In several types of vernal pools. 1-485 m.	X	X				X								X				
Koch's cord moss *Entosthodon kochii*	1B.3	Cismontane woodland, valley and foothill grasslands. Moss growing on soil on river banks. Known from serpentine on the plumas nf. 500-1000 m.	X	X		X		X	X					X						
Snow Mountain willowherb *Epilobium nivium*	1B.2	Upper montane coniferous forest, chaparral. In crevices of rocky outcrops, and dry talus and shale slopes. 785-2500 m.		X	X															
Oregon fireweed *Epilobium oreganum*	1B.2	Bogs and fens, meadows, lower montane coniferous forest, upper montane coniferous forest. In and near springs and bogs; at least sometimes on serpentine. 500-2610 m.		X	X			X	X								X			
Brandegee's eriastrum *Eriastrum brandegeeae*	1B.1	Chaparral, cismontane woodland. On barren volcanic soils; often in open areas. 425-840 m.		X		X	X													
Tracy's eriastrum *Eriastrum tracyi*	3.2	Chaparral, cismontane woodland. Gravelly shale or clay; often in open areas. 315-760 m.		X		X	X													
Greene's narrow-leaved daisy *Erigeron greenei*	1B.2	Chaparral. Serpentine and volcanic substrates, generally in shrubby vegetation. 75-1060 m.	X	X			X		X											
serpentine daisy *Erigeron serpentinus*	1B.3	Chaparral. Serpentine seeps. 60-670 m.	X				X		X											
supple daisy *Erigeron supplex*	1B.2	Coastal bluff scrub, coastal prairie. Usually in grassy sites. 10-50 m.	X	X			X	X												
The Cedars buckwheat *Eriogonum cedrorum*	1B.3	Closed-cone coniferous forest. Serpentine. Barren rock and talus steep slopes. 365-550 m.	X		X				X											
Kellogg's buckwheat *Eriogonum kelloggii*	SE, 1B.2	Lower montane coniferous forest, chaparral. Rocky, serpentine sites. 925-1220 m.		X	X		X		X											
Tiburon buckwheat *Eriogonum luteolum* var. *caninum*	1B.2	Chaparral, valley and foothill grassland, cismontane woodland, coastal prairie. Serpentine soils; sandy to gravelly sites. 0-700 m.	X			X	X	X	X											
Snow Mountain buckwheat *Eriogonum nervulosum*	1B.2	Chaparral. Dry serpentine outcrops, balds, and barrens. 300-2100 m.	X	X			X		X											
Loch Lomond button-celery *Eryngium constancei*	FE, SE, 1B.1	Vernal pools. Volcanic ash flow vernal pools. 625-855 m.	X	X												X				

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
bluff wallflower *Erysimum concinnum*	1B.2	Coastal dunes, coastal bluff scrub, coastal prairie. More or less a coastal generalist within coastal habitat types. 0-185 m.	X	X			X	X		X										
Menzies' wallflower *Erysimum menziesii*	FE, SE, 1B.1	Coastal dunes. Localized on dunes and coastal strand. 0-35 m.		X						X										
coast fawn lily *Erythronium revolutum*	2B.2	Bogs and fens, broadleafed upland forest, North Coast coniferous forest.		X	X	X											X			
minute pocket moss *Fissidens pauperculus*	1B.2	North coast coniferous forest. Moss growing on damp soil along the coast. In dry streambeds and on stream banks. 10-100 m.	X	X	X									X						
Marin checker lily *Fritillaria lanceolata* var. *tristulis*	1B.1	Coastal bluff scrub, coastal scrub, coastal prairie. Occurrences reported from canyons and riparian areas as well as rock outcrops; often on serpentine. 30-300 m.	X				X	X	X									X		
fragrant fritillary *Fritillaria liliacea*	1B.2	Coastal scrub, valley and foothill grassland, coastal prairie. Often on serpentine; various soils reported though usually clay, in grassland. 3-410 m.	X				X	X	X											
adobe-lily *Fritillaria pluriflora*	1B.2	Chaparral, cismontane woodland, foothill grassland. Usually on clay soils; sometimes serpentine. 55-820 m.		X		X	X	X	X											
Roderick's fritillary *Fritillaria roderickii*	SE, 1B.1	Coastal bluff scrub, coastal prairie, valley and foothill grassland. Grassy slopes, mesas. 15-610 m.	X	X			X	X												
Mendocino gentian *Gentiana setigera*	1B.2	Lower montane coniferous forest, meadows. Meadows, seeps and bogs. Usually or always on serpentine. 490-1065 m.		X	X			X	X								X			
blue coast gilia *Gilia capitata* ssp. *chamissonis*	1B.1	Coastal dunes, coastal scrub. 2-200 m.	X							X										
Pacific gilia *Gilia capitata* ssp. *pacifica*	1B.2	Coastal bluff scrub, coastal prairie, valley and foothill grassland. 5-300 m.	X	X			X	X												
woolly-headed gilia *Gilia capitata* ssp. *tomentosa*	1B.1	Coastal bluff scrub. Rocky outcrops on the coast. 15-155 m.	X				X													
dark-eyed gilia *Gilia millefoliata*	1B.2	Coastal dunes. 2-20 m.	X	X						X										
American manna grass *Glyceria grandis*	2B.3	Meadows. Wet meadows, ditches, streams, and ponds in valleys and lower elevations in the mountains. 15-1980 m.		X				X						X	X					

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Boggs Lake hedge-hyssop *Gratiola heterosepala*	SE, 1B.2	Marshes and swamps (freshwater), vernal pools. Clay soils; usually in vernal pools, sometimes on lake margins. 5-2400 m.	X	X											X	X	X			
Toren's grimmia *Grimmia torenii*	1B.3	Cismontane woodland, lower montane coniferous forest, chaparral. Openings, rocky, boulder and rock walls, carbonate, volcanic. 325-1160 m.		X	X	X	X													
Guggolz's harmonia *Harmonia guggolziorum*	1B.1	Chaparral. Open areas on serpentine. 160-195 m.		X			X		X											
Hall's harmonia *Harmonia hallii*	1B.2	Chaparral. Serpentine hills and ridges. Open, rocky areas within chaparral. 500-900 m.		X			X		X											
Diablo helianthella *Helianthella castanea*	1B.2	Broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland. Usually in chaparral/oak woodland interface in rocky, azonal soils. Often in partial shade. 25-1150 m.	X			X	X	X												
white seaside tarplant *Hemizonia congesta* ssp. *congesta*	1B.2	Coastal scrub, valley and foothill grassland. Grassy valleys and hills, often in fallow fields. 25-200 m.	X	X			X	X												
short-leaved evax *Hesperevax sparsiflora* var. *brevifolia*	1B.2	Coastal bluff scrub, coastal dunes. Sandy bluffs and flats. 0-200 m.	X	X			X			X										
pygmy cypress *Hesperocyparis pygmaea*	1B.2	Closed-cone coniferous forest. On podzol-like blacklock soil in pygmy cypress forest community. 35-305 m.	X	X	X															
glandular western flax *Hesperolinon adenophyllum*	1B.2	Chaparral, cismontane woodland, valley and foothill grassland. Serpentine soils; generally found in sepentine chaparral. 425-1315 m.		X		X	X	X	X											
two-carpellate western flax *Hesperolinon bicarpellatum*	1B.2	Serpentine chaparral. Serpentine barrens at edge of chaparral. 150-820 m.	X	X			X		X											
Brewer's western flax *Hesperolinon breweri*	1B.2	Chaparral, cismontane woodland, valley and foothill grassland. Often in rocky serpentine soil in serpentine chaparral and serpentine grassland. 30-885 m.		X		X	X	X	X											
Marin western flax *Hesperolinon congestum*	FT, ST, 1B.1	Chaparral, valley and foothill grassland. In serpentine barrens and in serpentine grassland and chaparral. 30-365 m.	X				X	X	X											
Lake County western flax *Hesperolinon didymocarpum*	SE, 1B.2	Chaparral, cismontane woodland, valley and foothill grassland. Serpentine soil in open grassland and near chaparral. 330-365 m.		X		X	X	X	X											

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
drymaria-like western flax *Hesperolinon drymarioides*	1B.2	Closed-cone coniferous forest, chaparral, cismontane woodland, valley and foothill grassland. Serpentine soils, mostly within chaparral. 390-1000 m.		X	X	X	X	X	X											
Sharsmith's western flax *Hesperolinon sharsmithiae*	1B.2	Chaparral. Serpentine substrates. 270-300 m.		X			X		X											
water star-grass *Heteranthera dubia*	2B.2	Marshes and swamps. Alkaline, still or slow-moving water. Requires a pH of 7 or higher, usually in slightly eutrophic waters. 30-1495 m.	X														X			
Santa Cruz tarplant *Holocarpha macradenia*	FT, SE, 1B.1	Coastal prairie, valley and foothill grassland. Light, sandy soil or sandy clay; often with nonnatives. 10-260 m.	X					X												
Bolander's horkelia *Horkelia bolanderi*	1B.2	Lower montane coniferous forest, chaparral, meadows, valley and foothill grassland. Grassy margins of vernal pools and meadows. 450-850 m.		X	X			X								X				
Kellogg's horkelia *Horkelia cuneata* var. *sericea*	1B.1	Closed-cone coniferous forest, coastal scrub, chaparral. Old dunes, coastal sandhills; openings. 10-200 m.	X		X		X			X										
Point Reyes horkelia *Horkelia marinensis*	1B.2	Coastal dunes, coastal prairie, coastal scrub. Sandy flats and dunes near coast; in grassland or scrub plant communities. 5-30 m.	X	X			X	X		X										
thin-lobed horkelia *Horkelia tenuiloba*	1B.2	Coastal scrub, chaparral. Sandy soils; mesic openings. 45-500 m.	X	X			X													
water howellia *Howellia aquatilis*	FT, 2B.2	Freshwater marshes and swamps, lower montane coniferous forest. In clear ponds with other aquatics and surrounded by ponderosa pine forest and sometimes riparian associates. 3-1375 m.		X	X										X		X	X		
Baker's globe mallow *Iliamna bakeri*	4.2	Chaparral, Great Basin scrub, pinyon juniper woodland, lower montane coniferous forest. Rocky loam or volcanic soils. 1000-2500 m.		X	X		X													
California satintail *Imperata brevifolia*	2B.1	Coastal scrub, chaparral, riparian scrub, Mojavean scrub, meadows and seeps (alkali). Mesic sites, alkali seeps, riparian areas. 0-500 m.		X			X	X									X			
Northern California black walnut *Juglans hindsii*	1B.1	Riparian forest, riparian woodland. Few extant native stands remain; widely naturalized. Deep alluvial soil associated with a creek or stream. 0-395 m.		X														X		
Santa Lucia dwarf rush *Juncus luciensis*	1B.2	Vernal pools, meadows, lower montane coniferous forest, chaparral, great basin scrub. Vernal pools, ephemeral drainages, wet meadow habitats and streamsides. 300-2040 m.		X	X		X	X							X	X				

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
hair-leaved rush *Juncus supiniformis*	2B.2	Marshes and swamps, bogs and fens. 20-100 m.		X													X			
small groundcone *Kopsiopsis hookeri*	2B.3	North coast coniferous forest. Open woods, shrubby places, generally on gaultheria shallon. 90-885 m.	X	X	X		X													
Burke's goldfields *Lasthenia burkei*	FE, SE, 1B.1	Vernal pools, meadows and seeps. Most often in vernal pools and swales. 15-580 m.	X	X												X	X			
Baker's goldfields *Lasthenia californica* ssp. *bakeri*	1B.2	Closed-cone coniferous forest, coastal scrub. Openings. 60-520 m.	X	X	X		X													
perennial goldfields *Lasthenia californica* ssp. *macrantha*	1B.2	Coastal bluff scrub, coastal dunes, coastal scrub. 5-520 m.	X	X			X			X										
Contra Costa goldfields *Lasthenia conjugens*	FE, 1B.1	Valley and foothill grassland, vernal pools, cismontane woodland. Extirpated from most of its range; extreme. Endangered. Vernal pools, swales, low depressions, in open grassy areas. 1-445 m.	X	X		X		X								X				
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	1B.2	Freshwater and brackish marshes. Often found with typha, aster lentus, rosa calif., juncus spp., scirpus, etc. Usually on marsh and slough edges.	X	X								X					X			
marsh pea *Lathyrus palustris*	2B.2	Bogs and fens, lower montane coniferous forest, marshes and swamps, north coast coniferous forest, coastal prairie, coastal scrub. Moist coastal areas. 1-100 m.		X	X		X	X									X			
beach layia *Layia carnosa*	FE, SE, 1B.1	Coastal dunes. Hugely reduced in range along California's north coast dunes. On sparsely vegetated, semi-stabilized dunes, usually behind foredunes. 0-75 m.	X							X										
Colusa layia *Layia septentrionalis*	1B.2	Chaparral, cismontane woodland, valley and foothill grassland. Scattered colonies in fields and grassy slopes in sandy or serpentine soil. 145-1095 m.	X	X		X	X	X	X											
legenere *Legenere limosa*	1B.1	Vernal pools. Many historical occurrences are extirpated. In beds of vernal pools. 1-880 m.	X	X												X				
coast yellow leptosiphon *Leptosiphon croceus*	1B.1	Coastal bluff scrub, coastal prairie. 10-150 m.	X				X	X												
Jepson's leptosiphon *Leptosiphon jepsonii*	1B.2	Chaparral, cismontane woodland. Open to partially shaded grassy slopes. On volcanics or the periphery of serpentine substrates. 100-500 m.	X	X		X	X		X											

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
rose leptosiphon *Leptosiphon rosaceus*	1B.1	Coastal bluff scrub. 0-100 m.	X				X													
Crystal Springs lessingia *Lessingia arachnoidea*	1B.2	Coastal sage scrub, valley and foothill grassland, cismontane woodland. Grassy slopes on serpentine; sometimes on roadsides. 60-200 m.	X			X	X	X	X											
Tamalpais lessingia *Lessingia micradenia* var. *micradenia*	1B.2	Chaparral, valley and foothill grassland. Usually on serpentine, in serpentine grassland or serpentine chaparral. Often on roadsides. 100-305 m.	X				X	X	X											
Stebbins' lewisia *Lewisia stebbinsii*	1B.2	Upper montane coniferous forest, lower montane coniferous forest. Relatively barren exposed ridges and slopes in nutrient poor soils (mostly serpentine). 1680-2050 m.		X	X				X											
Mason's lilaeopsis *Lilaeopsis masonii*	1B.1	Freshwater and brackish marshes, riparian scrub. Tidal zones, in muddy or silty soil formed through river deposition or river bank erosion. 0-10 m.	X	X								X		X			X	X		
coast lily *Lilium maritimum*	1B.1	Closed-cone coniferous forest, coastal prairie, coastal scrub, broadleaved upland forest, north coast coniferous forest. Historically in sandy soil, often on raised hummocks or bogs; today mostly in roadside ditches. 10-335 m.	X	X	X	X	X													
Pitkin Marsh lily *Lilium pardalinum* ssp. *pitkinense*	FE, SE	Cismontane woodland, meadows and seeps, freshwater marsh. Saturated, sandy soils with grasses and shrubs. 35-65 m.	X			X		X									X			
Baker's meadowfoam *Limnanthes bakeri*	1B.1	Freshwater marsh, valley and foothill grassland, meadows and seeps, vernal pools. Seasonally moist or saturated sites within grassland; also in swales, roadside ditches and margins of marshy areas. 175-910 m.		X				X								X	X			
Point Reyes meadowfoam *Limnanthes douglasii* ssp. *sulphurea*	SE, 1B.2	Fresh. Marsh, vernal pools, coastal prairie, meadows and seeps, cismontane woodland. Vernally wet depressions in open rolling, coastal prairies and meadows; typically in dark clay soil. 10-120 m.	X			X		X								X	X			
woolly meadowfoam *Limnanthes floccosa* ssp. *floccosa*	4.2	Chaparral, cismontane woodland, valley and foothill grassland, vernal pools. Vernally wet areas, ditches, and ponds. 60-1335 m.		X		X	X	X								X				
Sebastopol meadowfoam *Limnanthes vinculans*	FE, SE, 1B.1	Mesic meadows, vernal pools, valley and foothill grassland. Swales, wet meadows and marshy areas in valley oak savanna; on poorly drained soils of clays and sandy loam. 15-115 m.	X	X				X								X				

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Anthony Peak lupine *Lupinus antoninus*	1B.3	Upper montane coniferous forest, lower montane coniferous forest. Open areas with surrounding forest; rocky sites. 1210-2285 m.		X	X															
Milo Baker's lupine *Lupinus milo-bakeri*	ST, 1B.1	Cismontane woodland, valley and foothill grassland. In roadside ditches, dry gravelly areas along roads, and along small streams. 360-440 m.		X		X		X						X						
Cobb Mountain lupine *Lupinus sericatus*	1B.2	Chaparral, cismontane woodland, lower montane coniferous forest. In stands of knobcone pine-oak woodland, on open wooded slopes in gravelly soils; sometimes on serpentine. 180-1500 m.	X	X	X	X	X		X											
Tidestrom's lupine *Lupinus tidestromii*	FE, SE, 1B.1	Coastal dunes. Includes lupinus tidestromii var. Tidestromii, state-listed endangered. Partially stabilized dunes, immediately near the ocean. 0-35 m.	X							X										
running-pine *Lycopodium clavatum*	4.1	Lower montane coniferous forest, north coast coniferous forest, marshes and swamps. Forest understory, edges, openings, roadsides; mesic sites with partial shade and light. 45-1225 m.	X	X	X												X			
Hall's bush-mallow *Malacothamnus hallii*	1B.2	Chaparral. Some populations on serpentine. 10-550 m.		X			X		X											
Mendocino bush-mallow *Malacothamnus mendocinensis*	1A	Cismontane woodland. Open, roadside banks. Label location info inconsistent with elevation info. 420-575 m?		X		X														
northern microseris *Microseris borealis*	2B.1	Bogs and fens, meadows and seeps, lower montane coniferous forest. 940-2000 m.		X	X			X									X			
marsh microseris *Microseris paludosa*	1B.2	Closed-cone coniferous forest, cismontane woodland, coastal scrub, valley and foothill grassland. 5-300 m.	X	X	X	X	X	X												
elongate copper moss *Mielichhoferia elongata*	2B.2	Cismontane woodland. Commonly called "copper mosses." Moss growing on very acidic, metamorphic rock or substrate; usually in higher portions in fens. Often on substrates naturally enriched with heavy metals (e.g., copper). 0-1300 m.	X	X		X											X			
leafy-stemmed mitrewort *Mitellastra caulescens*	4.2	Broadleafed upland forest, lower montane coniferous forest, meadows and seeps, north coast coniferous forest. Mesic sites. 5-1700 m.		X	X	X		X									X			

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
northern curly-leaved monardella *Monardella sinuata* ssp. *nigrescens*	1B.2	Coastal dunes, coastal scrub, chaparral, lower montane coniferous forest. Sandy soils. 0-300 m.	X		X		X			X										
Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	1B.1	Cismontane woodland, meadows and seeps, vernal pools, valley and foothill grassland, lower montane coniferous forest. Vernal pools and swales; adobe or alkaline soils. 5-950 m.	X	X	X	X		X								X	X			
few-flowered navarretia *Navarretia leucocephala* ssp. *pauciflora*	FE, ST, 1B.1	Vernal pools. Volcanic ash flow, and volc substrate vernal pools. 400-855 m.		X												X				
many-flowered navarretia *Navarretia leucocephala* ssp. *plieantha*	FE, SE, 1B.2	Vernal pools. Volcanic ash flow vernal pools. 30-950 m.	X	X												X				
small pincushion navarretia *Navarretia myersii* ssp. *deminuta*	1B.1	Vernal pools. Known from only one site in lake county in vernal pool habitat on clay-loam soil; also in roadside depressions. 355 m.		X												X				
Marin County navarretia *Navarretia rosulata*	1B.2	Closed-cone coniferous forest, chaparral. Dry, open rocky places; can occur on serpentine. 200-635 m.	X	X	X		X		X											
Wolf's evening-primrose *Oenothera wolfii*	1B.1	Coastal bluff scrub, coastal dunes, coastal prairie, lower montane coniferous forest. Sandy substrates; usually mesic sites. 3-800 m.		X	X		X	X		X										
northern adder's-tongue *Ophioglossum pusillum*	2B.2	Marshes and swamps, meadows and seeps. Marsh edges, low pastures, grassy roadside ditches. Also described as in "open swamp." 1000-2000 m.		X				X								X				
slender Orcutt grass *Orcuttia tenuis*	FT, SE, 1B.1	Vernal pools. 30-1735 m.		X												X				
seacoast ragwort *Packera bolanderi* var. *bolanderi*	2B.2	Coastal scrub, north coast coniferous forest. 30-650 m.		X	X		X													
Geysers panicum *Panicum acuminatum* var. *thermale*	SE, 1B.2	Closed-cone coniferous forest, riparian forest, valley and foothill grassland. Usually around moist, warm soil in the vicinity of hot springs. 305-825 m.	X		X			X										X		
Sonoma beardtongue *Penstemon newberryi* var. *sonomensis*	1B.3	Chaparral. Crevices in rock outcrops and talus slopes. 180-1390 m.	X	X			X													

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
white-rayed pentachaeta *Pentachaeta bellidiflora*	FE, SE, 1B.1	Valley and foothill grassland. Open dry rocky slopes and grassy areas, often on soils derived from serpentine bedrock. 35-620 m.	X					X	X											
North Coast phacelia *Phacelia insularis* var. *continentis*	1B.2	Coastal bluff scrub, coastal dunes. Open maritime bluffs, sandy soil. 10-160 m.	X	X			X			X										
Bolander's beach pine *Pinus contorta* ssp. *bolanderi*	1B.2	Closed-cone coniferous forest. Podzol-like soils with Mendocino cypress and bishop pine; within pygmy cypress forest. 35-250 m.		X	X															
white-flowered rein orchid *Piperia candida*	1B.2	North coast coniferous forest, lower montane coniferous forest, broadleafed upland forest. Coast ranges from Santa Cruz County north; on serpentine. Forest duff, mossy banks, rock outcrops and muskeg. 0-1200 m.	X	X	X	X			X											
Point Reyes rein orchid *Piperia elegans* ssp. *decurtata*	1B.1	Coastal bluff scrub. 15-185 m.	X				X													
hairless popcornflower *Plagiobothrys glaber*	1A	Meadows and seeps, marshes and swamps. Coastal salt marshes and alkaline meadows. 5-180 m.	X					X				X					X			
bearded popcornflower *Plagiobothrys hystriculus*	1B.1	Vernal pools, valley and foothill grassland. Wet sites. 10-50 m.		X				X								X				
Mayacamas popcornflower *Plagiobothrys lithocaryus*	1A	Meadows, valley and foothill grassland, cismontane woodland, chaparral, moist sites. 285-450 m.		X		X	X	X												
Petaluma popcornflower *Plagiobothrys mollis* var. *vestitus*	1A	Valley and foothill grassland, coastal salt marsh, wet sites in grassland, possibly coastal marsh margins. 10-50 m.	X					X				X								
Calistoga popcornflower *Plagiobothrys strictus*	FE, ST	Broadleafed upland forest, meadows and seeps, valley and foothill grassland, vernal pools. Alkaline sites near thermal springs and on margins of vernal pools in heavy, dark, adobe-like clay. 90-160 m.	X	X		X		X								X	X			
North Coast semaphore grass *Pleuropogon hooverianus*	ST, 1B.1	Broadleafed upland forest, meadows and seeps, north coast coniferous forest. Wet grassy, usually shady areas, sometimes freshwater marsh; associated with forest environments; 10-1150 m.	X	X	X	X		X									X			
Napa blue grass *Poa napensis*	FE, SE, 1B.1	Meadows and seeps, valley and foothill grassland. Moist alkaline meadows fed by runoff from nearby hot springs. 100-125 m.		X				X									X			

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Oregon polemonium *Polemonium carneum*	2B.2	Coastal prairie, coastal scrub, lower montane coniferous forest. 0-1830 m.	X		X		X	X												
Marin knotweed *Polygonum marinense*	3.1	Marshes and swamps. Coastal salt marshes and brackish marshes. 0-10 m.	X	X								X					X			
Nuttall's ribbon-leaved pondweed *Potamogeton epihydrus*	2B.2	Marshes and swamps. Shallow water, ponds, lakes, streams, irrigation ditches. 400-2110 m.		X										X	X		X			
eel-grass pondweed *Potamogeton zosteriformis*	2B.2	Marshes and swamps. Ponds, lakes, streams. 0-1860 m.		X										X	X		X			
Cunningham Marsh cinquefoil *Potentilla uliginosa*	1A	Freshwater marshes and swamps. Found in permanent, oligotrophic wetlands. 30-40 m.	X														X			
Pacific fuzzwort *Ptilidium californicum*	4.3	Lower montane coniferous forest, Upper montane coniferous forest. Epiphytic on fallen and decaying logs and stumps. Rarely on boulders over humus. 0-1800 m.		X	X															
dwarf alkali grass *Puccinellia pumila*	2B.2	Meadows and seeps, marshes and swamps. Mineral spring meadows and coastal salt marshes. 1-10 m.		X				X				X					X			
Tamalpais oak *Quercus parvula* var. *tamalpaisensis*	1B.3	Lower montane coniferous forest. 100-750 m.	X		X															
angel's hair lichen *Ramalina thrausta*	2B.1	North coast coniferous forest. On dead twigs and other lichens. 75-430 m.	X	X	X															
white beaked-rush *Rhynchospora alba*	2B.2	Bogs and fens, marshes and swamps. Freshwater marshes and sphagnum bogs. 60-2000 m.	X	X													X			
California beaked-rush *Rhynchospora californica*	1B.1	Bogs and fens, marshes and swamps, lower montane coniferous forest, meadows and seeps. Freshwater seeps and open marshy areas. 45-1000 m.	X	X	X			X									X			
brownish beaked-rush *Rhynchospora capitellata*	2B.2	Lower montane coniferous forest, meadows and seeps, marshes and swamps, upper montane coniferous forest. Mesic sites. 455-2000 m.	X		X												X			
round-headed beaked-rush *Rhynchospora globularis*	2B.1	Marshes and swamps. Freshwater marsh. 45-60 m.	X														X			
great burnet *Sanguisorba officinalis*	2B.2	Bogs and fens, meadows and seeps, broadleafed upland forest, marshes and swamps, north coast coniferous forest, ripar. Forest. Rocky serpentine seepage areas and along stream borders. 60-1400 m.		X	X	X		X	X								X	X		

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Lake County stonecrop *Sedella leiocarpa*	FE, SE, 1B.1	Valley and foothill grassland, vernal pools, cismontane woodland. Level areas that are seasonally wet and dry out in late spring; substrate usually of volcanic origin. 365-790 m.		X		X		X								X				
Red Mountain stonecrop *Sedum laxum* ssp. *eastwoodiae*	1B.2	Lower montane coniferous forest. Serpentine soils among rocks. 600-1200 m.		X	X				X											
Point Reyes checkerbloom *Sidalcea calycosa* ssp. *rhizomata*	1B.2	Marshes and swamps. Freshwater marshes near the coast. 3-75 m.	X	X													X			
Napa checkerbloom *Sidalcea hickmanii* ssp. *napensis*	1B.1	Chaparral. Rhyolitic substrates. 415-610 m.	X	X			X													
Lake Pillsbury checkerbloom *Sidalcea hickmanii* ssp. *pillsburiensis*	1B.2	Chaparral. Openings in chaparral on franciscan soils. 700 m.		X			X													
Marin checkerbloom *Sidalcea hickmanii* ssp. *viridis*	1B.3	Chaparral. Serpentine or volcanic soils; sometimes appears after burns. 0-430 m.	X				X		X											
Keck's checkerbloom *Sidalcea keckii*	FE, 1B.1	Cismontane woodland, valley and foothill grassland grassy slopes in blue oak woodland. 180-425 m.		X		X		X												
Siskiyou checkerbloom *Sidalcea malviflora* ssp. *patula*	1B.2	Coastal prairie, broadleafed upland forest. Open coastal forest. 15-65 m.		X		X		X												
purple-stemmed checkerbloom *Sidalcea malviflora* ssp. *purpurea*	1B.2	Broadleafed upland forest, coastal prairie. 15-65 m.	X	X		X		X												
marsh checkerbloom *Sidalcea oregana* ssp. *hydrophila*	1B.2	Meadows and seeps, riparian forest. Wet soil of streambanks, meadows. 545-2300 m.	X	X				X						X			X	X		
Kenwood Marsh checkerbloom *Sidalcea oregana* ssp. *valida*	FE, SE, 1B.1	Marshes and swamps. Edges of freshwater marshes. 115-150 m.	X														X			
Red Mountain catchfly *Silene campanulata* ssp. *campanulata*	SE, 4.2	Lower montane coniferous forest, chaparral. State-listed endangered, but CNPS list 4; eo's mostly archived. Rocky dry shallow serpentine soil. 420-1200 m. Element occurrences archived; CNPS list 4.		X	X		X		X											

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Santa Cruz microseris *Stebbinsoseris decipiens*	1B.2	Broadleafed upland forest, closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub. Open areas in loose or disturbed soil, usu. Derived from sandstone, shale, or serp on seaward slopes. 10-500 m.	X		X	X	X	X												
Tamalpais jewelflower *Streptanthus batrachopus*	1B.3	Closed-cone coniferous forest, chaparral. Talus serpentine outcrops. 410-650 m.	X		X		X		X											
Socrates Mine jewelflower *Streptanthus brachiatus* ssp. *brachiatus*	1B.2	Chaparral, closed-cone coniferous forest. Serpentine areas and serpentine chaparral. 545-1000 m.	X	X	X		X		X											
Freed's jewelflower *Streptanthus brachiatus* ssp. *hoffmanii*	1B.2	Chaparral, cismontane woodland. Serpentine rock outcrops, primarily in geothermal development areas. 480-1030 m.	X	X		X	X		X											
Hoffman's bristly jewelflower *Streptanthus glandulosus* ssp. *hoffmanii*	1B.3	Chaparral, cismontane woodland, valley and foothill grassland. Moist, steep rocky banks, in serpentine and non-serpentine soil. 120-475 m.	X			X	X	X	X											
Tiburon jewelflower *Streptanthus glandulosus* ssp. *niger*	FE, SE, 1B.1	Valley and foothill grassland. Shallow, rocky serpentine slopes. 30-150 m.	X					X	X											
Mt. Tamalpais bristly jewelflower *Streptanthus glandulosus* ssp. *pulchellus*	1B.2	Chaparral, valley, and foothill grassland. Serpentine slopes. 150-800 m.	X				X	X	X											
green jewelflower *Streptanthus hesperidis*	1B.2	Chaparral, cismontane woodland. Openings in chaparral or woodland; serpentine, rocky sites. 130-760 m.		X		X	X		X											
Morrison's jewelflower *Streptanthus morrisonii*	1B.2	Chaparral, cismontane woodland, closed-cone coniferous forest. The complex has been mapped as the species, though at least 4 ssp. Have been recognized. On serpentine. 90-1035 m.	X	X	X	X	X		X											
early jewelflower *Streptanthus vernalis*	1B.2	Chaparral, closed-cone coniferous forest. On serpentine. 610 m.		X	X		X		X											
slender-leaved pondweed *Stuckenia filiformis* ssp. *alpina*	2B.2	Marshes and swamps. Shallow, clear water of lakes and drainage channels. 300-2150 m.	X											X	X		X			
Suisun Marsh aster *Symphyotrichum lentum*	1B.2	Marshes and swamps (brackish and freshwater). Most often seen along sloughs with phragmites, scirpus, blackberry, typha, etc. 0-3 m.		X								X					X			

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
whiteworm lichen *Thamnolia vermicularis*	2B.1	Chaparral, valley, and foothill grassland. On rocks derived from Wilson Ranch formation sandstone.	X				X	X												
robust false lupine *Thermopsis robusta*	1B.2	North coast coniferous forest, broadleafed upland forest. Ridgetops; sometimes on serpentine. 360-1290 m.		X	X	X			X											
alpine crisp moss *Tortella alpicola*	2B.3	Cismontane woodland. Moss on volcanic rock (in California). Wide ecological tolerance: shaded or exposed, wet or dry, low to high elevations.		X		X														
beaked tracyina *Tracyina rostrata*	1B.2	Cismontane woodland, valley and foothill grassland. Open grassy meadows within oak woodland and grassland habitats. 150-500 m.	X	X		X		X												
cylindrical trichodon *Trichodon cylindricus*	2B.2	Broadleafed upland forest, upper montane coniferous forest. Moss growing in openings on sandy or clay soils on roadsides, stream banks, trails or in fields. 50-1500 m.		X	X	X														
Napa bluecurls *Trichostema ruygtii*	1B.2	Cismontane woodland, chaparral, valley, and foothill grassland, vernal pools, lower montane coniferous forest. Often in open, sunny areas. Also has been found in vernal pools. 30-590 m.		X	X	X	X	X								X				
showy rancheria clover *Trifolium amoenum*	FE, 1B.1	Valley and foothill grassland, coastal bluff scrub. Sometimes on serpentine soil, open sunny sites, swales. Most recently sited on roadside and eroding cliff face. 5-560 m.	X	X			X	X	X											
Santa Cruz clover *Trifolium buckwestiorum*	1B.1	Coastal prairie, broadleafed upland forest, cismontane woodland. Moist grassland. 60-545 m.	X	X		X		X												
saline clover *Trifolium hydrophilum*	1B.2	Marshes and swamps, valley and foothill grassland, vernal pools. Mesic, alkaline sites. 0-300 m.	X	X				X								X	X			
Monterey clover *Trifolium trichocalyx*	FE, SE, 1B.1	Closed-cone coniferous forest. Poorly drained, low nutrient soil underlain with hardpan; also openings and burned areas. 120-205 m.		X	X															
San Francisco owl's-clover *Triphysaria floribunda*	1B.2	Coastal prairie, valley, and foothill grassland. On serpentine and nonserpentine substrate (such as at pt. Reyes). 10-160 m.	X					X	X											
coastal triquetrella *Triquetrella californica*	1B.2	Coastal bluff scrub, coastal scrub valley and foothill grasslands. Grows within 30 m from the coast in coastal scrub, grasslands and in open gravels on roadsides, hillsides, rocky slopes, and fields. On gravel or thin soil over outcrops. 10-100 m.	X	X			X	X												

Table 4-3 California Natural Diversity Database Occurrences Plant Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Conifer Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Tidal Marsh and Channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Methuselah's beard lichen *Usnea longissima*	4.2	North coast coniferous forest, broadleafed upland forest. Grows in the "redwood zone" on a variety of trees including big leaf maple, oaks, ash, Douglas-fir, and bay. 50-1460 m in California.	X	X	X	X														
oval-leaved viburnum *Viburnum ellipticum*	2B.3	Chaparral, cismontane woodland, lower montane coniferous forest.	X	X	X	X	X													

Table 4-4 **California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area**

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Invertebrates																						
San Bruno elfin butterfly *Callophrys mossii bayensis*	FE	Valley & foothill grassland. Coastal, mountainous areas with grassy ground cover, mainly in the vicinity of San Bruno Mountain, San Mateo County. Colonies are located on steep, north-facing slopes within the fog belt. Larval host plant is Sedum spathulifolium.	X					X														
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	FT	Riparian scrub Occurs only in the Central Valley of California, in association with blue elderberry (Sambucus mexicana). Prefers to lay eggs in elderberries 2-8 inches in diameter; some preference shown for "stressed" elderberries.		X			X													X		
Mission blue butterfly *Plebejus icarioides missionensis*	SE	Inhabits grasslands of the San Francisco peninsula. Three larval host plants: Lupinus albifrons, L. variicolor, and L. formosus, of which L. albifrons is favored.	X					X														
Lotis blue butterfly *Plebejus idas lotis*	SE	Inhabits wet meadows or poorly drained sphagnum-willow bogs, where soils are waterlogged & acidic; north coastal Calif. Inhabits upper edges of peat bog between peat & surrounding low willows; hostplant is Lotus formosissimus.		X															X			
Callippe silverspot butterfly *Speyeria callippe*	FE	Restricted to the northern coastal scrub of the San Francisco peninsula. hostplant is Viola pedunculata. Most adults found on e-facing slopes; males congregate on hilltops in search of females.		X			X															
Behren's silverspot butterfly *Speyeria zerene behrensii*	FE	Restricted to the pacific side of the coast ranges, from point arena to Cape Mendocino, Mendocino County inhabits coastal terrace prairie habitat. Foodplant is Viola sp.	X	X				X														

Table 4-4 **California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area**

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Myrtle's silverspot *Speyeria zerene myrtleae*	FE	Restricted to the foggy, coastal dunes/hills of the point reyes peninsula; extirpated from coastal San Mateo County. Larval foodplant thought to be Viola adunca.	X				X	X		X												
California freshwater shrimp *Syncaris pacifica*	FE, SE	Endemic to Marin, Napa, and Sonoma Counties. Found in low elevation, low gradient streams where riparian cover is moderately shallow pools away from main streamflow. Winter: undercut banks with exposed roots. Summer: leafy branches touching water.	X	X												X						
Fish																						
Sacramento perch *Archoplites interruptus*	SSC	Historically found in the sloughs, slow-moving rivers, and lakes of the Central Valley. Prefers warm water. Aquatic vegetation is essential for young. Tolerates wide range of physio-chemical water conditions.		X												X	X					
Tidewater goby *Eucyclogobius newberry*	FE, SSC	Brackish water habitats along the California coast from Agua Hedionda Lagoon, San Diego County to the mouth of the Smith river. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water and high oxygen levels.	X	X										X	X	X						
Russian River tule perch *Hysterocarpus traski pomo*	SSC	Low elevation streams of the Russian River system. Requires clear, flowing water with abundant cover. They also require deep (> 1 m) pool habitat.	X													X						
Clear Lake hitch *Lavinia exilicauda chi*	SCT, SSC	Found only in Clear Lake, Lake County, and associated ponds. spawns in streams flowing into clear lake. Adults found in the limnetic zone. Juveniles found in the nearshore shallow-water habitat hiding in the vegetation.		X													X					
Navarro roach *Lavinia symmetricus navarroensis*	SSC	Habitat generalists. Found in warm intermittent streams as well as cold, well-aerated streams.	X	X												X						

Table 4-4 **California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area**

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Gualala roach *Lavinia symmetricus parvipinnis*	SSC	Found only in the Gualala River.	X	X												X						
Tomales roach Lavinia symmetricus ssp. 2	SSC	Tributaries to Tomales Bay.	X													X						
Hardhead *Mylopharodon conocephalus*	SSC	Low to mid-elevation streams in the Sacramento-San Joaquin drainage. Also present in the Russian River. Clear, deep pools with sand-gravel-boulder bottoms and slow water velocity. Not found where exotic centrarchids predominate.	X		X											X						
Pink salmon *Oncorhynchus gorbuscha*	SSC	Most spawn in intertidal or lower reaches of streams and rivers in September and October move further upstream in Sacramento river. Optimal temperature is 5.6 to 14.4ºC. Embryos and alevins require fast-flowing, well oxygenated water for development and survival.		X	X											X						
Coho salmon - central California coast ESU *Oncorhynchus kisutch*	FE, SE	Federal listing = populations between Punta Gorda and San Lorenzo River. State listing = populations south of punta gorda. Require beds of loose, silt-free, coarse gravel for spawning. Also need cover, cool water, and sufficient dissolved oxygen.	X	X										X	X	X						
Steelhead - central California coast DPS *Oncorhynchus mykiss irideus*	FT	From Russian River, south to Soquel Creek and to, but not including, Pajaro River. Also San Francisco and San Pablo Bay basins.	X	X										X	X	X						
Sacramento splittail *Pogonichthys macrolepidotus*	SSC	Endemic to the lakes and rivers of the Central Valley, but now confined to the Delta, Suisun Bay & associated marshes. Slow moving river sections, dead end sloughs. Requires flooded vegetation for spawning & foraging for young.	X	X										X		X						

Table 4-4 **California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area**

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Longfin smelt *Spirinchus thaleichthys*	FCT, ST, SSC	Euryhaline, nektonic and anadromous. Found in open waters of estuaries, mostly in middle or bottom of water column. Prefer salinities of 15-30 ppt, but can be found in completely freshwater to almost pure seawater.	X	X								X										
Eulachon *Thaleichthys pacificus*	FT, SSC	Found in Klamath River, Mad River, Redwood Creek & in small numbers in Smith River & Humboldt Bay tributaries. Spawn in lower reaches of coastal rivers w/ moderate water velocities & bottom of pea-sized gravel, sand & woody debris.	X											X	X	X						
Amphibians																						
California Tiger Salamander *Ambystoma californiense*	FT, ST, SSC	Central Valley DPS federally listed as threatened. Santa Barbara and Sonoma Counties DPS federally listed as endangered. Need underground refuges, especially ground squirrel burrows and vernal pools or other seasonal water sources for breeding	X					X										X				
Pacific tailed frog *Ascaphus truei*	SSC	Occurs in montane hardwood-conifer, redwood, Douglas-fir and ponderosa pine habitats. Restricted to perennial montane streams. Tadpoles require water below 15 degrees C.		X												X						
Northern red-legged frog *Rana aurora*	SSC	Humid forests, woodlands, grasslands, and streamsides in northwestern California, usually near dense riparian cover. Generally near permanent water, but can be found far from water, in damp woods and meadows, during nonbreeding season.		X	X	X		X								X	X		X	X		
Foothill yellow-legged frog *Rana boylii*	SSC	Partly shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Need at least some cobble-sized substrate for egg-laying. Need at least 15 weeks to attain metamorphosis.	X	X	X											X				X		

Table 4-4 **California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area**

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats									
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
California red-legged frog *Rana draytonii*	FT, SSC	Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development. Must have access to estivation habitat.	X	X												X	X		X	X		
Southern torrent salamander *Rhyacotriton variegatus*	SSC	Coastal redwood, Douglas-fir, mixed conifer, montane riparian, and montane hardwood-conifer habitats. old growth forest. Cold, well-shaded, permanent streams and seepages, or within splash zone or on moss-covered rock within trickling water.		X	X	X											X					
Reptiles																						
Western pond turtle *Emys marmorata*	SSC	A thoroughly aquatic turtle of ponds, marshes, rivers, streams and irrigation ditches, usually with aquatic vegetation, be need basking sites and suitable (sandy banks or grassy open fields) upland habitat up to 0.5 km from water for egg-laying.	X	X			X	X								X	X		X	X		
Birds																						
Northern goshawk *Accipiter gentilis*	SSC	Within, and in vicinity of, coniferous forest. Uses old nests, and maintains alternate sites. Usually nests on north slopes, near water. Red fir, lodgepole pine, Jeffrey pine, and aspens are typical nest trees.		X	X															X		
Tricolored blackbird *Agelaius tricolor*	SSC	Highly colonial species, most numerous in Central Valley and vicinity. Largely endemic to California. Requires open water, protected nesting substrate, and foraging area with insect prey within a few km of the colony.	X	X										X				X	X			

Table 4-4 California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Grasshopper sparrow *Ammodramus savannarum*	SSC	Dense grasslands on rolling hills, lowland plains, in valleys and on hillsides on lower mountain slopes. Favors native grasslands with a mix of grasses, forbs and scattered shrubs. Loosely colonial when nesting.		X				X														
Golden eagle *Aquila chrysaetos*	FP	Rolling foothills, mountain areas, sage-juniper flats, and desert. Cliff-walled canyons provide nesting habitat in most parts of range; also, large trees in open areas.		X			X	X														
Burrowing owl *Athene cunicularia*	SSC	Open, dry annual or perennial grasslands, deserts and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.	X	X			X	X														
Swainson's hawk *Buteo swainsoni*	SSC	Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, and agricultural or ranch lands requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	X	X			X	X												X		
Western snowy plover *Charadrius alexandrinus nivosus*	FT, SSC	Sandy beaches, salt pond levees and shores of large alkali lakes. Needs sandy, gravelly or friable soils for nesting.	X	X						X												
Northern harrier *Circus cyaneus*	SSC	Coastal salt and fresh-water marsh. nest and forage in grasslands, from salt grass in desert sink to mountain cienagas. Nests on ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas.	X	X				X						X					X			

Table 4-4 California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	SE, FP	Riparian forest nester, along the broad, lower flood-bottoms of larger river systems. Nests in riparian jungles of willow, often mixed with cottonwoods, with lower story of blackberry, nettles, or wild grape.	X	X																X		
Black swift *Cypseloides niger*	SSC	Coastal belt of Santa Cruz and Monterey County; central and southern Sierra Nevada; San Bernardino and San Jacinto Mountains. Breeds in small colonies on cliffs behind or adjacent to waterfalls in deep canyons and sea-bluffs above the surf; forages widely.	X	X						X										X		
White-tailed kite *Elanus leucurus*	FP	Rolling foothills and valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	X	X		X		X											X	X		
American peregrine falcon *Falco peregrinus anatum*	FP	Near wetlands, lakes, rivers, or other water; on cliffs, banks, dunes, mounds; also, human-made structures. Nest consists of a scrape or a depression or ledge in an open site.	X	X										X	X	X	X		X			
Bald eagle *Haliaeetus leucocephalus*	FD, SE, FP,	Ocean shore, lake margins, and rivers for both nesting and wintering. Most nests within 1 mile of water. Nests in large, old-growth, or dominant live tree with open branches, especially ponderosa pine. Roosts communally in winter.		X												X	X					
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	SSC	Resident of the San Francisco Bay region, in fresh and salt water marshes. Requires thick, continuous cover down to water surface for foraging; tall grasses, tule patches, willows for nesting.	X	X										X					X			

Table 4-4 California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Yellow-breasted chat *Icteria virens*	SSC	Summer resident; inhabits riparian thickets of willow and other brushy tangles near watercourses. Nests in low, dense riparian, consisting of willow, blackberry, wild grape; forages and nests within 10 ft of ground.		X																X		
California black rail *Laterallus jamaicensis coturniculus*	ST	Inhabits freshwater marshes, wet meadows and shallow margins of saltwater marshes bordering larger bays. Needs water depths of about 1 inch that does not fluctuate during the year and dense vegetation for nesting habitat.	X	X				X						X					X			
Song sparrow ("Modesto" population) *Melospiza melodia*	SSC	Emergent freshwater marshes dominated by tules (Scirpus spp.) and cattails (Typha spp.) as well as riparian willow (Salix spp.) thickets. Primary habitat requirements include moderately dense vegetation to supply cover for nest sites, a source of standing or running water, semiopen canopies to allow light, and exposed ground or leaf litter for foraging.	X	X															X	X		
San Pablo song sparrow *Melospiza melodia samuelis*	SSC	Resident of salt marshes along the north side of San Francisco and San Pablo Bays. Inhabits tidal sloughs in the salicornia marshes; nests in grindelia bordering slough channels.	X	X										X								
Purple martin *Progne subis*	SSC	Inhabits woodlands, low elevation coniferous forest of Douglas-fir, ponderosa pine, and Monterey pine. Nests in old woodpecker cavities mostly, also in human-made structures. Nest often located in tall, isolated tree/snag.	X	X	X						X											

Table 4-4 **California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area**

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
California clapper rail *Rallus longirostris obsoletus*	FE, SE, FP	Salt-water and brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay. Associated with abundant growths of pickleweed, but feeds away from cover on invertebrates from mud-bottomed sloughs.	X	X										X								
Bank swallow *Riparia riparia*	ST	Colonial nester; nests primarily in riparian and other lowland habitats west of the desert. Requires vertical banks/cliffs with fine-textured/sandy soils near streams, rivers, lakes, ocean to dig nesting hole.	X	X																X		
Yellow warbler *Setophaga petechia*	SSC	Riparian plant associations in close proximity to water. Also nests in montane shrubbery in open conifer forests in Cascades and Sierra Nevada. Frequently found nesting and foraging in willow shrubs and thickets, and in other riparian plants including cottonwoods, sycamores, ash, and alders.	X	X	X															X		
Mammals																						
Pallid bat *Antrozous pallidus*	SSC	Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites.	X	X	X	X	X	X														
Point Arena mountain beaver *Aplodontia rufa nigra*	FE, SSC	Coastal areas of Point Arena with springs or seepages. North-facing slopes of ridges and gullies with friable soils and thickets of undergrowth.		X															X			
Point Reyes mountain beaver *Aplodontia rufa phaea*	SSC	Coastal area of Point Reyes in areas of springs or seepages. North-facing slopes of hills and gullies in areas overgrown with sword ferns and thimbleberries.	X																X			

Table 4-4 California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Sonoma tree vole *Arborimus pomo*	SSC	North coast fog belt from Oregon border to Sonoma County in Douglas-fir, redwood and montane hardwood-conifer forests. Feeds almost exclusively on Douglas-fir needles. Will occasionally take needles of grand fir, hemlock or spruce.	X	X	X																	
Townsend's big-eared bat *Corynorhinus townsendii*	SC, SSC	Throughout California in a wide variety of habitats. Most common in mesic sites. Roosts in the open, hanging from walls and ceilings. Roosting sites limiting. Extremely sensitive to human disturbance.	X	X		X	X	X														
California wolverine *Gulo gulo*	ST, FP	Found in the north coast mountains and the Sierra Nevada. Found in a wide variety of high elevation habitats. Needs water source. Uses caves, logs, burrows for cover and den area. Hunts in more open areas. can travel long distances		X	X																	
Western red bat *Lasiurus blossevillii*	SSC	Roosts primarily in trees, 2-40 ft above ground, from sea level up through mixed conifer forests. Prefers habitat edges and mosaics with trees that are protected from above and open below with open areas for foraging.	X	X	X		X	X														
Humboldt marten *Martes americana humboldtensis*	SSC	Occurs only in the coastal redwood zone from the Oregon border south to Sonoma County. Associated with late-successional coniferous forests, prefer forests with low, overhead cover.		X	X																	
Fisher - West Coast DPS *Pekania pennanti*	FC, SC, SSC	Intermediate to large-tree stages of coniferous forests & deciduous-riparian areas with high percent canopy closure. Uses cavities, snags, logs and rocky areas for cover & denning. Needs large areas of mature, dense forest.	X	X	*X*														X			

Table 4-4 California Natural Diversity Database Occurrences Animal Species in Marin/Sonoma Mosquito and Vector Control District and its Adjacent Program Area

Species Name	Status	Habitat	MSMVCD	MSMVCD Adjacent Counties	Upland Habitats							Wetland Habitats										
					Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Open Water (Marine/Brackish)	Tidal Flats	Tidal Marsh and channels	Lagoon	Creeks and Rivers	Ponds and Lakes	Seasonal Wetlands (includes Vernal Pools)	FW Marsh/Seeps	Riparian Forest	Artificial Containers, Temporary Standing Waters and Artificial Ponds	Wastewater Treatment Facilities/Septic Systems
Salt-marsh harvest mouse *Reithrodontomys raviventris*	FE, SE, FP	Only in the saline emergent wetlands of San Francisco Bay and its tributaries. Pickleweed is primary habitat. Do not burrow, build loosely organized nests. Require higher areas for flood escape.	X	X										X								
Suisun shrew *Sorex ornatus sinuosus*	SSC	Tidal marshes of the northern shores of San Pablo and Suisun Bays. Require dense low-lying cover and driftweed and other litter above the mean hightide line for nesting and foraging.	X	X										X								
American badger *Taxidea taxus*	SSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Needs sufficient food, friable soils and open, uncultivated ground. Preys on burrowing rodents. Digs burrows.	X	X		X	X	X														
Point Reyes jumping mouse *Zapus trinotatus orarius*	SSC	Primarily in bunch grass marshes on the uplands of Point Reyes. Also present in coastal scrub, grassland, and meadows. Eats mainly grass seeds with some insects and fruit taken. Builds grassy nests on ground under vegetation, burrows in winter	X				X	X											X			

FE = federally listed as endangered
FT = federally listed as threatened
FC = federal candidate species
SE = listed by California as endangered
ST = listed by California as threatened
SSC = California species of concern
FP = California Fully Protected species

This Page Intentionally Left Blank

4.1.3 Regulatory Setting

The regulatory setting includes the federal, state, and local laws, statutes, and regulations pertinent to the Program Area and vicinity and the aquatic resources residing therein. These laws include the following:

4.1.3.1 Federal

4.1.3.1.1 Endangered Species Act of 1973 (16 USC Section 1531 et seq.; 50 CFR Parts 17 and 222)

This law includes provisions for protection and management of species that are federally listed as threatened or endangered and designated critical habitat for these species. This law prohibits "take" of federally listed species, except as authorized under an incidental take permit or incidental take statement. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (http://www.fws.gov/endangered/laws-policies/section-3.html). The United States Fish and Wildlife Service (USFWS) is the administering agency for this authority for freshwater species. The National Marine Fisheries Service (NMFS) is the administering agency for anadromous species.

4.1.3.1.2 Magnusson-Stevenson Fishery Conservation and Management Act 1996 (Public Law 94-265)

This law provides for the conservation and management of all fish resources within the exclusive economic zone of the US and supports and encourages the implementation and enforcement of international fisheries agreements for conservation and management of highly migratory species. It calls for the establishment of Regional Fisheries Management Councils to develop, implement, monitor, and revise fish management plans to promote domestic commercial and recreational fishing. Specifically to this Program, it calls for the protection of essential fish habitat in review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. The NMFS is responsible for the administration of this act.

4.1.3.1.3 Clean Water Act of 1977 [33 USC Section(s) 1251-1376; 30 CFR Section(s) 330.5 (a)(26)]

These sections provide for the protection of wetlands. The administering agency for the above authority is the United States Army Corps of Engineers (USACE). Under CWA Sections 301 and 502, any discharge of dredged or fill materials into "waters of the United States," including wetlands, is forbidden unless authorized by a permit issued by the USACE pursuant to Section 404. These permits are an essential part of protecting streams and wetlands. Wetlands are vital to the ecosystem in filtering streams and rivers and providing habitat for wildlife.

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." Also see Section 9.1.2.1 in Chapter 9, Water Resources.

4.1.3.1.4 Executive Order 11990, Protection of Wetlands (May 24, 1977)

This order provides for the protection of wetlands. The administering agency for the above authority is the USACE.

4.1.3.1.5 Federal Insecticide, Fungicide, and Rodenticide Act

FIFRA defines a pesticide as “any substance intended for preventing, destroying, repelling, or mitigating any pest.” FIFRA requires USEPA registration of pesticides prior to their distribution for use in the US, sets registration criteria (testing guidelines), and mandates that pesticides perform their intended functions without causing unreasonable adverse effects on people and the environment when used according to USEPA-approved label directions. FIFRA defines an "unreasonable adverse effect on the environment" as "(1) any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of the pesticide, or (2) a human dietary risk from residues that result from a use of a pesticide in or on any food inconsistent with the standard under Section 408 of the Federal Food, Drug, and Cosmetic Act (21 USC 346a)."

FIFRA regulates only the active ingredients of pesticides, not inert ingredients, which manufacturers are not required to reveal. However, toxicity studies conducted under FIFRA are required to evaluate the active ingredient and the entire product formulation, through which any potential additive or synergistic effects of inert ingredients are established.

4.1.3.1.6 Stipulated Injunction and Order, Protection of California Red-Legged Frog from Pesticides

On October 20, 2006, the US District Court for the Northern District of California imposed no-use buffer zones around California red-legged frog upland and aquatic habitats for certain pesticides. This injunction and order will remain in effect for each pesticide listed in the injunction until the USEPA goes through formal 7(A)(2) consultation with the USFWS on each of the 66 active ingredients, and the USFWS issues a Biological Opinion including a “not likely to adversely affect” statement for the pesticides. Under the injunction and order, no-use buffer zones of 60 feet for ground applications and 200 feet for aerial applications apply from the edge of the following California red-legged frog habitats as defined by the USFWS and the Center for Biological Diversity: Aquatic Feature, Aquatic Breeding Habitat, Nonbreeding Aquatic Habitat, and Upland Habitat. These habitats are found in 33 counties of California including Marin and Sonoma counties.

Of the 66 pesticides listed in the injunction, the District may employ esfenvalerate, methoprene, and permethrin for vector control. Esfenvalerate may be used for yellow-jacket and wasp control in response to public complaints. Methoprene is used for larval mosquito control, and permethrin is may be used for adult mosquito control. However, vector control programs are exempt. Specifically, for applications of a pesticide for purposes of public health vector control under a program administered by a public entity, the injunction does not apply. The District may use the following herbicides listed in the injunction: glyphosate, imazapyr, and triclopyr. Where used for vegetation management for control of mosquito-breeding habitat, the injunction would not apply. If these herbicides were to be used for invasive species management to assist other agencies or landowners, then the injunction generally applies until such time that the material has been reviewed by USEPA and USFWS determines that it does not apply or the following “exceptions for invasive species and noxious weed programs” can be met:

a. You are applying a pesticide for purposes of controlling state-designated invasive species and noxious weeds under a program administered by a public entity; and

b. You do not apply the pesticide within 15 feet of aquatic breeding critical habitat or nonbreeding aquatic critical habitat within critical habitat areas, or within 15 feet of aquatic features within noncritical habitat sections subject to the injunction; and

c. Application is limited to localized spot treatment using hand-held devices; and

d. Precipitation is not occurring or forecast to occur within 24 hours; and

e. You are a certified applicator or working under the direct supervision of a certified applicator; and

f. If using 2,4-D or triclopyr, you are using only the amine formulations. (USEPA 2014a).

4.1.3.2 State

4.1.3.2.1 Porter-Cologne Water Quality Control Act of 1970

This law provides the California State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs) with authority to establish Water Quality Control Plans (Basin Plans) that are reviewed and revised periodically. The SWRCB and the RWQCBs carry out the federal Clean Water Act, including the National Pollutant Discharge Elimination System (NPDES) permitting process for point source discharges and the CWA Section 303 water quality standards program. The administering agencies are the SWRCB and the RWQCBs.

4.1.3.2.2 California Fish and Wildlife Code Section 1600 et seq.

This law provides for protection and conservation of fish and wildlife resources with respect to any project that may substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of any river, stream, or lake. The administering agency is the California Department of Fish and Wildlife (CDFW).

4.1.3.2.3 California Endangered Species Act of 1984 (California Fish and Wildlife Code Sections 2050 2098)

This law provides for the protection and management of species and subspecies listed by the State of California as endangered or threatened, or designated as candidates for such listing. They are listed at 14 California Code of Regulations (CCR) Section 670.5. This law prohibits "take" of state-listed or candidate species, except as otherwise authorized by the Fish and Wildlife Code. The term "take" is defined by Section 86 of the Fish and Wildlife Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." This definition is different in some respects from the definition of "take" under the federal Endangered Species Act. The administering agency is the CDFW.

4.1.3.2.4 California Fish and Wildlife Code §3503

This law prohibits take, possession, or needless destruction of any bird egg or nest, except as otherwise provided by the Fish and Wildlife Code or regulation made pursuant thereto. The administering agency is the CDFW.

4.1.3.2.5 California Fish and Wildlife Code §3503.5

This law prohibits take, possession, or destruction of any bird of prey (birds in the order of Falconiformes or Strigiformes), except as otherwise provided by the Fish and Wildlife Code or regulation adopted pursuant thereto. The administering agency is the CDFW.

4.1.3.2.6 California Fish and Wildlife Code §3511, 4700, and 5050

These laws prohibit take or possession of birds, mammals, and reptiles listed as "fully protected," except as provided by the Fish and Wildlife Code. The administering agency is the CDFW.

4.1.3.2.7 California Fish and Wildlife Code Section 5650

This law protects water quality from substances or materials deleterious to fish, plant life, or bird life. It prohibits such substances or materials from being placed in waters or places where they can pass into waters of the state, except as authorized pursuant to, and in compliance with, the terms and conditions of permits or authorizations of the SWRCB or a RWQCB such as a waste discharge requirement issued pursuant to California Water Code Section 13263, a waiver issued pursuant to Water Code Section 13269(a), or permit pursuant to Water Code Section 13160. The administering agency for Fish and Wildlife Code Section 5650 is the CDFW.

4.1.3.2.8 Native Plant Protection Act (California Fish and Wildlife Code §1900 et seq.)

This law provides for the preservation, protection, and enhancement of endangered or rare native plants of the state. The Native Plant Protection Act allows for the designation of endangered and rare native plant species and states that no person shall take any native plant, or any part or product thereof that the commission has determined to be an endangered native plant or rare native plant, except as otherwise provided in the act. The administering agency is the CDFW.

4.1.3.2.9 Natural Community Conservation Planning Act (California Fish and Wildlife Code §2800 to 2835)

This law provides for the development of Natural Community Conservation Plans (NCCPs) to provide for regional or areawide protection and perpetuation of natural wildlife diversity, while allowing compatible and appropriate development and growth. The administering agency is the CDFW.

4.1.3.2.10 California Food and Agricultural Code, Section(s) 12976 and Section(s) 12981

This code states that no pesticide application should be made or continued when a reasonable possibility exists of damage to nontarget crops, animals, or other public or private property. The administering agency for the above authority is the California Department of Pesticide Regulation (CDPR).

4.1.3.3 Local

Local governing bodies may pass ordinances that regulate or restrict pesticide use within their jurisdictional areas. However, these restrictions do not apply to state operations and would not be applicable to treatments proposed by the District under the Program (including those conducted under the authority of the state, specifically CDPH for the District's vector control activities) because California state law preempts local regulation and restriction of pesticide use. See Sections 1.3.3 and 3.1.3.3 for a discussion of this issue. However, a school district board can decree that certain pesticides cannot be used in schools under the Healthy Schools Act. The District works collaboratively with schools and school district administration to minimize mosquito and vector production and control populations, when necessary. The District will work with the local entities and property owners to implement best management practices for the protection of public health.

Concerning local ordinances and policies to protect biological resources, Marin County and its cities (Belvedere, Corte Madera, Fairfax, Larkspur, Mill Valley, Novato, Ross, San Anselmo, San Rafael, Sausalito, and Tiburon) and Sonoma County and its cities (Cloverdale, Cotati, Healdsburg, Petaluma, Rohnert Park, Santa Rosa, Sebastopol, Sonoma, and Windsor) maintain general plans for development and protection of lands within their jurisdictions. The general plans address the protection and enhancement of natural resources including plant, wildlife and fish habitat and special-status species with broad goals and more specific policies to implement those goals. The discussions below for Marin and Sonoma counties are examples of the local policies affecting biological resources.

4.1.3.3.1 County of Marin General Plan

The County of Marin's General Plan (Countywide Plan), adopted in 2007 (Marin County 2007), includes a Natural Systems and Agriculture Element that establishes county policies "to preserve native habitat and protect natural resources, and sets out programs to restore and enhance ailing habitat." The element describes goals relating to biological resources, water resources, environmental hazards, atmosphere and climate, open space, trails, and agriculture and food. For each of these goals policies and implementing programs are outlined. The goals most pertinent to the District's vector control activities are listed below.

> Section 2.4 Biological Resources:

- BIO-1. Enhanced Native Habitat and Biodiversity. Effectively manage and enhance native habitat, maintain viable native plant and animal populations, and provide for improved biodiversity throughout the County.
- BIO-2. Protection of Sensitive Biological Resources. Require identification of sensitive biological resources and commitment to adequate protection and mitigation, and monitor development trends and resource preservation efforts.
- BIO-3. Wetland Conservation. Require all feasible measures to avoid and minimize potential adverse impacts on existing wetlands and to encourage programs for restoration and enhancement of degraded wetlands.
- BIO-4. Riparian Conservation. Protect and, where possible, restore the natural structure and function of riparian systems.
- BIO-5. Baylands Conservation. Preserve and enhance the diversity of the baylands ecosystem, including tidal marshes and adjacent uplands, seasonal marshes and wetlands, rocky shorelines, lagoons, agricultural lands, and low-lying grasslands overlying historical marshlands.

> Section 2.5 Water Resources.

- WR-2. Clean Water. Ensure that surface and groundwater supplies are sufficiently unpolluted to support local natural communities, the health of the human population, and the viability of agriculture and other commercial uses.

> Section 2.5 Open Space.

- OS-1. Sustainably Managed Open Space. Manage open space in a sustainable manner for environmental health and the long-term protection of resources.
- This goal includes Implementing Program OS-1.C. Utilize Integrated Pest Management. Minimize the use of pesticides and herbicides in open space management. This Program is described below.

Integrated Pest Management Program

The Marin County Board of Supervisors adopted an Integrated Pest Management Ordinance (No. 3521) and IPM policy that governs and guides the control of pests on property owned, managed, and leased by the County of Marin. The IPM program uses best practices and science to protect the health of the public and environment, manage county properties, minimize loss due to pests, and reduce pesticide use. The county's IPM is overseen by an IPM Commission (Marin County Parks 2010). The IPM Policy outlines the programs purpose and intent, describes its components, and identifies the duties and responsibilities of those implementing the plan (County of Marin 2013).

4.1.3.3.2 County of Sonoma General Plan

The Sonoma County General Plan 2020 (Sonoma County 2008) was approved by the Sonoma County Board of Supervisors on September 23, 2008. This plan provides goals, objectives, and policies that will guide decisions on future growth, development, and conservation of resources through 2020 in a manner consistent with the goals and quality of life desired by the county's residents. The Plan includes the following elements pertinent to the District's activities: Open Space and Resource Conservation and Water Resources.

The Open Spaces and Resources Conservation Element includes policies addressing the protection of biotic habitats and riparian corridors. It also addresses air quality and energy resources, mineral and timber resources, and soil resources.

> OSRC-7. Protect and enhance the County's natural habitats (special-status species habitat, marshes and wetlands, sensitive natural communities, and habitat connectivity corridors) and diverse plant and animal communities.

> OSRC-8. Protect and enhance Riparian Corridors and functions along streams, balancing the need for agricultural production, urban development, timber and mining operations, and other land uses with the preservation of riparian vegetation, protection of water resources, flood control, bank stabilization, and other riparian functions and values.

> OSRC-9. Protect and conserve the quality of ocean, marine and estuarine environments for their scenic, economic, and environmental values.

The Water Resources Element recognizes the importance of natural vegetation and wildlife habitat, both as beneficial water uses whose needs must be considered but also as factors in maintaining adequate water quality and quantity.

> Goal WR-1. Protect, restore, and enhance the quality of surface and groundwater resources to meet the needs of all reasonable beneficial uses.

4.1.4 Habitat Conservation Plans and Natural Community Conservation Plans

HCPs are planning documents required as part of an application by a nonfederal entity for incidental take of a species listed under the federal Endangered Species Act as part of their proposed activities. An HCP describes the proposed action(s), and its anticipated effects on the individuals and populations of listed species. It also will describe how impacts will be minimized and mitigated. An HCP also can include protections for species that are candidates for listing or are proposed for listing. The HCP is reviewed by USFWS or National Oceanic and Atmospheric Administration (NOAA) Fisheries, when reviewing a project. If a project is approved by the USFWS or NOAA Fisheries, they will issue an incidental take permit for the project actions, which provides for take of these species based on the actions provided for in the HCP, as well as additional measures that the USFWS or NOAA Fisheries might include.

The California Natural Community Conservation Planning Act was first passed by the state legislature in 1991, and was updated and superseded in 2003. The primary objective of the NCCP program is to conserve natural communities at the ecosystem level, while accommodating compatible land use. It focuses on the long-term stability of wildlife and habitat, and seeks to avoid controversy and delays associated with species listings.

CEQA requires that an EIR consider whether a project would conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan. Listings of these documents on the USFWS and CDFW websites were reviewed, and four approved plans were identified, along with three plans that are currently in development (Table 4-5). In addition, one regional plan, the Santa Rosa Plain Conservation Strategy (SRPCS) is also under preparation. Two of these conservation strategies, Turkey Road and SRPCS, lie within the District's immediate Service Area. The remainder covers portions of the adjoining counties (Mendocino, Lake, Napa, and Solano). These plans are described below.

4.1.4.1 Turkey Road Low Effects HCP

This HCP was prepared by Wildlife Research Associates on behalf of Bradley Jacobs to address the effects of development of a residential property and vineyard on California red-legged frog. The HCP provides measures to minimize and mitigate the adverse effects of the project relating to 0.25 acre of permanent impacts associated with structures and roads, along with temporary disturbance of grasslands during construction, and the development of a 4.5-acre vineyard. Project impacts will be offset through purchase of 0.75 acre of habitat credits in a USFWS-approved mitigation bank.

Table 4-5 Habitat Conservation Plans and Natural Community Conservation Plans in the Marin/Sonoma Mosquito and Vector Control District Program Area

Plan Title	Location	Covered Species Listed and Nonlisted	Date Permit Issued	Size	Duration
Turkey Road Low-effects HCP	Sonoma	California red-legged frog	4/4/2014	8.5 acres	5 years
California Department of Corrections Statewide Electrified Fence Project	26 sites throughout California	45 species	6/12/2002	2,937 acres	50 years[1]
Shiloh III	Montezuma Hills Wind Resources Area, 3 miles west of Rio Vista and south of Highway 12, Solano County, CA	Salamander, California tiger (USA Central CA DPS)	5/18/2011	4,600 acres	36 years[1]
Shiloh IV	Montezuma Hills Wind Resource Area in Solano County, CA	Salamander, California tiger (USA Central CA DPS)	4/10/2012	0 acre	36 years[1]
Bay Delta Conservation Plan	Overlaps portions of 5 counties	56 Species	In Development	947,075	5 years
Solano Habitat Conservation Plan	Solano County, CA	36 Species	In Development	585,000	30 years[3] (proposed)
Mendocino Redwoods Company	Mendocino, CA	42 Species	In Development	213,000 in Mendocino County	80 years (proposed)
Santa Rosa Plains Conservation Strategy	Sonoma, CA	Salamander, California tiger (USA Central CA DPS), Burke's goldfield, Sonoma sunshine; Sebastopol meadowfoam; many-flowered navarretia	Case by case permits via a programmatic BO issued by USFWS in 2007	~43,000	Not reported

Sources:

[1] USFWS ECOS website accessed April 10, 2013: http://ecos.fws.gov/conserv_plans/PlanReport?region=8&type=HCP&rtype=2&hcpUser=&view=report

[2] CDFW NCCP website accessed April 10, 2013: http://www.dfg.ca.gov/habcon/nccp/status/NCCP Summary Table.pdf

[3] Sacramento USFWS Office website accessed October 24, 2014: http://www.fws.gov/sacramento/es/Habitat-Conservation-Plans/es_hcp.htm

The District will review these websites periodically to determine if new HCP/NCCPs are being considered for or have been implemented in their area.

Notes:

DPS = Distinct Population Segment

LE = low effect

4.1.4.2 California Department of Corrections Statewide Electrified Fence Project

This HCP was prepared by the California Department of Corrections for their Statewide Electrified Fence Project and addresses mortality or the potential for mortality of special-status species and native migratory birds at 25 prisons where lethal electrified fences are operational and 4 future sites where electrified fences are planned. The HCP provides for take of 62 species covered by the federal Endangered Species Act, California Endangered Species Act, or listed as California Species of Concern, along with an additional 57 species covered under the Migratory Bird Treaty Act, but not included in the preceding category. This HCP would apply to the Solano State Prison within the District's Adjacent Project Area, although this facility is located in Vacaville, where the District would not be expected to conduct its activities. As the HCP is confined to the prison sites and specifically to mortality due to electrocution of covered species on those fences, this HCP does not apply to the District's activities.

4.1.4.3 Shiloh III

This HCP was prepared by enXco, Inc. to cover the potential impacts of construction of the Shiloh III Wind Project, near Rio Vista, CA. The HCP addresses impacts to the central California (Distinct Population Segment (DPS) of California tiger salamander over an area of 4,600 acres for a period of 36 years. The activities covered under the HCP are the construction and installation of wind turbines and associated facilities, maintenance of these facilities, and decommissioning of these facilities in the future. These activities are anticipated to cause both permanent and temporary loss of California tiger salamander habitat. Avoidance and minimization measures (AMMs) include minimizing impact area; avoiding injury to salamanders during implementation; avoiding erosion and sedimentation impacts to habitat; avoidance of toxic spills; restoration of temporarily disturbed habitat; and ensuring AMMs are implemented. Mitigation is to offset unavoidable permanent impacts at an approved conservation bank. As this HCP is located near Rio Vista, more than 20 miles from the Napa County line, it is unlikely that the District's activities would occur within the boundaries of this HCP.

4.1.4.4 Shiloh IV

This HCP was prepared by Shiloh IV Wind Project, LLC to cover the potential impacts of construction of the Shiloh IV Wind Project, near Rio Vista, California. The project covers impacts to the central California DPS of California tiger salamander over an area of 3,514 acres for a period of 36 years. The activities covered under the HCP are installation and operations of maintenance yards, a substation, wind turbines, and associated facilities (including access roads) and decommissioning of these facilities in the future. These activities are anticipated to result in both permanent and temporary loss of California tiger salamander habitat. AMMs include minimizing impact area; avoiding injury to salamanders during implementation; avoiding erosion and sedimentation impacts to habitat; avoiding toxic spills; restoration of temporarily disturbed habitat; and ensuring AMMs are implemented. Mitigation is to offset unavoidable permanent impacts at an approved conservation bank. As this HCP is located near Rio Vista, more than 20 miles from the Napa County line, it is unlikely that the District's activities would occur within the boundaries of this HCP.

4.1.4.5 Bay Delta Conservation Plan

The BDCP is an HCP being developed as part of California's overall water management portfolio. It is being developed as a 50-year habitat conservation plan with the goals of restoring the Sacramento-San Joaquin River Delta (Delta) ecosystem and securing California water supplies. The plan area encompasses the legal Delta and surrounding areas (Solano, Yolo, Contra Costa, San Joaquin and Sacramento counties). It does not border Marin or Sonoma Counties, but does encompass parts of adjoining Solano County. The activities covered under the BDCP include improvements to water infrastructure facilities in and around the Delta and the protection of approximately 150,000 acres of habitat to address the Delta's environmental challenges. The BDCP includes 22 conservation measures

aimed at improving water operations, protecting water supplies and water quality, and restoring the Delta ecosystem within a stable regulatory framework (BDCP 2014).

The BDCP seeks coverage for 56 species and identifies conservation measures designed to contribute to their protection and recovery. The plan includes 67 goals and 165 objectives that form the basis of the conservation strategy, which includes landscape scale, natural community and biological and species specific goals and objectives. The BDCP also includes 37 AMMs that are incorporated into covered activities to minimize the effects of these actions on various resources. Many of these AMMs focus on minimizing the general environmental effects of construction activities and many others are species specific AMMs.

AMM 33 Mosquito Management calls for management and control of mosquitoes during construction of project facilities. The HCP Implementation Office will accomplish this through consultation with appropriate mosquito and vector control districts and will carry out mosquito control activities as necessary and applicable. The types of mosquito control activities that may be carried out under this AMM include surveillance, biological controls, physical controls, vegetation management, and use of larvicides and adulticides, as necessary.

4.1.4.6 Solano Habitat Conservation Plan

The Solano Habitat Conservation Plan is being developed by the Solano County Water Agency (SCWA) and will cover activities over a plan area of 577,000 acres in Solano County and 8,000 acres in Yolo County. The purpose of the Solano HCP is to (a) promote the conservation of biological diversity and the preservation of endangered species and their habitats consistent with the recognition of private property rights; (b) provide for a healthy economic environment for the citizens, agriculture, and industries; and (c) allow for the ongoing maintenance and operation of public and private facilities in Solano County. The plan is intended to cover activities undertaken by or under the permitting authority/control of the plan participants. Coverage may also be extended to third parties who fall under the direct regulatory control of the plan parties. The plan covers a number of natural communities and 36 covered species (SCWA 2102).

The Solano HCP would set up a reserve system with measurable biological standards to measure the overall success of the HCP conservation program. The plan specifies specific acreages of habitat to be established within the reserve system for different natural habitat types and species. Plan goals and objectives would be accomplished through implementation AMMs and mitigation measures. To obtain coverage under the Solano HCP will require that baseline studies be conducted for any proposed projects, the plan AMMs are implemented, and that the mitigation measures of the plan are carried out, when impacts do occur. AMMs include general measures for operation, maintenance and construction activities; habitat and covered species-specific AMMS; and special management species AMMS, with corresponding mitigation requirements for each covered resource.

4.1.4.7 Mendocino Redwood Company

Mendocino Redwood Company, LLC (MRC) is in the process of developing a HCP with the federal agencies (USFWS and NMFS), a NCCP with the CDFW, and a Program Timberland Environmental Impact Report with the California Department of Forestry and Fire Protection.

Timber management is the primary activity in the plan area, occurring on approximately 213,000 acres. Management activities include timber harvest and regeneration, site preparation, planting, vegetation management, thinning, and fire suppression.

The HCP/NCCP is MRC's operational plan for managing 11 federal or state threatened or endangered wildlife species, 31 rare plants, and 4 sensitive natural communities on the approximately 213,000-acre property located in coastal Mendocino County, California.

The plan, based on the Humboldt Redwood Company, LLC HCP/NCCP, provides for conservation measures for many endangered and threatened species (including spotted owls, marbled murrelets,

several salmonid species, rare mammals, amphibians, reptiles, and plants). The HCP requires large riparian buffers designed to provide tree canopy over streams for maintenance of cool water temperatures, filter strip properties, and abundant large wood for protection and enhancement of salmonid habitat. Management of these buffers over time should also increase the amount of old forest characteristics along these streams.

MRC's proposed 80-year term plan provides for the following outcomes: protect, enhance, and increase habitat for rare, threatened, or endangered species covered in the plan; mitigate the impact of land management on covered species; maintain and improve biodiversity in the covered area; contribute to the recovery of threatened and endangered species, and; attain "regulatory certainty" for endangered species management (MRC 2014.

As this HCP/NCCP is located in Mendocino County adjacent to Sonoma County and within approximately 2 miles of the county border, it is possible that the District's activities could occur within the HCP/NCCP boundaries.

4.1.4.8 Santa Rosa Plain Conservation Strategy (Regional)

The SRPCS is a long-term conservation program sufficient to mitigate potential adverse effects on five listed species (California tiger salamander, Burke's goldfield, Sonoma sunshine, Sebastopol meadowfoam, and many-flowered navarretia) due to future development on the Santa Rosa Plain. The Santa Rosa Plain (Sonoma County) is about 20 miles long (encompassing Windsor and Rohnert Park) and 6 miles wide (extending from Santa Rosa to Sebastopol). The goals are to:

> Develop a habitat conservation strategy that contributes to the recovery of California tiger salamander and listed plant species.

> Identify proposed areas for conservation.

> Develop an implementation framework for the conservation strategy which identifies short and long-term actions and milestones as needed.

> Establish development process predictability.

The strategy identified eight conservation areas, one tiger salamander preserve system, one listed plant preserve system, and one listed plant conservation area. Although local governmental agencies have not yet been able to complete the implementing ordinances for the strategy (USFWS 2013), the strategy is being implemented under the authority of a programmatic biological opinion (USFWS 2007 cited in USFWS 2013) and the oversight of an Implementation Committee, including representatives from local jurisdictions, USFWS, CDFW, and private landowners and the environmental community. Three conservation banks have been approved by the USFWS to date, and they continue to work to approve additional banks. The programmatic biological opinion simplifies the process of consulting with USFWS and complying with the federal Endangered Species Act by using a template in many circumstances, significantly shortening the permitting timeline.

The conservation program will contribute to the recovery of the Sonoma County populations of the five listed species and the conservation of their habitat within the conservation areas described above in a manner that protects stakeholders' (both public and private) land use interests, and supports issuance of an authorization for incidental take of California tiger. Project impacts may be mitigated with the purchase of mitigation credits in one of the USFWS-approved mitigation banks located on the Plain.

4.2 Environmental Impacts and Mitigation Measures

This section presents the environmental concerns associated with the various alternatives and presents significance criteria used to evaluate the likely impacts of the various Program alternatives under CEQA. The significance criteria establish thresholds for determining whether an impact rises to a level that is biologically significant. The environmental issues describe the mechanisms by which such impacts might occur.

4.2.1 Evaluation Concerns and Criteria

The Program alternatives are implemented as part of an IVMP as described in Section 2.3. The IVMP uses alternative nonchemical and chemical treatments in a sequential manner to minimize potential environmental impacts; evaluating each treatment site and situation and implementing the least harmful technique that is applicable for that situation consistent with IPM principles. Treatments with higher potential risk to the environment are only implemented when treatments with lower potential risk are ineffective or cannot be applied to that site. This approach minimizes the overall Program risk to the environment, but environmental concerns relating to the different alternatives remain.

4.2.1.1 Environmental Concerns

Some Program alternatives have the potential to affect aquatic resources directly by affecting physical habitat and through direct toxicity to nontarget organisms. The Program alternatives may also affect aquatic resources indirectly through effects on nontarget organisms that may affect food webs, making food less available.

Direct impacts would include habitat modifications, such as draining or changing the hydrology of waterways through removal of or placement of sediment and fill, removal of debris and weeds, and trimming or removal of emergent and riparian vegetation. The District may also request or require other landowners to perform similar activities. These activities may be undertaken in a variety of aquatic or wetland habitats including creeks and rivers, riparian corridors, ponds and lakes, freshwater marsh and seeps, seasonal wetlands, lagoons, tidal marsh and channels, as well as wastewater treatment and septic systems, temporary standing waters and artificial ponds.

Introduction of mosquito predators, specifically mosquitofish, into natural, and some artificial, environments could adversely affect nontarget organisms including insects, amphibians, and fish. Mosquitofish may prey upon these nontarget species directly or may compete with them for food resources.

Chemical control alternative options, including larvicides, adulticides, herbicides (under the Vegetation Management Alternative), and the biological agents (Bs), or their byproducts (Bti, and *Saccharopolyspora spinosa*), have the potential to affect nontarget organisms, either through direct toxicity or through effects on nontarget organisms, which could affect the food web. Similar types of effects could occur through the use of surfactants and adjuvants. The Program's potential to affect ecological health through impacts to nontarget ecological receptors is evaluated separately in Section 6.2 with an emphasis there on chemicals used or proposed for use as part of the District's IVMP.

Concerns identified during public scoping include the following, which are addressed as elements of the broader issues explained above:

> Employ techniques associated with the physical control of vectors and their habitat that conform to Habitat Conservation Plan (HCP) avoidance, minimization, and mitigation measures.

> Ensure mosquito abatement staff minimize impact to tidal marsh habitats (especially during breeding season).

> The PEIR should include a detailed description and complete assessment of the surveillance impacts (current and future, direct and indirect) on habitats (including endangered, threatened, and locally unique species and sensitive habitats) and on species (sensitive fish, wildlife, or plants).

> The PEIR should include a detailed description and complete assessment of the biological control impacts (current and future, direct and indirect) on habitats (including endangered, threatened, and locally unique species and sensitive habitats) and on species (sensitive fish, wildlife, or plants).

> The PEIR should include a detailed description and complete assessment of the chemical control impacts (current and future, direct and indirect) on habitats (including endangered, threatened, and locally unique species and sensitive habitats) and on species (sensitive fish, wildlife, or plants). This issue is also addressed in Section 6.2.

4.2.1.2 Significance Criteria

Significance criteria were developed based on applicable regulations and management policies, a review of the available information, and the professional judgment of the authors.

The CEQA Guidelines include several criteria for determining whether there is a potentially significant impact to biological resources in the CEQA Appendix G, Environmental Checklist Form, Section IV. Those that could apply to the Proposed Program as thresholds of significance for biological resources have been used in the following evaluation with the analysis organized according to these criteria as environmental topics. Impacts were considered potentially significant if they would:

a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS.

b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFW or USFWS.

c. Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act, (including but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.

d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites.

e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

f. Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

4.2.2 Evaluation Methods and Assumptions

4.2.2.1 Evaluation Methods

Impacts are evaluated with regard to desired fish and amphibian species (e.g., native and listed species), macroinvertebrate communities, and effects on food supply for fish or amphibians, using the criteria described above as environmental topics. Potential impacts were assessed using available information on the types of control and treatment as described in Chapter 2, and assuming that all applicable BMPs as described in Chapter 2, Program Description; CDPH's Best Management Practices for Mosquito Control in California; 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) and District-specific BMPs, as indicated in the PAPs and Aquatic Weed Control Permits (Aquatic Pesticide Application Plans [APAPs]), and all BMPs in Table 2-6, are implemented.

The BMPs most applicable to minimizing and/or avoiding impacts to aquatic resources are repeated in Table 4-6, which also indicates the habitat types in which those BMPs will be applied. This assessment considers the physical and biological connections between treatment areas and aquatic or wetland ecosystems. This information was evaluated in the context of the treatment alternatives and the existing environment under baseline conditions in 2012 in the Program Area as described in Section 4.1.1.

The detailed BMPs listed in Table 4-6 can be summarized and placed into several categories. These categories include:

1. Agency communication includes periodic discussion with resource agencies, refuge managers and other land managers on topics such as planning, specific site issues, special-status species occurrence, opportunities for source reduction, observations made by District staff (e.g., wildlife, trespass/unauthorized equipment use) and about activities to be implemented. This will include obtaining any required permits and reporting regarding existing permits, periodic check-in calls, and calls as needed, when unanticipated circumstances arise.
2. Environmental training includes environmental awareness training provided to all field staff regarding environmental resource issues, recognition, and documentation of sensitive environmental resources in the field, and BMPs to avoid or minimize impacts to those resources. This includes both general training, training to avoid or eliminate the spread of weeds, and special-status species or habitat specific training provided to District staff by USFWS, CDFW or other appropriately trained individuals approved by these agencies.
3. Pre-treatment screening involves a pre-treatment, in-office assessment of treatment locations for environmentally sensitive resources to determine appropriate treatment, access routes, and other BMPs to be applied for that location. This may include a pre-treatment site visit to confirm information used in the screening.
4. Disturbance minimization includes:
    a. avoiding environmentally sensitive areas as much as practical;
    b. use of existing access routes where ever possible, whether on foot or in a vehicle;
    c. minimizing use of offroad vehicles as much as possible, and driving slowly when they are used;
    d. being observant and working carefully to avoid or minimize disturbance; and,
    e. using hand tools rather than mechanized tools as much as practical for all vegetation clearing (including clearing of access ways) or physical control treatments.
5. Habitat or species-specific BMPs includes BMPs targeted to a specific habitat type or species (e.g., tidal marshes or salt marsh harvest mouse). These BMPs include measures specific to those habitat types or species including diurnal or seasonal limitations on specific project activities, specific controls on the types of activities or how they are carried out, Specific measures are those documented in Table 4-6.
6. Alternative specific BMPs relate specifically to the implementation of a particular treatment (Physical Control, Vegetation Management, Chemical Control). These may overlap many of the BMPs described above, but also include alternative-specific measures to protect environmental resources, based the type of activity to be conducted (e.g., protection of soil surface, minimization of turbidity under the Physical Control Alternative or adherence to label directions, treating only during periods with acceptable weather conditions, and employing appropriate buffers for Chemical Control).

These categories are not inclusive of all the BMPs in Chapter 2 or Table 2-6, **nor are they intended to replace those more specific BMPs**. These categories are provided to facilitate the discussion of the impact evaluation through the end of this chapter. The application of specific BMPs by alternative and habitat type is provided in Table 4-6. Table 4-6 lists all of the BMPs for Program implementation by alternative and habitat types that are relevant to biological resources and determinations of impact significance.

Impact determinations follow the analysis for each Program alternative and cover the following issues derived from the CEQA significance criteria (Section 4.2.1.2):

a. Impacts to special-status species

b. Impacts to riparian habitats or other sensitive natural communities

c. Impacts to federally protected wetlands

d. Impacts to movement of native resident or migratory fish or wildlife species.

e. Conflicts with to local policies

f. Conflicts with provisions of HCP, NCCP, or other approved habitat conservation plan

The potential effects of the treatment alternatives will vary depending on the specific treatment applied, the size and location of the treated area, the type of habitat treated, and the timing and frequency of treatment. Small treatment areas or less frequent applications of a treatment would generally be expected to result in lesser effects than the same treatment applied over a larger area or more frequently.

The potential impacts of the nonchemical alternatives are based on the type and location of habitats treated and the magnitude and frequency of treatment. The potential impacts of the chemical alternatives were evaluated based on the magnitude and duration of the treatments and the toxicity and application information presented in Chapter 6, Ecological Health, and Appendix B, Human and Ecological Health Assessment Report. The evaluation of all alternatives considered the life histories of the different listed fish and amphibian species and ecological interactions including impacts to the aquatic food chain.

The pesticide application scenarios that result in reasonable efficacy with minimal unwanted estimated risk are preferred and are the basis of IPM approaches and BMPs the District employs. BMPs are contained in Chapter 2, Section 2.9 and associated with habitat types in which they would be applied in Table 4-6. Each of the pesticides and herbicides identified as warranting further evaluation in Appendix B (as a subset of all pesticides and herbicides in use) are known to exhibit at least one parameter that appears to have a significant role in the resulting potential or perceived risk.

4.2.2.2 Assumptions

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

> Site-specific evaluation of aquatic resource impacts is not within the scope of this programmatic evaluation. Rather, the analysis uses habitat types likely to be affected by any of the alternatives as the basis for evaluation.

> The programmatic evaluation is based on the current proposed control methods and is subject to change based on future needs (see Section 1.8).

> The BMPs listed in Table 4-6 will be implemented by District staff as appropriate to the type of activity under the Program alternatives.

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
A. General BMPs																						
1. District staff has had long standing and continues to have cooperative, collaborative relationships with federal, state, and local agencies. The District regularly communicates with agencies regarding the District's operations and/or the necessity and opportunity for increased access for surveillance, source reduction, habitat enhancement, and the presence of special-status species and wildlife. The District often participates in and contributes to interagency projects. The District will continue to foster these relationships, communication, and collaboration.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. In particular, District staff will regularly communicate with resource agency staff regarding vector management operations, habitat, and flora and fauna in sensitive habitats. Such communications will include wildlife studies and occurrences of special-status species in areas that may be subject to vector management activities.	X	X	X	*	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X
3. 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.	X	X	X	*[1]	X	X								X	X	X	X	X	X	X		
4. District staff has received training from USFWS and CDFW biologists regarding endangered species, endangered species habitat, and wildlife/wildlife habitat recognition and avoidance measures. District supervisory staff frequently engages staff on these subjects. For example, District staff has become familiar with Ridgway's rail call recordings to invoke avoidance measures if these calls are heard in the field. District staff is trained to be observant, proceed carefully, and practice avoidance measures if needed when accessing areas that may serve as bird nesting habitat (e.g., watch for flushing birds that may indicate a nest is nearby). Emphasis will be placed on species and habitats of concern where vector management activities might occur (e.g., SMHM, RIRA, special-status plants, vernal pools, tidal marsh, etc.). These training sessions will be included as a part of the safety training records that are kept by vector control agencies.	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[1] (*) means not available at this time. Should a viable biocontrol agent become available, evaluation of BMP measures would occur and be implemented.

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
5. Conduct worker environmental awareness training for all treatment field crews and contractors for special-status species and sensitive natural communities that a qualified person (e.g., District biologist) determines to have the potential to occur on treatment sites. Conduct the education training prior to starting work at treatment sites and upon arrival of any new worker onto sites with the potential for special-status species or sensitive natural communities.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6. District staff will work with care and caution to minimize potential disturbance to wildlife while performing surveillance and vector treatment/population management activities (see 1 through 5 above).	X	X	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7. Identify probable (based on historical experience) treatment sites that may contain habitat for special-status species every year prior to work to determine the potential presence of special-status flora and fauna using the CNDDB, relevant Habitat Conservation Plans (HCPs), NOAA Fisheries and USFWS websites, Calfish.org, and other biological information developed for other permits. Establish a buffer of reasonable distance, when feasible, from known special-status species locations and do not allow application of pesticides/herbicides within this buffer without further agency consultations. Nonchemical methods are acceptable within the buffer zone when designed to avoid damage to any identified and documented rare flora and fauna.	X	X	X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8. Vehicles driving on levees to travel through tidal marsh or to access sloughs or channels for surveillance or treatment activities will travel at speeds no greater than 10 miles per hour to minimize noise and dust disturbance.	X	X	X		X	X														X		
9. District staff will implement site access selection guidelines to minimize equipment use in sensitive habitats including active nesting areas and to use the proper vehicles for on-road and off-road conditions.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10. 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.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
11. Operation of noise-generating equipment (e.g., chainsaws, wood chippers, brush-cutters, pickup trucks) will abide by the time-of-day restrictions established by the applicable local jurisdiction (i.e., City and/or County) if such noise activities would be audible to receptors (e.g., residential land uses, schools, hospitals, places of worship) located in the applicable local jurisdiction. Shut down all motorized equipment when not in use.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
12. For operations that generate noise expected to be of concern to the public, the following measures will be implemented: – Measure 1: Provide Advance Notices: A variety of measures are implemented depending on the magnitude/nature of the activities undertaken by the District, and may include but are not limited to press releases, social media, District websites, emails, phone messages, hand-delivered flyers, and posted signs. Public agencies and elected officials also may be notified of the nature and duration of the activities, including the Board of Supervisors or City Council, environmental health and agricultural agencies, emergency service providers, and airports. – Measure 2: Provide Mechanism to Address Complaints. The District staff is available during regular business hours to respond to service calls and may staff phone lines to address concerns during nighttime operations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13. The District will perform public education and outreach activities.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14. Engine idling times will be minimized either by shutting equipment and vehicles off when not in use or reducing the maximum idling time to 5 minutes. Clear signage will be provided for workers at all access points. Correct tire inflation will be maintained in accordance with manufacturer's specifications on wheeled equipment and vehicles to prevent excessive rolling resistance. All equipment and vehicles will be maintained and properly tuned in accordance with manufacturer's specifications. All equipment will be checked by a certified visible emissions evaluator if visible emissions are apparent to onsite staff.	X	X	X	X	X	X																

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
B. Tidal Marsh-Specific BMPs																						
1. District staff will continue to implement the measures in the USFWS's "Walking in the Marsh: Methods to Increase Safety and Reduce Impacts to Wildlife/Plants." District staff will receive annual training and review of this document to remain up to date and current on this document and its methodologies for protecting special-status species and the marsh habitat.	X	X	X	*	X														X	X		
2. 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 and fixed wing) 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.	X	X	X	*	X	X													X	X		
3. District will minimize travel along tidal channels and sloughs in order to reduce impacts to vegetation used as habitat (e.g., Ridgway's Rail nesting and escape habitat).	X	X	X		X														X	X		
4. District staff will minimize the potential for the introduction and spread of spartina, perennial pepperweed and other invasive plant species by cleaning all equipment, vehicles, personal gear, clothing, and boots of soil, seeds, and plant material prior to entering the marsh, and avoiding walking and driving through patches of perennial pepperweed to the maximum extent feasible.	X	X	X	*	X	X								X[1]		X[1]	X[1]	X[1]	X	X		
5. When feasible, boats will be used to access marsh areas for surveillance and treatment of vectors to further reduce the risk of potential impacts that may occur when using ATVs to conduct vector management activities.	X	X	X	*	X														X	X		

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
6. The District currently references and provides staff training relevant to the USFWS "Walking in the Marsh: Methods to Increase Safety and Reduce Impacts to Wildlife/Plants" guidelines (USFWS undated). – District staff is trained to walk carefully in the marsh and to continuously look ahead of themselves to avoid potential wildlife disturbance (e.g., carefully make observations in their surroundings to detect flushing birds and nests). Specific care is taken when walking and performing surveillance in the vicinity of natural and manmade ditches or sloughs or in vicinity of cord grass habitat (e.g., rack line). – When walking in marshes District staff utilizes existing trails when possible (i.e., deer trails and other preexisting trails).	X	X	X	X	X	X	X[2]	X[2]	X[2]	X[2]	X[2]	X[2]		X[2]			X[2]	X[2]	X	X		
C. Salt Marsh Harvest Mouse (SMHM)																						
1. Activities (surveillance, treatment, source reduction) within or adjacent to harvest mouse habitat will not occur within two hours before or after extreme high tides of 6.5 feet National Geodetic Vertical Datum (NGVD) or above as measured at the Golden Gate Bridge (corrected for time and tide height for the site) or when the marsh plain is completely inundated because suitable upland refugia cover is limited and potentially disturbance-creating activities could prevent mice from reaching available cover.	X	X	X	*	X	X													X	X		
2. Vegetation removal is limited to the minimum amount necessary to allow for surveillance, treatment, and vector habitat reduction (vegetation management) to minimize or avoid loss of SMHM. Similarly, excavation, fill, or construction activities will also be limited to the minimum amount necessary to minimize/avoid loss of SMHM.	X	X	X		X														X	X		
3. Vegetation clearing will be conducted systematically within the project area to ensure that SMHM are encouraged to move toward remaining vegetation and are not trapped in islands of vegetation subject to removal and far from suitable cover.		X	X																X	X		
4. Each day, 30 minutes before commencement of vector habitat management (physical control, vegetation management), observations will be conducted for the presence of SMHM in the work area by staff trained by USFWS personnel in the safe and effective methods for observing SMHM.		X	X	*	X														X	X		

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
5. To the extent feasible, physical control, vegetation management and other vector habitat reduction activities will be conducted between December 1 and February 28 (outside of the SMHM breeding season). Surveillance, chemical control, biological control, and public education activities occur year-round and are therefore carefully coordinated with resource agencies to minimize potential impacts to SMHMs and their habitats.		X	X		X														X	X		
6. When walking in the marsh, existing trails will be used whenever possible. 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 to avoid potential disturbance of SMHM.	X	X	X	*	X	X													X	X		
7. District staff will receive training on measures to avoid impacts to SMHM.	X	X	X	*	X	X													X	X		
8. If SMHM nests or adults are encountered during vector management activities, avoidance measures will be immediately implemented and findings will be reported to the appropriate resource agency.	X	X	X	*	X	X													X	X		
D. Ridgway's Rail (RIRA)																						
1. Activities (surveillance, treatment, source reduction) within or adjacent to RIRA's habitat will not occur within two hours before or after extreme high tides of 6.5 feet National Geodetic Vertical Datum (NGVD) or above as measured at the Golden Gate Bridge (corrected for time and tide height for the site) or when the marsh plain is completely inundated because suitable upland refugia cover is limited and potentially disturbance-creating activities could prevent RIRAs from reaching available cover.	X	X	X	*	X	X													X	X		
2. Vegetation removal is limited to the minimum amount necessary to allow for surveillance, treatment, and vector habitat reduction (vegetation management) to minimize or avoid loss of RIRA. Similarly, excavation, fill, or construction activities will also be limited to the minimum amount necessary to minimize/avoid loss of RIRA.	X	X	X		X														X	X		
3. To the extent feasible, physical control, vegetation management and other vector habitat reduction activities will be conducted between September 1 and January 31 (outside of the RIRA breeding season). Surveillance, chemical control, biological control, and public education activities occur year-round and are therefore carefully coordinated with resource agencies to minimize potential impacts to RIRAs and their habitats.		X	X		X														X	X		

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
4. District staff will notify the appropriate resource agency prior to entering potential RIRA habitats and will regularly coordinate with the resource agency(ies) on the locations of breeding RIRAs and avoid breeding RIRAs to the extent feasible. Any observations of adverse effects to RIRAs will be reported by District staff.	X	X	X	X	X														X	X		
5. When walking in the marsh District staff will use existing trails whenever possible. 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 to avoid potential disturbance of RIRAs.	X	X	X	*	X	X													X	X		
6. Entry into suitable breeding habitat for RIRAs will be minimized. When entry is required, the preferred method will be by foot. Other entry methods will be based on consultation with the appropriate resource agency.	X	X	X	*	X	X													X	X		
7. District staff will receive training on measures to avoid impacts to RIRAs	X	X	X	*	X	X													X	X		
8. If RIRA nests or adults are encountered during vector management activities, avoidance measures, as provided during training from the resource agencies, will be immediately implemented and findings will be reported to the appropriate resource agency.	X	X	X	*	X	X													X	X		
E. Soft Bird's Beak																						
1. District staff will receive training on the identification, biology and preferred habitat of soft bird's beak.	X	X	X	*	X	X													X	X		
2. When possible, project actions to be conducted in areas containing suitable habitat for this species will occur during the time period when soft bird's beak is in bloom and identifiable (July-November), so that any soft bird's beaks plants observed can be avoided and documented.	X	X	X	*	X	X													X	X		
3. District staff will coordinate with Napa-Sonoma Marshes Wildlife Area (CDFW) and San Pablo Bay National Wildlife Refuge regarding the locations of known soft bird's beak populations, so that these populations can be avoided. Flagging will be used to identify the boundaries of known soft bird's beak populations.	X	X	X	*	X	X													X	X		
4. When possible, vector management activities will be conducted on foot using hand equipment.	X	X	X	*	X	X													X	X		

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
F. Vegetation Management																						
1. Consultations will be made with the appropriate resource agency to discuss proposed vegetation management work, determine potential presence of special-status species and areas of concern, and any required permits.		X	X											X	X	X	X	X	X	X		
2. Vegetation management work performed will typically be by hand, using handheld tools, to provide access to vector habitat for surveillance, and when needed control activities. Tools used include machetes, small garden-variety chainsaw, hedge trimmers and "weed-eaters."		X	X											X	X	X	X	X	X	X		
3. District will consult and coordinate with resource agencies as well as have all necessary permits prior to the commencement of work using heavy equipment (e.g., larger than handheld/garden variety tools such as small excavators with rotary mowers) in riparian areas.		X	X											X	X	X	X	X	X	X		
4. 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 vector 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, defined corridor but rather a path maintained by selective trimming of overhanging or intrusive vegetation. Paths to be maintained will range in width from three to 6 feet across.		X	X												X							
5. 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 vector habitats.		X	X												X							
6. Vegetation management work will be confined to October 1 to April 30[2] to minimize potential impacts to special-status species, especially breeding birds. When work is expected to occur between February 1 and April 30, additional consultations will occur with appropriate resource agencies to help identify locations of active nests of raptors or migratory birds as well as any additional protection measures that will need to be implemented prior to commencement of work.		X	X												X	X	X	X	X	X		

[2] Dates are from MSMVCD's Final LSAA permit with CDFW; Notification No. 1600-2010-2053-R3, Public Health/Mosquito Control Access Maintenance (October 6, 2010).

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
7. 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 new growth, poison oak, blackberries, and downed trees that block these paths.		X	X												X							
8. District staff will work with care and caution to minimize potential disturbance to wildlife, while performing vegetation management activities within or near riparian corridors.		X	X											X	X	X	X	X	X	X		
9. Within suitable habitat for California Freshwater Shrimp (*Syncaris pacifica*), no in-channel vegetation will be removed, trimmed, or otherwise disturbed. District staff will work with resource agencies to determine locations of suitable habitat for California Freshwater Shrimp and receive written authorization to proceed prior to commencement of vegetation management activities.		X	X											X	X							
10. If suitable habitat necessary for special-status species is found, including vernal pools, and if nonchemical physical and vegetation management control methods have the potential for affecting special-status species, then the District will coordinate with the CDFW, USFWS, and/or NMFS before conducting control activities within this boundary or cancel activities in this area. If the District determines no suitable habitat is present, control activities may occur without further agency consultations.		X	X											X	X	X	X	X	X	X		
11. When 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.		X	X											X	X	X	X	X	X	X		
G. Maintenance / Construction and Repair of Tide Gates and Water Structures in Waters of the US																						
1. District staff will consult with appropriate resource agencies (USACE, USFWS, CDFW, NMFS, BCDC, RWQCB) and obtain all required permits prior to the commencement of ditch maintenance or construction within tidal marshes.		X												X		X	X	X	X	X	X	

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
2. Work plans for the upcoming season proposed work as well as a summary of the last season completed work will be submitted for review and comment to USACE, USFWS, NMFS, CDFW, BCDC, and RWQCB no later than July 1 of each year for which work is being proposed. The work plan will include a delineation of all proposed ditching overlain on topographic maps at a minimum of 1" = 1000' scale, with accompanying vicinity maps. The plan will also indicate the dominant vegetation of the site, based on subjective estimates, the length and width of the ditches to be maintained, cleared or filled, and the estimated date the work will be carried out.		X												X		X	X	X	X	X	X	
3. All maintenance work will be done at times that minimize adverse impacts to nesting birds, anadromous fish, and other species of concern, in consultation with USFWS, NMFS, and CDFW. Work conducted will, whenever possible, be conducted during approved in water work periods for that habitat, considering the species likely to be present. For example, tidal marsh work will be conducted between September 1 and January 31, where possible and not contraindicated by the presence of other special-status species. Similarly, in water work in waterbodies that support anadromous fish, work will be conducted between July 1 and September 30.[3]		X	X											X		X	X	X	X	X	X	
4. Care will be taken to minimize the risk of potential disruption to the indigenous aquatic life of a waterbody in which ditch maintenance is to take place, including those aquatic organisms that migrate through the area.		X												X		X	X	X	X	X	X	
5. Staging of equipment will occur on upland sites.		X												X		X	X	X	X	X	X	
6. Mats or other measures taken to minimize soil disturbance (e.g., use of low ground pressure equipment) when heavy equipment is used.		X												X		X	X	X	X	X	X	
7. 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.		X												X		X	X	X	X	X	X	
8. 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.		X												X		X	X	X	X	X	X	

[3] Dates are from District's USACE. Regional Permit 4, July 31, 2007.

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
9. 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.		X												X		X	X	X	X	X	X	
10. Discovery of historic or archeological remains will be reported to USACE and all work stopped until authorized to proceed by the appropriate regulatory authorities/resource agencies.		X												X		X	X	X	X	X	X	
11. Ditching that drains high marsh ponds will be minimized to the extent possible in order to protect the habitat of native salt pan species.		X																	X	X		
12. 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.		X																	X	X		
13. If review of the proposed work plan by USACE, USFWS, or CDFW determines the proposed maintenance is likely to destroy or damage substantial amounts of shrubby or sub-shrubby vegetation (e.g., coyote brush, gumplant) on old sidecast spoils, the District will provide a quantitative estimate of the extent and quality of the vegetation, and provide a revegetation plan for the impacted species prepared by a biologist/botanist with expertise in marsh vegetation. The Corps approved revegetation plan will be implemented prior to April 1 of the year following the impacts.		X																	X	X		
14. 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.)		X														X	X	X	X	X	X	
15. Work will be done at low tide (for tidal areas) and times of entry will be planned to minimize disruption to wildlife.		X												X	X	X	X	X	X	X	X	

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
16. 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.		X																	X	X		
17. 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.		X	X											X		X	X	X	X	X	X	
H. Applications of Pesticides, Surfactants, and/or Herbicides																						
1. 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.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. District will avoid use of surfactants when possible in sites with aquatic nontargets or natural enemies of mosquitoes present such as nymphal damsel flies and dragonflies, dytiscids, hydrophilids, corixids, notonectids, and ephydrids. Surfactants are the only tool that can be used with pupae to prevent adult mosquitos emergence, but generally the District will use a microbial larvicide (Bti, Bs) or insect growth regulator (e.g., methoprene) instead or another alternative when possible.			X		X								X	X	X	X	X	X	X	X	X	X
3. Materials will be applied at the lowest effective concentration for a specific set of vectors and environmental conditions. Application rates will never exceed the maximum label application rate.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4. To minimize application of pesticides, application of pesticides will be informed by surveillance and monitoring of vector populations.			X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5. District staff will follow label requirements for storage, loading, and mixing of pesticides and herbicides. Handle all mixing and transferring of herbicides within a contained area.			X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
6. 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.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7. 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.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8. Spray nozzles will be adjusted to produce larger droplet size rather than smaller droplet size. Use low nozzle pressures where possible (e.g., 30 to 70 pounds per square inch). Keep spray nozzles within a predetermined maximum distance of target weeds (e.g., within 24 inches of vegetation for hand application) or vectors. Adjusting droplet size would only apply to larvicides, herbicides and non-ULV applications. Use ULV applications that are calibrated to be effective and environmentally compatible at the proper droplet size (about 10-30 microns).			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9. Clean containers at an approved site and dispose of at a legal dumpsite or recycle in accordance with manufacturer's instructions if available.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10. Special-Status Aquatic Wildlife Species: – A CNDDB search was conducted in 2012 and the results incorporated into Appendix A for this PEIR. An update was completed in November 2014 and the results incorporated into Section 4.1.2 of 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 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.			X	*	X									X		X	X	X	X	X	X	

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
– 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.																						
11. District staff will monitor sites post-treatment to determine if the target vector 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.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12. 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 handheld 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.			X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13. The District will provide notification to the public (24 to 48 hours in advance if 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.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
I. Hazardous Materials and Spill Management																						
1. Exercise adequate caution to prevent spillage of pesticides during storage, transportation, mixing or application of pesticides. Report all pesticide spills and cleanups (excepting cases where dry materials may be returned to the container or application equipment).			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. Maintain a pesticide spill cleanup kit and proper protective equipment at the District's Service Yard and in each District truck used for pesticide transport.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4-6 Marin/Sonoma Mosquito and Vector Control District BMPs to Avoid / Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Alternative						Upland Habitats							Aquatic and Wetland Habitats								
	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other	Coniferous Forest	Deciduous Forest	Shrublands	Grasslands	Serpentine	Coastal Dunes	Tree Holes	Creeks and Rivers	Riparian Corridor	Ponds and Lakes (includes stock and golf ponds that have natural bottoms)	FW Marsh/Seeps	Seasonal Wetlands (includes Vernal Pools)	Lagoon	Tidal Marsh and channels	Water and Wastewater Management Facilities	Artificial Containers, Temporary Standing Waters and Ornamental Ponds
3. 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.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4. Properly secure the spilled material, label the bags with service container labels identifying the pesticide, and deliver them to a District/Field Supervisor for disposal.			X	*	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5. 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 vector treatment activities.	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6. Field-based mixing and loading operations will occur in such a manner as to minimize the risk of accidental spill or release of pesticides.			X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[1] This BMP would also be applied in aquatic habitats other than tidal marshes, although the weed species of concern would differ.

[2] This BMP would also be applied in all habitats.

This Page Intentionally Left Blank

This aquatic resources evaluation does not incorporate any assumptions about which alternative treatment strategy or strategies (options) would be applied in any given area. Therefore, each treatment alternative is considered as a stand-alone option, although the Program may include multiple alternative treatments within a given area, i.e., physical controls followed by larvicide application. This evaluation assumes that all chemical treatments would be made in accordance with label instructions and guidance provided by the USEPA and CDPR (and in consideration of the local context for that area, i.e., nearby area land uses and habitats). Guidelines used to trigger a particular alternative based on vector abundance and other variables are included in District-specific operating procedures. This evaluation assumes that important parameters such as sediment half-life are dependent on the specific conditions at the time of pesticide application; therefore, the values listed herein serve as reference values. The USEPA requires mandatory statements on pesticide product labels that include directions for use; precautions for avoiding certain dangerous actions; and where, when, and how the pesticide should be applied. This guidance is designed to ensure proper use of the pesticide and prevent unreasonable adverse effects to humans and the environment. All pesticide labels are required to include the name and percentage by weight of each active ingredient in the product/formulation. Toxicity categories for product hazards and appropriate first-aid measures must be properly and prominently displayed. Pesticide labels also outline proper use, storage, and disposal procedures, as well as precautions to protect applicators. The directions for use specify the target organism, appropriate application sites, application rates or dosages, contact times, and required application equipment for the pesticide. Warnings regarding appropriate wind speeds, droplet sizes, or habitats to avoid during application are also prominently displayed.

Concerning the application of multiple chemical treatments in the same area, such as larvicides followed by adulticides (i.e., not likely to occur under normal circumstances), or the application of multiple pesticides at the same time in a specific area (e.g., usually multiple active ingredients in the formulation such as VectoMax which combines Bti and Bs), the following information applies:

> Most products sold as herbicides and pesticides are evaluated herein both for the active ingredient and for the adjuvants and surfactants used to make the product more useful. When multiple products are used in a vector control application, the impacts are weighed against the proximity and timing of each application. If products with similar or even different active ingredients are applied simultaneously, it is likely that the net effect could be the sum of the effects of the active ingredients to impact the vector. However, for vector control applications materials with the same active ingredient are not applied to the same specific area or simultaneously at a given site. The need for reapplication of mosquito larvicides or adulticides is surveillance driven and performed per the label directions. The District can apply larvicide materials with different active ingredients during a single application. This type of application is necessary if multiple hatches of mosquito larvae occur and results in mosquito populations occurring at different stages of the life cycle. An example of this occurs when liquid Bti and methoprene are applied simultaneously. When this occurs the combination of the material is a product called Duplex, and the mixture of the materials and active ingredients is provided for on the product label. Another example for the District includes a pre-application of a liquid trans allethrin and phenothrin spray product may be used to minimize the hazard of approaching a yellow jacket nest. Situations that would produce a residual exposure adequate to cause harm to humans would not occur unless the application(s) were inappropriate or the timing of applications is inappropriately close. Actual applications do not generally occur that close together unless there is a problem with treatment effectiveness. A material is applied followed by post treatment inspection to determine effectiveness. Only if the vectors (mosquitoes) have not been sufficiently killed would the District go back into the area and reapply a pesticide.

Assumptions and/or background material related to the analysis of hazards, toxicity, and exposure for chemical treatment methods are explained below, including the definition of key terms. The ecological food web concept is explained as well, and it is addressed primarily in Section 6.2.2.2, Assumptions, along with the potential for bioaccumulation and biomagnification in the environment. Background information on bioaccumulation and biomagnification is provided in Section 6.1.1.3, the analyses of the chemicals with potential for bioaccumulation are covered in Sections 6.2.5 and 6.2.7.

4.2.2.3 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."

4.2.2.4 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, in which the probability of a toxic response generally increases as the 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 in all circumstances. Thus, toxic and adverse effects can be mitigated by limiting potential exposure to a dose less than the amount that may result in adverse health effects.

The toxicity data included in the tables and charts in this PEIR 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 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). These two levels are used to describe the potential range of exposures that could result in adverse effects, including the highest dose with no observed effects.

However, these, and other, coordinated and focused laboratory tests are designed to document the effects of the chemical using a continuous, controlled laboratory exposure that does not realistically reflect the likely patchy exposures typical of the District field application scenarios. As such, the toxicity information generated using laboratory tests (and some limited field tests) are intended as an overview of potential issues that might be associated with maximum direct exposures to develop and recommend guidance for use that should provide maximum exposure levels of applications that are protective of ecological health. These guidelines include numerous "safety margins" in the toxicity calculations that are intended to provide adequate efficacy to target organisms while not adversely impacting humans or nontarget plant and animal species. In some instances, the regulatory guidance may include additional suggestions for protective application to assure no significant adverse effect on nontarget species and humans.

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 material safety data sheets (MSDSs)[4], in actual practice, the amounts actually applied by the District within the District's Program Area for vector control are often substantially less than the amounts used in the laboratory 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 for vector control. 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). Impacts may occur to some nontarget organisms. Although numerous precautions (BMPs) and use of recommended application guidance is intended to provide efficacy without adverse effects to nontarget organisms, misapplication or unexpected weather conditions may still result in effects on some nontarget organisms in the exposure area. This potential impact is ameliorated/mitigated by careful use of BMPs and advance planning by the District.

Although laboratory toxicity testing focuses on tiered concentrations of chemical exposure, the results of these tests produce a series of toxicity estimates of concentrations less than those that produce mortality. Extrapolation of these data is used to generate estimates of chronic toxicity or possible effects of lower doses that may result in sublethal effects such as reproduction or metabolic changes. In reality, these low-dose exposures need to be sustained over longer periods than are relevant to typical application scenarios for vector control including multiple applications in an area such as a wetland.

4.2.2.5 Chemistry, Fate, and Transport

The toxicity of a chemical is also affected by various biological, chemical, and physical parameters that affect the behavior of a compound in the environment and its potential toxicity. The chemistry, fate, and transport of a compound must be analyzed to fully estimate potential exposure to a given receptor. The fate and transport of a compound is determined by the physical and chemical properties of the compound itself and the environment in which it is released. Thus, the following characteristics of a compound must be evaluated: its half-life in various environmental media (e.g., sediment, water, air); photolytic half-life; lipid and water solubility; adsorption to sediments and plants; and volatilization. Environmental factors that affect fate and transport processes include temperature, rainfall, wind, sunlight, water turbidity, dissolved oxygen concentrations, and water and soil pH. Information pertaining to these parameters allows evaluation of how compounds may be transported between environmental media (e.g., from sediments to biota), how a compound may be degraded into various breakdown products, and how long a compound or its breakdown products may persist in different environmental media. In general, when a compound or its breakdown products decomposes rapidly in the environment and does not persist for extended periods, then the compound or product poses a lower risk to nontarget species and a lower potential for environmental pollution. Appendix B provides a discussion of the environmental fate of the pesticide active ingredients and other chemicals associated with specific pesticide formulations used in the Vegetation Management and Chemical Control alternatives.

[4] Although the MSDS format is referenced in this document, it should be noted that under the international Globally Harmonized System, the MSDS format has been substantially revised and is now largely replaced by standardized Safety Data Sheets (SDSs).

4.2.2.6 Ecological Food Web

While it is important to evaluate the potential adverse impacts of a pesticide application to potentially affected nontarget species, it is not practical to evaluate those potential impacts to all of the food webs present in the various ecosystems under consideration. An ecological food web is represented in the illustration representing some of the multitude of possible biotic and food uptake interactions in an ecosystem. Figure 4-2 depicts a highly simplified food web. In an ecological system each level in the food web is occupied by dozens or hundreds of species, with consumers using those resources (in this case species from a lower trophic level) in different ways depending on availability and competition for those resources. Their utilization of these resources shifts by time of day and season, and multiple resources being used simultaneously or alternatively. If the availability of one resource deceases, the consumer can generally replace that with another resource. Each of the possible connections between species is also associated with other interactions, such as competitive release, where the abundance of a species increases in response to the decline in a competitor's abundance, or competitive interactions between consumers where one consumer can use a particular resource better than its competitor.

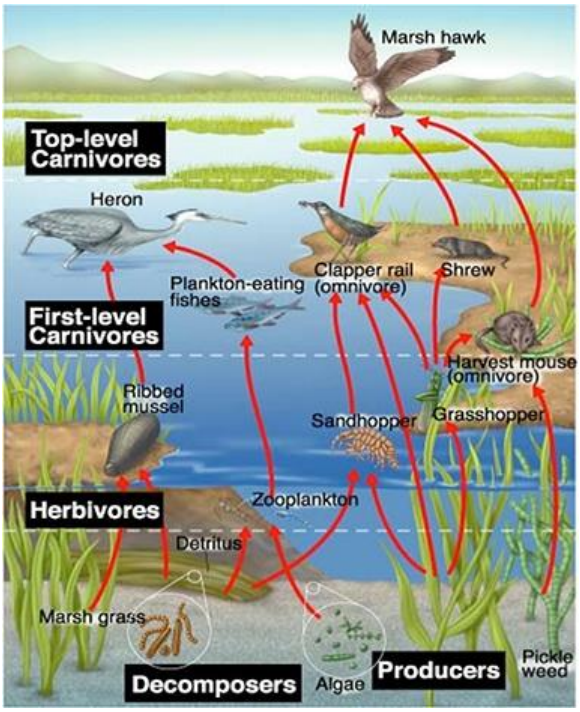


Figure 4-2 Ecological Food Web Concept

Although ecological food webs could be used to describe the complex system interactions that might be associated with District pesticide application scenarios, it is neither feasible nor practical to evaluate those potential impacts using a food-web approach. The numerous, interactions in typical food webs are highly complex and would be subject to substantial uncertainty, making it exceedingly difficult to confidently assess relevant impacts. Because of these constraints and complexity, it is neither practical nor productive to attempt to predict food-web interactions for each of the numerous application scenarios the District uses. It is appropriate, however, to use a food-web analysis to identify and consider the first level of potentially adverse effects to nontarget species that might result from a pesticide application. This information is used to assure a minimal impact to nontarget species and is typically a part of the MSDS and Toxicology profiles, providing the basis for the more reasonable, technically feasible approach to consider the possible nontarget impacts prior to use and the compatibility of each proposed pesticide in the overall approach to the typical vector control chemical application by the District.

Pesticides can kill natural predators of mosquitoes. The District's activities associated with the Physical Control and Vegetation Management Alternatives would help allow these predators to access habitats where mosquito larvae are present. When chemical control is used to manage mosquitoes it generally is used at levels that are below the effects thresholds for other insects and invertebrate predators, as described above. Although mosquito pesticides may also affect invertebrate predators (e.g., dragonflies), recovery of predator populations is usually rapid as the predator populations extend beyond the application areas and will rapidly replace any lost individuals. In general, the pesticides used for mosquito control exhibit low or no toxicity to birds or mammals. Limited information is available regarding toxic effects to reptile or terrestrial amphibian mosquito predators.

Mosquitoes are part of the food web and their loss may reduce the food base for some predators. Although mosquitoes serve a role as one of many types of prey items for some fish, avian insectivores, bats, and small reptiles and amphibians, the reduction of mosquito abundance over a small area will not affect the predator populations overall, as other prey sources are available.

4.2.3 Surveillance Alternative

Surveillance activities involve monitoring the abundance of adult and larval mosquitoes, field inspection of mosquito habitat, testing for the presence of antibodies specific to encephalitis virus in domestic and wild fowl, collection and testing of ticks, small rodent trapping and disease testing, and/or response to public service requests regarding vectors such as mosquitoes and yellow jackets.

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, treeholes, 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. Ticks are collected along trails and sampled for disease. Rodents (roof rats and Norway rats) may be collected during inspections to respond to public service requests.

4.2.3.1 Impacts to Special-Status Species

The Surveillance Alternative would affect small areas with the intent of monitoring vector populations to determine where control alternatives are required. Small numbers of vector and nontarget organisms are trapped at sites with the potential to support substantial vector populations. These sites are dispersed throughout the District. Chemicals may be used within adult mosquito traps (some adult mosquito traps use a Vapona strip infused with dichlorvos), but these chemicals are confined to the traps and do not enter the environment. Surveillance activities would occur in all wetland and aquatic habitat types, except open water and tidal flats (see Table 4-2 in Section 4.1.1). Surveillance activities would be conducted in accordance with the BMPs relating to agency communication, pre-treatment screening, environmental training, and disturbance minimization as detailed in Table 4-6. The potential impacts of the Surveillance Alternative would be similar for all habitat types, although the species potentially affected would differ, as indicated in Tables 4-3 and 4-4.

Small impacts to upland and wetland habitats in the vicinity of aquatic ecosystems may occur when the District is required to maintain paths and clearings to access surveillance sites and facilitate sampling. Such maintenance may include clearing small amounts of vegetation to retain footpaths up to 3 feet wide, or ATV/ARGO paths up to 6 feet wide. However, the vast majority of access routes are via preexisting roads, trails, and walkways, and do not require clearing by the District. Some trails do require periodic clearing by the District. Occasionally new access routes may be required to assess a vector source. This will often consist of personnel picking their way through natural openings in the vegetation to the source, but in some cases (i.e., heavy growth of blackberries or poison oak) a trail may need to be created. Where such clearing is required, it is generally done with hand tools. In those rare cases where especially dense vegetation is encountered, a skip loader with mower attachment may be used. No trimming of vegetation greater than 4 inches diameter breast height would be conducted. Most heavier trail maintenance activities, especially those using weed trimmers, small chainsaws, or other motorized equipment, would be conducted in the fall, when potential impacts associated with disturbance of breeding habitat would be minimized. However, lighter trail maintenance activities (trimming back small branches or fronds hanging over the access route) may occasionally occur during other times of year. These activities are of small size, and new access routes would be minimal; therefore, indirect impacts to wetland and aquatic habitats would be inconsequential.

The presence of District personnel and equipment implementing the Surveillance Alternative and associated noise could result in disturbance to special-status aquatic species. Such disturbance is most likely to occur during breeding season for fish and amphibians, should the animals abandon suitable habitat as a result of such disturbance. These disturbances would be very minor and of short duration, so would likely not cause these animals to abandon the area, but rather move away from the activity while it is occurring. Special-status invertebrates (all species associated with vernal pools, with the exception of the California freshwater shrimp) would likely not be disturbed by the presence of District personnel.

The Surveillance Alternative may also result in disturbance to species as District personnel are traveling to and from surveillance sites. These access-related impacts would be minimized by adherence to the BMPs previously cited, but in particular discussing activities regularly with regulatory agencies or wildlife refuge managers, staying on existing access routes wherever possible, maintaining and implementing training from USFWS and CDFW personnel regarding special-status species, and being aware of the environment and minimizing noise and disturbance when working in the field.

In addition, when working in tidal marshes, the District will implement all Tidal Marsh-Specific BMPs, as well as those for salt marsh harvest mouse, Ridgway's rail and soft bird's beak, where these species are potentially present, as determined through discussion with refuge managers, CDFW, or USFWS personnel. This will include continuing to follow the measures provided in the USFWS' "Walking in the Marsh;" employing seasonal and daily activity restriction periods, wherever practical; minimizing travel along tidal channels and sloughs; limiting vegetation removal to the minimum necessary; and other BMPs as indicated in Table 4-6. Through the implementation of these BMPs, substantive impacts to habitat would be avoided and no impact to special-status animals would occur.

The only potential for the Surveillance Alternative to directly impact fish, amphibians or special-status aquatic invertebrates would be when dipping to collect samples. Prior to collection of a sample, the technician would visually inspect the area to be sampled for nontarget organisms and avoid areas where special-status species were potentially present. Samples consist of collection of approximately 1 pint of water from the immediate surface of the waterbody, where mosquito larvae live, an area special-status fish and invertebrates are unlikely to occupy, as their risk of predation is increased in these areas. The sample would be inspected for vertebrates or special-status invertebrates, and in the unlikely event that such are captured, these animals would be returned immediately to the source water. It is highly unlikely that the organism would be harmed.

Surveillance activities might result in some physical damage to habitat or associated vegetation from foot traffic in areas without marked trails to access areas for potential vector inspection. Special-status species could be directly impacted by these activities. The District investigates sites for the presence of special-status species prior to initiating any further surveillance measures in natural habitat areas, and only small areas would be disrupted briefly by access activities. As explained above, most surveillance occurs along access routes that are already established, and would only be cleared periodically to maintain access, as necessary. Where new access routes are required they would have only a very small effect on habitat in areas where surveillance occurs. Therefore, minimal impacts would occur to aquatic species.

> **Impact AR-1.** The Surveillance Alternative would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.

4.2.3.2 Impacts to Habitat

This alternative would not affect the quantity or distribution of habitats, such as riparian areas, marshes, lakes or ponds, seasonal wetlands, or other habitat types identified as sensitive natural communities in local or regional plans, policies, regulations, or by the CDFW or USFWS. This alternative would not affect the composition of their vegetative communities, as very limited numbers of plants would be pruned or removed over a very small area. Surveillance would not result in any ground-disturbing activity and, therefore, would not result in any removal, filling or hydrologic interruption of federally protected wetlands as defined by Section 404 of the Clean Water Act, (including but not limited to, marsh, vernal pool, coastal, etc.). Most surveillance occurs along access routes that are already established, and would only be cleared periodically, during the fall to minimize impacts, to maintain access, as necessary. Where new access routes are required they would have only a very small effect on habitat in areas where surveillance occurs.

The District has long-standing cooperative and collaborative relationships with CDFW, professional biologists and property owners with regard to access, mosquito surveillance and control in association with vernal pools. District staff have received information and training from CDFW and professional biologists with respect to minimizing the potential for impacts to vernal pool habitat and specifically California tiger salamander, Sebastopol meadowfoam, Burke's goldfields, and Sonoma sunshine. When using ATVs to perform mosquito surveillance in the proximity of vernal pools, District staff stay outside of the margin of the vernal pools (delineated by the change from wetland to upland vegetation types), and do not operate ATVs within the actual vernal pool. The District may cross hydrological connections, i.e., swales, between vernal pools when necessary and with permission from regulatory agencies. When possible, District staff performs mosquito surveillance on foot with hand equipment, or by operating ATVs in upland areas a considerable distance from the pools and walking from the ATV to the pools to perform mosquito control (e.g., using a long hose reel based on the ATV). When it is necessary to use an ATV for mosquito surveillance in proximity to vernal pools, the District utilizes low ground pressure vehicles. District staff operates ATVs at slow speeds on sites containing vernal pools, and remains observant while operating equipment and walking in and amongst vernal pool habitat. The District avoids performing mosquito surveillance on rainy days or during dawn and dusk to avoid peak movement periods for California tiger salamander.

> **Impact AR-2.** The Surveillance Alternative would have a **less-than-significant** impact on any riparian habitat or other sensitive natural community No mitigation is required.
>
> **Impact AR-3.** The Surveillance Alternative would have a **less-than-significant** impact on federally protected wetlands as defined by Section 404 of the Clean Water Act. No mitigation is required.

4.2.3.3 Impacts to Migration and Movement

Any disruption of migration patterns would be due to the presence of personnel and machinery in the environment. In all cases this would be a very short-term occurrence, generally not more than a few hours in any given location and, therefore, this effect would be minimal and would have no effect on the movement of wildlife and would not affect wildlife migration corridors or nursery areas, as no physical disturbance would occur.

> **Impact AR-4.** The Surveillance Alternative would have **no impact** on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites.

4.2.3.4 Conflict with Local Ordinances

The county and city general plans and their goals and policies pertaining to natural resources are protective of aquatic resources and focused on conservation of existing resources including riparian, wetland, and bayland communities. Surveillance activities would not result in the conversion of natural habitats to other land uses or in the long-term or permanent dislocation of plant and animal species from natural areas except indirectly for mosquitoes and vectors of disease and discomfort. Surveillance activities would not affect trees more than 4 inches diameter at breast height and, therefore, would not conflict with local tree ordinances.

> **Impact AR-5.** The Surveillance Alternative would have **no impact** on local policies or ordinances protecting biological resources.

4.2.3.5 Conflict with Conservation Plans

Two conservation plans, Turkey Road and the SRPCS, were identified whose action area is within the District's primary Service Area. The Turkey Road HCP provides for protection and mitigation of impacts to California red-legged frog associated with residential and vineyard development. The SRPCS provides for the protection and mitigation of impacts to California tiger salamander and four listed plant species from development on the Santa Rosa Plain.

The District conducts surveillance operations within the area covered by the regional SRPCS. While District activities may occur within the boundaries of conservation areas, these activities are coordinated with the plan managers. The District regularly communicates with and works collaboratively with the SRPCS Interagency Review Team (IRT, also referred to as the Implementation Committee) and representatives from agencies such as RWQCB, USEPA, USACE, CDFW, and USFWS. The District receives training from agency staff and independent biologists (e.g., CDFW, USACE) to minimize impacts and conducts annual field training for field staff regarding precautionary and avoidance measures related to vernal pool habitat. The District uses specialized equipment in conjunction with vernal pool habitats.

Six conservation plans affect portions of adjacent counties as identified in Table 4-5. District activities are typically not among those covered by these HCPs. When called into these adjacent counties to perform work, the District would operate under the auspices of that county's mosquito and vector control district and in compliance with their practices and permits, or with the county, if there is no vector control district. The District would operate in compliance with all active HCP/NCCPs. Therefore, the District activities would not be in conflict with the provisions of any adopted HCP, NCCP, or other approved local, regional, or state-approved conservation plan.

> **Impact AR-6**. The Surveillance Alternative has a **less-than-significant** impact on any adopted HCPs or NCCPs. No mitigation is required.

4.2.4 Physical Control Alternative

The Physical Control Alternative would be a continuation of existing activities using applicable techniques, equipment, vehicles, and watercraft.

Physical control for mosquitoes consists of the management of aquatic areas that provide mosquito-producing habitat (including freshwater marshes and lakes, saltwater marshes, temporary standing water, vernal pools, and wastewater treatment facilities) especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities. For physical control measures used for onsite wastewater treatment systems, see Section 9.2.4.

The potential effects of this alternative on these habitats are described below. The District may also advise landowners and homeowners about the importance of dumping/inverting of containers holding water, controlling vegetation against structures, and avoiding stagnant ponds. In situations where any potential

exists for sensitive habitats or special-status species to be present, the District includes information and contact data for resource agencies and potential permits.

4.2.4.1 Impacts to Special-Status Species and Habitats

Mosquitoes typically breed in shallow areas, with emergent vegetation, little to no current, and where fish are excluded. This alternative modifies habitats that support mosquito larva to make these habitats less suitable for mosquitoes and/or more suitable for their predators. This alternative includes maintenance of ditches and water control structures, removal of debris and weeds, clearance of brush for access to areas to be treated, and filling of nonfunctional water circulation ditches. It may also include reconnecting backwaters or isolated pools on the floodplains of streams and rivers, and increased drainage rates and areas in managed wetlands. These activities are conducted in accordance with all appropriate environmental regulations. This work in creeks, rivers, ponds, lakes, marshes and other wetlands may require permits from the USACE, RWQCB, CDFW, USFWS, NOAA Fisheries, and others. Federally protected wetlands are defined by Section 404 of the Clean Water Act, (including but not limited to, marsh, vernal pool, coastal, etc.) where adverse effects could occur through direct removal, filling, hydrological interruption, or other means. The Physical Control Alternative would not reduce the quantity of this habitat, but simply improve circulation within the marsh. Only inactive channels would be filled to eliminate ponding. Work would not begin until all required permits are obtained. The District may also advise landowners and homeowners about the importance of dumping/inverting of containers holding water, controlling vegetation against structures. In situations where there is any potential for sensitive habitats or species to be present, the District includes information and contact data for resource agencies and potential permits.

District activities largely involve maintenance of existing facilities in the same manner they do under baseline conditions. The District is rarely involved in new drainage projects, and when they are, they consult with the appropriate agencies and acquire all required permits for implementing that work, which provides protection for native and special-status fish species. The District's annual work plans are submitted for review by other responsible agencies prior to implementation. Completed work is available for inspection by the USACE, USFWS, and CDFW upon request.

Physical control activities occur in most aquatic and wetland habitats, with the exception of open water and tidal flat habitats, as these do not provide suitable habitat for mosquitoes, due to their circulation patterns. Impacts are evaluated based on the types and locations of habitats where such activities would be performed. Impact determinations of significance follow the analyses by habitat type. These activities would generally occur over a period of a few days in any specific location, and so the physical disturbance would be very short term. The impacts could include short-term increases in dust and sedimentation, but BMPs (see category G in Table 4-6) would be implemented to make these impacts less than significant. Short-term increases in noise could also result. This would be expected to have the largest effect on adult amphibians when they are out of the water, or terrestrial animals. Most of this work will be conducted when the area is dry or otherwise isolated from active waterways, so impacts to purely aquatic organisms from noise and vibration are not expected to occur.

Mosquitoes are part of the food web and their loss may reduce the food base for some predators. Although mosquitoes serve a role as one of many types of prey items for some fish, avian insectivores, bats, and small reptiles and amphibians, the reduction of mosquito abundance over a small area will not affect the predator populations overall, as other prey sources are available.

Physical control measures for rodents and other nuisance wildlife would be limited to providing advice for restricting ingress of rodents into structures or decreasing habitat for them near residences. These measures would not affect aquatic habitats and would have no effect on aquatic resources. Physical controls are not implemented for yellow jackets or ticks.

4.2.4.1.1 Creeks and Rivers and Riparian Corridors

Because their rapid currents do not provide suitable habitat for mosquitoes, creeks and rivers generally do not support substantial numbers of mosquitoes, although, some mosquitoes can be found in slow eddies and back channels, or in pools isolated on the banks as flows recede. Creeks and rivers may support special-status fish species including steelhead, Chinook salmon, foothill yellow legged frog, California red legged frog, California freshwater shrimp, and other species, as indicated in Table 4-1. Isolated ponds and back channels may provide habitat for mosquito larva, but these areas may also provide excellent rearing habitat for young fish and amphibians, as they provide warmer water temperatures, higher primary productivity and protection from predaceous fish. Draining areas of shallow freshwater habitat to reduce the amount of standing water or reduce the amount of time such water remains standing could result in adverse effects to young fish or amphibians using those habitats, leaving organisms that cannot vacate the area without water, or requiring organisms that can leave the area to move to new locations, and reducing the amount of larval rearing habitat present. Where native or special-status fish species are not present, these impacts would be negligible. Where native or special-status species are present, these areas could be important nursery areas, depending on location, season, species present, and amount of other habitat available to the species. Habitat alterations to drain such areas will be avoided to the maximum extent possible. This type of activity is not routinely conducted by the District, but may be required in some circumstances. The potential effects of this alternative would be avoided or minimized through implementation of the BMPs in Table 4-6, including those relating to agency communication, environmental training, and pre-treatment screening (see BMP A7). The habitat and species-specific BMPs in Table 4-6 may also be applied, including seasonal avoidance measures. Furthermore, BMP G3 requires that all maintenance work will be done at times that minimize adverse impacts to nesting birds, anadromous fish, and other species of concern, in consultation with USFWS, NMFS, and CDFW. With these BMPs, the effects of this alternative would be less than significant.

4.2.4.1.2 Ponds and Lakes

The freshwater habitats that could be treated include the margin of reservoirs and ponds (including artificial ponds such as golf course ponds or stock ponds with natural bottoms). These areas are generally man-made habitats, and if they support fish, these fish will largely consist of introduced species, or stocked native species such as rainbow trout. While rainbow trout are native to the region, these stocked fish are not considered to be natural populations, and are treated as introduced fish. Amphibians (i.e., red legged-frog, California tiger salamander) or western pond turtles may also use these reservoirs and ponds, particularly if these areas do not support fish.

Treatment of stagnant areas where mosquito larvae eggs and larvae occur would be accomplished by increasing circulation (water flow) to these areas. This increases the accessibility of these areas to young fish, which then eat the mosquito larvae. This access provides these fish with a previously inaccessible food source. Additionally, these areas can be important for young fish, as they provide protection from predation by larger fish and tend to be warmer, with higher primary productivity, providing good conditions for the growth of young fish. Most young fish eat insect larvae during at least the first few months of their lives, and some species eat insect larvae throughout their lives. Special-status fish species would not be impacted in reservoirs and ponds, and ditches, as these species do not occur in these habitats.

This type of treatment could affect breeding and rearing areas for amphibians, as they tend to avoid areas where fish are present. This would increase the risk of predation on eggs and tadpoles. This potential effect would be avoided and minimized by the BMPs in Table 4-6 relating to agency communication, environmental training, and pre-treatment screening. The habitat and species-specific BMPs in Table 4-6 may also be applied, including seasonal avoidance measures. Furthermore, BMP G3 requires that all maintenance work will be done at times that minimize adverse impacts to nesting birds, anadromous fish, and other species of concern, in consultation with USFWS, NMFS, and CDFW. With these BMPs, the effects of this alternative would be less than significant.

4.2.4.1.3 Freshwater Marsh/Seeps

Freshwater marsh and seeps may provide ideal habitat for mosquito breeding due to their substantial areas of shallow water, limited circulation and emergent vegetation. These areas may potentially support a number of native and nonnative fish, amphibians (California tiger salamander) and reptiles (western pond turtle), as indicated in Table 4-1. Physical control in these areas would have the same potential effects as described for lake and pond habitats and would be avoided or minimized by the BMPs in Table 4-6 relating to agency communication, environmental training, and pre-treatment screening. The habitat and species-specific BMPs may also be applied, including seasonal avoidance measures. Furthermore, BMP G3 requires that all maintenance work will be done at times that minimize adverse impacts to nesting birds, anadromous fish, and other species of concern, in consultation with USFWS, NMFS, and CDFW. With these BMPs, the effects of this action would be less than significant.

4.2.4.1.4 Seasonal Wetlands (includes Vernal Pools)

The USACE defines wetlands as "*those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (33 [Code of Federal Regulations] CFR 328.3(b); 40 CFR 230.3(t)).*" For the purposes of this document, seasonal wetlands are areas that are flooded for 1 week or more during the year, generally during the rainy season, but do not retain water through the entire year. Seasonal wetlands may be flooded by increased runoff, rainfall, or unusually high tides. Fish may use these areas for spawning and rearing. Splittail, for instance, use floodplain habitats to spawn and rear (Moyle 2002). Their young may live in these seasonally flooded habitats for several weeks, until these habitats dry out. Chinook salmon can use flooded wetlands and floodplains for rearing habitat during their outward migration toward the ocean. Young salmonids using these seasonally flooded wetlands have higher growth rates than the fish that remain in the mainstem rivers (Sommer et al. 2003; Swenson et al. 2003; Moyle et al. 2007). The availability of such habitats has been substantially reduced by human land use practices and flood control measures. Reducing the frequency or duration with which such habitats are flooded would adversely affect habitat and aquatic resources. The Physical Control Alternative would not reduce the quantity of this habitat, but simply improve circulation within the marsh. Only inactive channels would be filled to eliminate ponding. All work in wetlands would be subject to additional permitting by the USACE, CDFW, BCDC, and RWQCB.

Vernal pools[5], a specific type of seasonal wetland, sometimes support a unique assemblage of endemic plant and animal species, many of which have been identified as special-status species by federal and state agencies (see Table 4-1). The District receives environmental awareness training from agency staff (e.g., CDFW, USACE) and independent biologists to minimize impacts and conducts annual field training for field staff regarding precautionary and avoidance measures related to vernal pool habitat. This training addresses California tiger salamander, Sebastopol meadowfoam, Burke's goldfields, and Sonoma sunshine. When using ATVs to perform mosquito control in the proximity of vernal pools, District staff stay outside of the margin of the vernal pools (delineated by vegetation change from wetland to upland), and do not operate ATVs within the actual vernal pool. The District may cross hydrological connections, i.e., swales, between vernal pools when necessary and with permission from regulatory agencies. When possible, District staff performs mosquito control on foot with hand equipment, or by operating ATVs in upland areas a considerable distance from the pools and walking from the ATV to the pools to perform mosquito control (e.g., using a long hose reel based on the ATV). When it is necessary to use an ATV for mosquito control in proximity to vernal pools, the District utilizes low ground pressure vehicles. District staff operates ATVs at slow speeds on sites containing vernal pools and remains observant while

[5] "Vernal pool," whether by transfer or by independent invention, is now applied to small wetlands that are present primarily or exclusively in the early part of the growing season and that typically "dry" completely or "substantially" at some point during the growing season. (http://users.ipfw.edu/isiorho/wetvernalisolatedwetlands2003.pdf)

operating equipment and walking in and amongst vernal pool habitat. The District avoids performing mosquito control on rainy days or during dawn and dusk to avoid peak movement periods for California tiger salamander.

The District conducts physical control operations within the area covered by the regional Santa Rosa Plains Conservation Strategy. The District regularly communicates with and works collaboratively with the SRPCS IRT and representatives from agencies such as RWQCB, USEPA, USACE, CDFW, and USFWS.

Because of the sensitive nature of these habitat types, the District generally would not undertake Physical Control measures in these areas. In the event that Physical Control in a vernal pool was required, the District would not implement such actions without previously discussing their need with the relevant regulatory agencies to verify that no other option exists to control the mosquito problem and to make sure that any such activity would be done in such a way as to minimize its impacts. As a result, this "consultation prior to implementation" BMP and the practices described above will result in a less-than-significant impact to seasonal wetland resources.

4.2.4.1.5 Lagoon

Lagoons, located at the mouths of creeks or rivers where they enter the ocean or bay, but isolated from the receiving waterbody by a berm, are indirectly influenced by the tide, which may cause freshwater to back up within the lagoon, and may also allow water to percolate through the berm, with the direction of such movement depending on water levels on either side of the berm. As a result, lagoons often contain a lens of freshwater at the surface and brackish water at the bottom. Lagoons may therefore contain species from both creeks and rivers, and from the receiving waterbodies. Amphibians are not likely to occur in lagoons due to elevated salt content, but could occur at the upstream end of the lagoon, within the backwater, but above the reach of the saline influence. Lagoons would support mosquitoes in areas of reduced circulation, often associated with emergent vegetation. Physical control in lagoons would include reconnecting isolated areas to the main lagoon. The BMPs in Table 4-6 would be applied to avoid or minimize impacts to environmental resources. BMP G3 requires that all maintenance work will be done at times that minimize adverse impacts to nesting birds, anadromous fish, and other species of concern, in consultation with USFWS, NMFS, and CDFW. With these BMPs, the effects of the Physical Control Alternative on resources within the lagoon would be less than significant.

4.2.4.1.6 Tidal Marsh and Channels

Tidal marsh and tidal channel habitats occur along the margins of San Francisco, San Pablo, and Suisun bays and are subject to tidal action.

They are typically bounded by levees and water control structures. The San Francisco Bay-Delta once supported vast tracts of freshwater, brackish, and saline marsh habitat. The vast majority of these marsh habitats have been converted to human uses such as farming, industrial uses, and urban development. Some of the remaining marsh lands are maintained and operated to provide habitat for wildlife or as private or public duck clubs. Several examples of these types of habitats occur along the Highway 37 corridor and along Highways 101 and 29 in close proximity to the cities of American Canyon, Napa, Sonoma, Petaluma, and Novato. These wetlands can be important sources of mosquitoes seasonally. These marshes are seasonally flooded and drained to optimize habitat for ducks, geese, and other wildlife. A variety of special-status fish species including all races of Central Valley Chinook salmon, steelhead, green sturgeon, delta smelt, longfin smelt, Sacramento splittail, and Sacramento perch could use these marshes. These tidal marshes, however, do not provide primary habitat for these species. No special-status amphibians, aquatic reptiles, or invertebrates occupy these habitats.

Physical measures to control mosquitoes in these areas include maintenance of ditches and water control structures, removal of debris and weeds, clearance of brush for access to areas to be treated, and filling of nonfunctional water circulation ditches, as described in Chapter 2. Other measures include retaining water on the surface of the area, and rotational impoundment monitoring, which reduces mosquito populations by

increasing the frequency with which suitable habitats are inundated and drained. The District works with landowners and property managers to accomplish these actions on an as needed basis. The District advises the landowner and property managers that these actions may require discussion with CDFW, NOAA Fisheries, or the USFWS and that these agencies should be contacted before work is initiated.

These activities would be subject to the BMPs described in Table 4-6, relating to agency communication, environmental training, and pre-treatment screening, and the tidal marsh-specific BMPs would also be employed including conducting this work during appropriate seasons and times of day (when the tide is out and when Ridgway's rail and salt marsh harvest mouse are not nesting), making sure staff have appropriate training when working in the marsh, minimizing the use of mechanical equipment where practical. Channels that have substantial tidal flow and inundation would not support mosquitoes and thus would not need to be maintained. Fish would be absent from the channels where maintenance is required during low tides, when the work would be conducted. Thus, fish would not be directly affected. Increasing circulation of water in low lying areas these areas would not substantially affect fish populations. Improving drainage of low-lying areas within these managed areas, which would be drained with or without mosquito control activities, could decrease the likelihood that fish become trapped or stranded. Construction of channels could result in temporary increases in turbidity, which could adversely affect fish. BMPs to avoid discharge of unsuitable material and spoils would be implemented to control and localize this turbidity. They may include constructing new channels during periods when the marsh is dry or isolating areas where new channels are being constructed from the surrounding environment and other BMPs associated with the USACE 404 and other permits required for such work. These turbidity increases would be short term and temporary and, thus, would not substantially affect aquatic species.

4.2.4.1.7 Water and Wastewater Treatment Facilities

Wastewater treatment facilities do not provide habitat for native or special-status fish species, although such facilities may lie close to suitable habitats in streams or the San Francisco Bay Delta system and connectivity may exist between the facility and the natural environment that could allow aquatic resources to enter the facility. The extent to which these species may enter these facilities is unknown. Because of the limited number of such facilities and the very limited use of such facilities by fish, amphibian or aquatic reptiles, physical control measures are not anticipated to substantially affect these fish species.

Septic/onsite wastewater treatment systems and their associated leach fields do not provide habitat for native fish or special-status fish, amphibian, aquatic reptile or invertebrate species. This type of facility would only affect fish if they drained into a waterbody supporting fish, in which case the physical control measures for freshwater habitats would apply.

Winery waste ponds generally contain waste from grape pressings and washwater from cleaning winery equipment. These ponds generally do not provide suitable habitat for special-status species, as they are highly managed and often suffer from low water quality. In Marin County, the permitting of these ponds is controlled by the County Division of Environmental Health Services and in Sonoma County by the Permit and Resource Management Department. In both cases, the local permitting agency deals with flows of up to 10,000 gallons per day and with subsurface disposal only. If the daily flow exceeds this value or surface disposal is used, the RWQCB is the controlling agency. The District provides input relating to controlling mosquitos and other vectors associated with the ponds and winery operations. Physical control is not typically undertaken in winery waste ponds, although it is possible that this could be required under unusual circumstances. Because of the poor quality habitat provided and because physical control activities would rarely be conducted in these waste ponds, there is little likelihood of impacts to special-status species.

Flood control channels and ditches may support special-status species where they have standing water for sufficient periods of time and have suitable physical and vegetative structure. Physical management activities would be designed to reduce ponding of water within these areas. The application of the BMPs in

Table 4-6, particularly those pertaining to agency communication, pre-treatment screening, and environmental training, would avoid impacts to any special-status species that might occur in these habitats.

4.2.4.1.8 Artificial Containers, Temporary Standing Waters and Ornamental Ponds

Artificial containers do not provide habitat for fish or support populations of native or special-status fish, amphibians, aquatic reptiles, or invertebrates. Thus, physical control of artificial containers (ensuring that these containers do not hold water for a sufficient period to support mosquito larvae) would have no impact on these species or their habitat.

Temporary standing waters refers to water ponding on an upland habitat because of rainfall or irrigation. Ornamental ponds are small ponds with artificial bottoms. These habitats do not provide habitat for special-status aquatic species.

4.2.4.1.9 Impact Determinations for Special-Status Species and Habitats

Impact AR-7. The Physical Control Alternative, would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.

Impact AR-8. The Physical Control Alternative would have a **less-than-significant** impact on any riparian habitat or other sensitive natural community. No mitigation is required.

Impact AR-9. The Physical Control Alternative would have a **less-than-significant** impact on federally protected wetlands as defined by Section 404 of the Clean Water Act. No mitigation is required.

4.2.4.2 Effects on Movement and Migration

Physical changes in the habitat would have the potential to affect fish migration. However these changes would tend to enhance migration, opening routes, not closing them. This alternative would likely benefit the movement of fish and other aquatic species, as it would deepen channels and improve flow. This effect would occur within restricted areas and would not substantially alter migratory pathways or success. Additional disruption of migration patterns may occur due to the presence of personnel and machinery in the environment. In all cases this would be a short-term occurrence, generally not more than a few days in any given location and, therefore, this effect would be minimal and would have little effect on the movement of fish and other aquatic species.

Impact AR-10. The Physical Control Alternative would have a **less-than-significant** impact on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites. No mitigation is required.

4.2.4.3 Conflict with Local Ordinances

The county and city general plans and their goals pertaining to natural resources are protective of terrestrial resources and focused on conservation of existing resources including mature trees and important woodland communities. Physical control activities would not result in the conversion of natural habitats to other land uses or in the long-term or permanent dislocation of plant and animal species from natural areas except for mosquitoes and vectors of disease and discomfort. The Physical Control Alternative would not affect trees more than 4 inches diameter breast height and, therefore, would not conflict with local tree ordinances.

Impact AR-11. The Physical Control Alternative would have **no impact** on local policies or ordinances protecting aquatic resources.

4.2.4.4 Conflict with Conservation Plans

Two conservation plans, Turkey Road and the SRPCS, were identified whose action area is within the District's primary Service Area. The Turkey Road HCP provides for protection and mitigation of impacts to California red-legged frog associated with residential and vineyard development. The SRPCS provides for the protection and mitigation of impacts to California tiger salamander and four listed plant species from development on the Santa Rosa Plain. While District activities may occur within the boundaries of conservation areas, these activities are coordinated with the plan managers and would not conflict with the provisions of any adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan.

The District's physical control work in the Santa Rosa Plain is infrequent and minimal. Work is not associated with vernal pools, rather the work is typically in conjunction with wastewater management irrigation (e.g., City of Santa Rosa) or with physical control in waste ponds (e.g., dairy). The District regularly communicates with and works collaboratively with the SRPCS IRT (also referred to as the Implementation Committee) and representatives from agencies such as RWQCB, USEPA, USACE, CDFW, and USFWS. The District receives training from agency staff and independent biologists (e.g., CDFW, USACE) to minimize impacts and conducts annual field training for field staff regarding precautionary and avoidance measures related to vernal pool habitat and other seasonal wetland and wetland habitats. The District uses specialized equipment in conjunction with vernal pool habitats, as previously described. While District activities may occur within the boundaries of conservation areas, these activities are coordinated with the plan managers and would not conflict with the provisions of any adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan.

Six conservation plans affect portions of adjacent counties. District activities are typically not among those covered by these HCPs. When called into these adjacent counties to perform work, the District would operate under the auspices of the affected county or that county's mosquito and vector control district and in compliance with their practices and permits, including compliance with all active HCP/NCCPs. Therefore, the District activities would not be in conflict with the provisions of any adopted HCP, NCCP, or other approved local, regional, or state-approved conservation plan.

> **Impact AR-12**. The Physical Control Alternative would have a **less-than-significant** impact on adopted HCPs or NCCPs. No mitigation is required.

4.2.5 Vegetation Management Alternative

The vegetation within and surrounding aquatic and wetland habitats is an important component of the aquatic ecosystem. This vegetation provides shade, helping to keep the water cool; increases structure and habitat complexity; and contributes organic material and insect drop, subsidizing the food web. It provides fish and other aquatic organisms with cover from aquatic and terrestrial predators and provides visual separation that increases the density of territorial species. Vegetation also helps slow runoff from the surrounding land surface, protecting the aquatic environment from sediments and toxins that may wash in from upland areas.

Vegetation management involves the trimming or removal of vegetation to improve access, and to improve water circulation to areas that support mosquito breeding and improve access to natural predators, so that chemical treatments are not required. All such work is done in coordination with the landowner or land manager and the resource agencies, as required. Permits are generally required for this type of activity, and this work would only be initiated after all necessary permits are obtained. All areas are pre-screened to determine the potential presence of special-status species and to develop appropriate measures to avoid or minimize effects to these species. The vast majority of this vegetation management work is conducted manually and encompasses only a small area. Occasionally, larger areas of vegetation may be removed using equipment, such as a skid steer with mower attachment. This equipment is typically used at a small number of sites to mow access paths in dense stands of cattails in seasonal wetlands and retention basins and infrequently in riparian habitat to mow access paths through dense stands of blackberry and poison oak

to facilitate surveillance and the application of larvicides. This work is typically done in the fall to avoid the breeding season for birds and other species. The District is in communication with resource agencies prior to performing this type of work. “Mechanized” vegetation management using equipment is typically restricted to ditches, wastewater ponds and stormwater retention basins or areas. The District will ensure that all required permits are in place before vegetation management activities are undertaken. Short-term (a few days to a week) increases in noise could result from the operation of heavy equipment under this alternative. This would be expected to have the largest effect on adult amphibians when they are out of the water (or terrestrial animals, discussed in Chapter 5), and would cause them to move away from the work area. Most of this work will be conducted when the area is dry or otherwise isolated from active waterways, so impacts to purely aquatic organisms from noise and vibration are not expected to occur.

The District preferentially uses physical control for vegetation management and rarely uses herbicides (and some adjuvants) for vegetation management in natural environments. The District may use herbicides in artificial environments, winery waste ponds, wastewater treatment ponds, and agricultural ditches. Whenever herbicides are used, they are applied in compliance with label requirements. As indicated in Table 4-7, a number of herbicides have low toxicity to fish and aquatic invertebrates. These herbicides would be used in areas near aquatic environments potentially supporting native or special-status aquatic species. Herbicides with moderate to high toxicity to fish and aquatic invertebrates would not be used in these areas (but may be used in less sensitive areas where needed). Toxicity information for these herbicides can be found in Appendix B and Chapter 6.

The District may use glyphosate on a limited, infrequent basis for mosquito source control. Although some recent concerns have been expressed about possible sublethal effects of glyphosate products (e.g., endocrine disruption in humans, see Section 7.2.5.1.), it is virtually nontoxic to mammals and practically nontoxic to birds, fish, and invertebrates on an acute basis. Claims that glyphosate is destroying bee and butterfly populations have not been substantiated. The use of glyphosate to control milkweed, which is a severe problem for farmers, may be connected to loss of foraging vegetation and, thereby, indirectly impacting butterfly populations. However, this effect is an indirect effect and not actually toxicity to the butterflies from glyphosate. With BMPs and targeted application techniques, glyphosate can be used safely when an adequate buffer (>15 feet) to water sources is maintained (glyphosate is much more toxic to fish and aquatic invertebrates than to mammals, birds, or terrestrial invertebrates) or when a formulation specifically designed for use in aquatic environments (Aquamaster) is used.

Table 4-7 Herbicide and Adjuvant Toxicity[1,2] to Fish and Aquatic Invertebrates

Chemical	Toxicity to	
	Fish	Aquatic Invertebrates
Imazapyr, glyphosate, modified plant oil and methylated seed oil, lecithin, aliphatic polycarboxylate	Low	Low
Triclopyr (triclopyr acid, TEA)	Moderate	Moderate
Triclopyr (TBEE), alkylphenol ethoxylates (APEs)	High	High

[1] Toxicity information is summarized from the information provided in Appendix B (Table 6-1) and Chapter 6.

[2] The toxicity data are derived from rigidly controlled laboratory animal studies designed to determine the potential adverse effects of the chemical under several possible routes of exposure (see Appendix B for further information). In these studies, the species of interest is continuously exposed to 100 percent chemical at several doses. In actual practice, the amounts applied in the District’s Program Area are substantially less than the amounts used in the toxicity studies, and organisms are not continuously exposed to the chemical. Furthermore, actual application rates by the District may be less than label maximum allowable application rates. Thus, the laboratory test results do not provide a realistic assessment of field exposure.

See Section 6.2.5 for further analysis of the herbicides and adjuvants that could be used on a limited basis for vegetation management. The herbicides the District would potentially use are discussed in detail in Appendix B and are listed in Table 2-1 with the active ingredients listed in Table 6-3. An adjuvant is any compound that is added to an herbicide (or pesticide) formulation or tank mix to facilitate the mixing, application, or effectiveness of that herbicide. Adjuvants can either enhance activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with spray application, such as adverse water quality or wind (special purpose or utility modifiers). Activator adjuvants include surfactants, wetting agents, sticker-spreaders, and penetrants. The environmental fate and toxicity of adjuvants the District may use are described in detail in Appendix B and listed in Table 6-4.

4.2.5.1 Impacts to Special-Status Species and Habitats

The District would conduct vegetation management work infrequently in or adjacent to creeks, rivers, ponds, lakes, marshes, and other wetlands that may require permits from the USACE, RWQCB, CDFW, USFWS, NOAA Fisheries, and others. Work would not begin until all required permits are obtained. The potential effects of this alternative on these aquatic habitats are described below.

Mosquitoes are part of the food web and their loss may reduce the food base for some predators. Although mosquitoes serve a role as one of many types of prey items for some fish, avian insectivores, bats, and small reptiles and amphibians, the reduction of mosquito abundance over a small area will not affect the predator populations overall, as other prey sources are available.

4.2.5.1.1 Creeks and Rivers and Riparian Corridors

Because their rapid currents do not provide suitable habitat for mosquitoes, creeks and rivers generally do not support substantial numbers of mosquitoes, although, some mosquitoes can be found in slow eddies and back channels, or in pools isolated on the banks as flows recede. Creeks and rivers may support special-status species including steelhead, Chinook salmon, foothill yellow legged frog, California red legged frog, California freshwater shrimp, and other species, as indicated in Table 4-1. Isolated ponds and back channels may provide habitat for mosquito larva, but these areas may also provide excellent rearing habitat for young fish and amphibians, as they provide warmer water temperatures, higher primary productivity and protection from predaceous fish.

Vegetation that requires management would typically be confined to channel margins and backwaters with slow currents. This activity would be done in coordination with landowners or land managers and resource agencies, as well as following the BMPs described in Table 4-6 relating to environmental training, pre-treatment screening, disturbance minimization, habitat and species-specific BMPs, and vegetation management-specific BMPs. This would result in less-than-significant impacts to fish, amphibians, and aquatic reptiles associated with creeks and streams.

4.2.5.1.2 Ponds and Lakes

The freshwater habitats that could be treated include the margin of reservoirs and ponds (including artificial ponds such as golf course ponds or stock ponds with natural bottoms). These areas are generally man-made habitats, and if they support fish, these fish will largely consist of introduced species, or stocked native species such as rainbow trout. While rainbow trout are native to the region, these stocked fish are not considered to be natural populations, and are treated as introduced fish. Amphibians (i.e., red legged-frog, California tiger salamander) or western pond turtles may also use these reservoirs and ponds, particularly if these areas do not support fish.

Vegetation management would be limited in this habitat type, except in smaller ponds, as the depth and size of these areas would typically preclude emergent vegetation from exceeding 30 percent of the surface area. Where necessary, vegetation management activities would be implemented in stagnant areas along the edges of these habitats where mosquito larvae eggs and larvae occur. Special-status fish species would not be impacted in reservoirs and ponds, and ditches, as these species do not occur in

these habitats. Amphibians would likely not be present in lakes or ponds supporting fish, but may be present in some areas. Vegetation management could reduce cover for these species and increase their vulnerability to predation, but substantial areas of similar habitat would remain.

This potential effect would be avoided and minimized by the BMPs in Table 4-6 relating to agency communication, environmental training, and pre-treatment screening. Vegetation management -specific BMPs would be applied. The species-specific BMPs in Table 4-6 may also be applied, including seasonal avoidance measures. With these BMPs, the effects of vegetation control activities would be less than significant.

4.2.5.1.3 Freshwater Marsh/Seeps

Freshwater marsh and seeps may provide ideal habitat for mosquito breeding due to their substantial areas of shallow water, limited circulation and emergent vegetation. These areas may potentially support a number of native and nonnative fish, amphibians (California tiger salamander) and reptiles (western pond turtle), as indicated in Table 4-1. Vegetation management in these areas would have the same potential effects as described for lake and pond habitats and would be avoided or minimized by the BMPs in Table 4-6 relating to agency communication, environmental training, and pre-treatment screening. The vegetation management and species-specific BMPs in Table 4-6 may also be applied, including seasonal avoidance measures. With these BMPs, the effects of this activity would be less than significant.

4.2.5.1.4 Seasonal Wetlands (includes Vernal Pools)

Seasonal wetlands, including vernal pools, may also support substantial stands of emergent vegetation, although these areas are typically not inundated for long enough periods to support dense stands of vegetation preferred by mosquitoes. As a result, these areas are unlikely to be subject to vegetation management actions. While the District would not operate equipment including ATVs within vernal pools, the District may cross hydrological connections, i.e., swales, between vernal pools when necessary and with permission from regulatory agencies. If vegetation management activities were required, potential effects would be avoided and minimized by the BMPs in Table 4-6 relating to agency communication, environmental training, and pre-treatment screening.

The District conducts limited control operations within the area covered by the regional Santa Rosa Plains Conservation Strategy. The District regularly communicates with and works collaboratively with the SRPCS IRT and representatives from agencies such as RWQCB, USEPA, USACE, CDFW, and USFWS. The District receives training from agency staff and independent biologists (e.g., CDFW, USACE) to minimize impacts and conducts annual field training for field staff regarding precautionary and avoidance measures related to vernal pool habitat. The District uses specialized equipment in conjunction with vernal pool habitats.

From Table 4-6, the vegetation management-specific BMPs would be applied. The species-specific BMPs may also be applied, including seasonal avoidance measures. With these BMPs, the effects of this action would be less-than-significant.

4.2.5.1.5 Lagoon

Lagoons would support mosquitoes in areas of reduced circulation, often associated with emergent vegetation. Vegetation management in lagoons would be subject to the BMPs in Table 4-6 to avoid or minimize impacts to environmental resources. With these BMPs, the effects of the Vegetation Management Alternative on biological resources within lagoons would be less-than-significant.

4.2.5.1.6 Tidal Marsh and Channels

Vegetation management activities are conducted in coordination with landowners or land managers and the resource agencies and generally focus on the removal of nondesired species. This work is done using hand tools and in accordance with the BMPs identified in Table 4-6, relating to agency coordination, environmental training, pre-treatment screening, disturbance minimization, tidal marsh and species-specific BMPs, and vegetation management-specific BMPs. With these BMPs, the effects of the Vegetation Management Alternative on biological resources within tidal marshes would be less-than-significant.

4.2.5.1.7 Water and Wastewater Treatment Facilities

Vegetation management activities may occur in coordination with the owners or operators of wastewater treatment facilities or septic systems. These facilities do not provide habitat for native or special-status fish or other aquatic species, although such facilities may lie close to suitable habitats in streams or the San Francisco Bay Delta system and connectivity may exist between the system and the natural environment that could allow aquatic resources to enter the system. The extent to which these species may enter these facilities is unknown. Because of the limited number of such facilities and the very limited use of such facilities by fish, amphibian or aquatic reptiles, vegetation management measures would have a less-than-significant impact on aquatic resources.

Winery waste ponds generally contain waste from grape pressings and washwater from cleaning winery equipment. These ponds generally do not provide suitable habitat for special-status species, as they are highly managed and often suffer from low water quality. In Marin County, the permitting of these ponds is controlled by the County Division of Environmental Health Services and in Sonoma County by the Permit and Resource Management Department. In both cases, the local permitting agency deals with flows of up to 10,000 gallons per day and with subsurface disposal only. If the daily flow exceeds this value or surface disposal is used, the RWQCB is the controlling agency. These entities require that vegetation within the waste ponds to be managed to prevent the creation of risks to public health. The District provides input relating to controlling mosquitoes and other vectors associated with the ponds and winery operations. The District may ask the landowner to implement vegetation management measures where appropriate. Because of the poor quality habitat provided and because physical control activities would rarely be conducted in these waste ponds, there is little likelihood of impacts to special-status species.

Flood control channels and ditches may support special-status species where they have standing water for sufficient periods of time and have suitable physical and vegetative structure. The application of the BMPs in Table 4-6, particularly those pertaining to agency communication, pre-treatment screening, and environmental training, would avoid impacts to any special-status species that might occur in these habitats.

4.2.5.1.8 Artificial Containers, Temporary Standing Waters and Ornamental Ponds

Vegetation management would not performed for artificial containers, temporary standing waters or ornamental ponds, as these areas would not support substantial stands of vegetation.

4.2.5.1.9 Impact Determinations for Special-Status Species and Habitats

Impact AR-13. The Vegetation Management Alternative would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.

Impact AR-14. The Vegetation Management Alternative would have a **less-than-significant** impact on any riparian habitat or other sensitive natural community. No mitigation is required.

Impact AR-15. The Vegetation Management Alternative would not result in the direct removal, filling, or hydrological interruption of federally protected wetlands as defined by CWA Section 404. As such, this alternative and would have a have a **less-than-significant** impact on these resources. No mitigation is required.

4.2.5.2 Effects on Movement and Migration

This alternative could have a small effect on the migration of wildlife and movement and migration corridors. The removal of small areas of vegetation would not substantially affect movement corridors, but the presence of personnel and machinery may result in short term avoidance of active work areas. In all cases this would be a short-term occurrence, generally not more than a few days in any given location and, therefore, this effect would be minimal and would have little impact on the movement of any native resident or migratory fish or wildlife and would not impact wildlife migration corridors or nursery areas, as little to no physical disturbance would occur.

Impact AR-16. The Vegetation Management Alternative would have a **less-than-significant** impact on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites. No mitigation is required.

4.2.5.3 Conflict with Local Ordinances

The county and city general plans and their goals and policies pertaining to natural resources are protective of aquatic resources and focused on conservation of existing resources. Vegetation management activities would not result in the conversion of natural habitats to other land uses or in the long-term or permanent dislocation of plant and animal species from natural areas except indirectly for mosquitoes and vectors of disease and discomfort. Vegetation removal would not affect trees more than 4 inches diameter at breast height and, therefore, would not conflict with local tree ordinances.

Impact AR-17. The Vegetation Management Alternative would have **no impact** on local policies or ordinances protecting biological resources.

4.2.5.4 Conflict with Conservation Plans

Two conservation plans, Turkey Road and the SRPCS, were identified whose action area is within the District's primary Service Area. The Turkey Road HCP provides for protection and mitigation of impacts to California red-legged frog associated with residential and vineyard development. The SRPCS provides for the protection and mitigation of impacts to California tiger salamander and four listed plant species from development on the Santa Rosa Plain.

The District conducts limited vegetation control operations within the area covered by the regional SRPCS. The District regularly communicates with and works collaboratively with the SRPCS IRT (also referred to as the Implementation Committee) and representatives from agencies such as RWQCB, USEPA, USACE, CDFW, and USFWS. The District receives training from agency staff and independent biologists (e.g., CDFW, USACE) to minimize impacts and conducts annual field training for field staff regarding precautionary and avoidance measures related to vernal pool habitat. The District uses specialized equipment in conjunction with vernal pool habitats.

Six conservation plans affect portions of adjacent counties. District activities are typically not among those covered by these HCPs. When called into these adjacent counties to perform work, the District would operate under the auspices of the county or that county's mosquito and vector control district and in compliance with their practices and permits, including compliance with all active HCP/NCCPs. Therefore, the District activities would not be in conflict with the provisions of any adopted HCP, NCCP, or other approved local, regional, or state-approved conservation plan.

Impact AR-18. The Vegetation Management Alternative would have a **less-than-significant** impact on adopted HCPs or NCCPs. No mitigation is required.

4.2.6 Biological Control Alternative

4.2.6.1 Impacts to Special-Status Species

This alternative consists of the introduction of mosquito predators, specifically mosquitofish (*Gambusia affinis*), into habitats occupied by mosquito larvae. These fish are ideal candidates for this use because they are highly tolerant of a wide range of temperature and water quality conditions, they can reproduce rapidly, and they are highly effective at locating and consuming mosquito larvae. Mosquitofish are also opportunistic omnivores, eating other invertebrates when they are more abundant and feeding on algae during times when insects are not abundant. This species can affect aquatic food webs. They are known to feed on fish and amphibian eggs and larvae (Moyle 2002; Nico et al. 2013). Mosquitofish can compete with other small fish for food and can also prey on other fish and insect mosquito predators when those species are present.

The District's purchase and use of mosquitofish in a given situation is given careful consideration with regard to the potential ecological consequences of such introductions. District policy is to limit the use of mosquitofish to artificial aquatic habitats (e.g., ornamental fish ponds, water troughs, water gardens, fountains, waste and industrial ponds, and unmaintained swimming pools) that do not connect to natural waterbodies and, therefore, where they do not pose a threat to natural environments or native fish and amphibians. Other types of isolated man-made ponds that do not provide habitat that could support native species could be treated with mosquito fish. These artificial habitats are not included in HCP/NCCPs. Mosquitofish would not be introduced into any of the other habitat types. This alternative would not result in any noise related effects.

Mosquito control agents such as Bs (a live bacteria) or Bti, and *Saacharopolyspora spinosa* (bacteria byproducts) may be considered biological controls, but are regulated by USEPA. Therefore, they are addressed in the Chemical Control Alternative. Currently, no commercial biological control agents or products are available for wasp and yellow jacket control, and the District does not employ predators (e.g., cats) for rodent control.

Impact AR-19. The Biological Control Alternative would have **no impact** either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species.

4.2.6.2 Impacts to Habitats

The use of mosquitofish under the Biological Alternative would not affect any natural habitats or result in the presence of District personnel or equipment in natural habitats. Therefore, it would not affect the quantity or distribution of habitats, such as riparian areas, marshes, lakes or ponds, seasonal wetlands, or habitat types identified in local or regional plans, policies, regulations, or by the CDFW or USFWS. This alternative would not affect the composition of their vegetative community. This alternative would not result in any ground-disturbing activity and, therefore, would not result in any removal, filling or hydrologic interruption of federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.).

Impact AR-20. The Biological Control Alternative would have **no impact** on any riparian habitat or other sensitive natural community.

Impact AR-21. The Biological Control Alternative would have **no impact** on federally protected wetlands as defined by CWA Section 404.

4.2.6.3 Effects on Movement and Migration

This alternative would not occur in natural environments and would have no effect on the movement of wildlife and would not affect wildlife migration or movement corridors.

> **Impact AR-22.** The Biological Control Alternative would have **no impact** on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites.

4.2.6.4 Conflict with Local Ordinances

The county and city general plans and their goals pertaining to natural resources are protective of aquatic resources and focused on conservation of existing resources. Biological control activities with mosquitofish would not result in the conversion of natural habitats to other land uses or in the long-term or permanent dislocation of plant and animal species from natural areas except for mosquitoes and vectors of disease and discomfort. This alternative would not affect trees more than 4 inches diameter breast height and, therefore, would not conflict with local tree ordinances.

> **Impact AR-23.** The Biological Control Alternative would have **no impact** on local policies or ordinances protecting biological resources.

4.2.6.5 Conflict with Conservation Plans

Two conservation plans, Turkey Road and the SRPCS, were identified whose action area is within the District's primary Service Area. The Turkey Road HCP provides for protection and mitigation of impacts to California red-legged frog associated with residential and vineyard development. The SRPCS provides for the protection and mitigation of impacts to California tiger salamander and four listed plant species from development on the Santa Rosa Plain.

Biological control with mosquitofish would not be implemented within the boundaries of these conservations plans, unless appropriate protocols as required by the USFWS demonstrated that special-status species did not occupy that habitat and such habitat did not connect to other waters that could support special-status species.

The District regularly communicates with and works collaboratively with the SRPCS IRT (also referred to as the Implementation Committee) and representatives from agencies such as RWQCB, USEPA, USACE, CDFW, and USFWS.

Six conservation plans affect portions of adjacent counties. The District would not implement biological controls within the boundaries of these plan areas. When called into these adjacent counties to perform work, the District would operate under the auspices of the county or that county's mosquito and vector control district and in compliance with their practices and permits, including compliance with all active HCP/NCCPs. Therefore, the District activities would not be in conflict with the provisions of any adopted HCP, NCCP, or other approved local, regional, or state-approved conservation plan.

> **Impact AR-24**. The Biological Control Alternative would have **no impact** on approved HCPs, NCCPs, or local conservation plans.

4.2.7 Chemical Control Alternative

The Chemical Control Alternative would be primarily a continuation of existing activities using applicable techniques, equipment, vehicles, watercraft, and aircraft. A wide variety of chemicals and formulations are available for use to control mosquitoes and other adult insect vectors. These chemicals can be used as mosquito larvicides, adulticides, or both. Chemical control is also used to control nuisance populations of yellow jackets. The District does not currently perform control work with respect to tick populations but may potentially do a limited amount of control work in the future. The District does not use chemical control for rodents and nuisance wildlife.

Chemical control is a Program tool that consists of the application of nonpersistent insecticide products demonstrated to reduce populations of larval or adult mosquitoes and other vectors (e.g., yellow jacket wasps). If and when inspections reveal that mosquitoes or other vector populations are present at levels that trigger the District's guidelines for chemical control – based on the vector's abundance, density, species composition, proximity to human settlements, water temperature, presence of predators and other factors – staff will apply pesticides to the site in strict accordance with the pesticide label instructions and the BMPs summarized in Section 4.2.2 and listed in Table 4-6. The threshold guidelines for these response triggers are based on previous documentation and monitoring/current surveillance of likely vector outbreaks or population expansions. Additional response triggers are based on verified mosquito/vector populations, outbreaks, discomfort and irritation issues for humans and animals, and public concern about vectors.

A wide variety of chemicals and formulations are available for use to control mosquitoes. These chemicals can be used as mosquito larvicides, adulticides, or both. Chemical control may also be used to control populations of yellow jackets and ticks. The pesticide products used by the District are listed in Tables 2-2 through 2-4 in Chapter 2. Table 4-8 presents the chemical classes and their toxicity to fish and nontarget aquatic invertebrates. The synthetic pyrethroids allethrin, deltamethrin, and esfenvalerate are the materials under consideration by the District for use to control ticks in limited areas.

Table 4-8 Chemical Classes and their Toxicity[1] to Fish and Nontarget Aquatic Invertebrates

Class	Chemical	Mechanism of Action	Toxicity to	
			Fish	Nontarget Invertebrates
Mosquito Larvicides				
Bacterial Larvicides	Bs, Bti, spinosad	Paralyzes gut or disrupts central nervous system	Low	Low
Hydrocarbon esters	Methoprene and s-methoprene	Interferes with maturation process of insects	Moderate	High
Surfactants	Alcohol ethoxylated surfactant, aliphatic solvents (i.e., BVA-2, CoCo Bear oil), plant-derived oils	Drowns pupae and larvae	Very low	Affects Only Surface Breathing Insects
Mosquito Adulticides				
Pyrethrins	pyrethrin I and II, cinerin I and II, and jasmolin I and II	Causes persistent activation of the sodium channels on insect neurons resulting in "knock-down" agent	High	High
Pyrethroids	phenothrin, resmethrin, tetramethrin, permethrin, etofenprox	Interferes with operation of sodium channels in insect neurons	High	High
Synergist	Piperonyl butoxide	Synergist. Enhances operation of other active ingredients by inhibiting their breakdown	Moderate to High	High

Table 4-8 Chemical Classes and their Toxicity[1] to Fish and Nontarget Aquatic Invertebrates

Class	Chemical	Mechanism of Action	Toxicity to	
			Fish	Nontarget Invertebrates
Yellow Jackets and Ticks				
Pyrethrins	pyrethrin I and II, cinerin I and II, and jasmolin I and II	Causes persistent activation of the sodium channels on insect neurons resulting in "knock-down" agent	High	High
Pyrethroids	Allethrins, and d-*trans*-allethrin, deltamethrin, tetramethrin, phenothrin, permethrin, esfenvalerate, etofenprox	Interferes with operation of sodium channels in insect neurons	High	High
Synergist	Piperonyl butoxide	Synergist. Enhances operation of other active ingredients by inhibiting their breakdown	Moderate to High	High

[1] Toxicity information is summarized for each group from the information provided in Appendix B (Table 6-1).

[2] The toxicity data are derived from rigidly controlled laboratory animal studies designed to determine the potential adverse effects of the chemical under several possible routes of exposure (see Appendix B for further information). In these studies, the species of interest is continuously exposed to 100 percent chemical at several doses. In actual practice, the amounts applied in the District's Program Area are substantially less than the amounts used in the toxicity studies and organisms are not continuously exposed to the chemical. Furthermore, actual application rates by the District may be less than label requirements. Thus, the laboratory test results do not provide a realistic assessment of field exposure.

These chemicals are used in accordance with all applicable BMPs as listed in Table 4-6, CDPH's *Best Management Practices for Mosquito Control in California*, 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) and District-specific BMPs as indicated in the PAPs and APAPs. All of these measures are designed to minimize impacts to nontarget organisms.

The toxicity data included in the tables in this section 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 the lowest concentration resulting in a predetermined adverse effect (lowest observed adverse effect level [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 (no observed adverse effect level [NOAEL]). These two levels are used to describe the potential range of exposures that could result in adverse effects, including the highest dose with no observed effects.

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 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,[6] in actual practice, the amounts applied by the District in the District's Program Area for vector control are often substantially less than the amounts used in the laboratory 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 for vector control. 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). Thus, adverse effects may still occur to some nontarget organisms. However, the chemicals would be applied in strict accordance with label directions, and BMPs contained in Table 4-6, including those relating to worker environmental awareness training, and disturbance minimization measures. The specific BMPs covering "Applications of Pesticides, Surfactants, and/or Herbicides" would be applied, as would appropriate habitat and species-specific BMPs. These practices make it highly unlikely that this alternative would result in adverse effects to special-status species or their habitats.

This assessment also considers the physical and biological connections between treatment areas and aquatic ecosystems. These chemicals are assessed by the vectors they are primarily used to control, and are grouped within these vectors into classes based on their composition, mechanism of action, and relative effect on aquatic resources (Tables 4-3 and 4-4). This section focuses on the potential impacts of these chemicals on fish, amphibians, aquatic reptiles, and aquatic invertebrates. These chemicals are discussed in greater detail in Chapter 6, Ecological Health, and in Appendix B.

Pesticides may be applied using motorized equipment including trucks, ARGOs, watercraft, and rotary or fixed-wing aircraft operating at low altitudes. Each application is expected to take less than a day (perhaps two days for larger areas), and thus the noise effects would be temporary. This would be expected to have the largest effect on adult amphibians when they are out of the water (or on terrestrial animals, discussed in Chapter 5), and would cause them to move away from the work area. Impacts to purely aquatic organisms from noise and vibration are not expected to occur.

4.2.7.1 Impacts to Special-Status Species

4.2.7.1.1 Mosquito Larvicides

Mosquito larvicides are applied to aquatic and wetland environments that surveillance has identified as having substantial concentrations of mosquito larvae. Larvicides may be applied in any of the aquatic and wetland habitat types previously listed. Special care is used when treating vernal pool habitats because of the number of special-status invertebrate species endemic to these habitats. The District predominantly applies Bti, Bs mosquito treatment is required in vernal pools. If mosquitoes reach the late stages of development in the larval cycle, methoprene may be applied (e.g., methoprene liquid). Surfactants (i.e., oils or monomecular films) are typically not applied to vernal pools; however an application of these materials may be considered if an abundance of mosquitoes in the pupal stage are present and present a potential threat to public health.

Bacterial Larvicides

These larvicides are developed from bacteria that have natural insecticidal properties. Concentrates are prepared that include fermentation solids, bacterial spores, and insecticidal toxins. These larvicides act by paralyzing the gut when ingested, causing the mosquito larvae to starve. Because Bs is a live bacterial pathogen of mosquitoes it may persist in the environment for 2 to 4 weeks; Bti, which is nonliving and consists of protein spores and crystals, generally persists for 1 to 4 days.

[6] Although the MSDS format is referenced in this document, it should be noted that under the international Globally Harmonized System, the MSDS format has been substantially revised and is now largely replaced by standardized Safety Data Sheets (SDSs).

Neither Bs nor Bti are acutely toxic to nontarget species including fish and invertebrates, nor are they toxic to predators of mosquito larvae (Appendix B). Bti may affect some dipterans (chironomids, simullids, ceratopogonids, and dixids), but only at concentrations 10 to 1,000 times higher than what is allowed for mosquito control.

Spinosad is a biologically derived insecticide produced from the fermentation of *Saccharopolyspora spinosa*, a naturally occurring soil organism. Spinosad activates the central nervous system of insects through interaction with neuroreceptors and causes continuous stimulation of the insect nervous system. In water, spinosad is degraded primarily through photolysis, and has a half-life of less than 1 day. It is slightly to moderately toxic to fish and most aquatic invertebrates. It may have slight impacts on some aquatic invertebrates with chronic exposure, but application for mosquitoes tends to be episodic, and given the rapid breakdown of spinosad in the environment, chronic exposure is unlikely.

Hydrocarbon Esters

Methoprene is an insect growth regulator and selective larvicide. Methoprene is used primarily against mosquitoes, but can also be used at much higher concentrations for the control of flies, moths and butterflies, and beetles. Methoprene interferes with the development of larval insects, preventing them from becoming adults. Within the aquatic environment, methoprene has a half-life of a few hours to a couple of days, but is sometimes applied in an extended release format, which may persist for many days or even months in the environment. Methoprene is effective for mosquito control at concentrations of up to 5.0 micrograms per liter (µg/L), with the District generally applying it at a maximum concentration of 2.4 – 4.8 (µg/L). At these application rates, some effects may occur to some nontarget midges (*Chironomidae*) and blackflies (*Simuliidae*), but these populations recover quickly after treatment (Appendix B; Maffei, pers. comm., 2013). No other invertebrates have shown signs of toxicity at these concentrations. Methoprene can be toxic to fish, but the lowest median lethal dose[7] (LD50 4.62 milligrams per kilogram [mg/L]) is several orders of magnitude greater (over 9,000 times) than the dose used by the District to control mosquitoes. The District infrequently applies methoprene to vernal pools. Methoprene may be applied when mosquito populations are abundant in the pools and when mosquitoes have reached the later stages of development.

Considered one of the least environmentally disruptive larvicides available, the District uses methoprene prevalently during each season of the year. Liquid and granular forms are used in residential and ornamental pond application scenarios. Treatments to wetlands, including marshes, at times require the granular form (e.g., Altosid pellets) to penetrate dense aquatic vegetation including cattails and tules. See Section 9.2.7.1 for discussion of use of methoprene in malfunctioning onsite wastewater treatment systems due to improper lid seals, cracks, or missing vent screens and/or due to drain fields where water ponds on the surface.

Surfactants

Surfactants (mostly alcohol ethoxylated surfactants, aliphatic solvents, and plant-derived oils) work by making it difficult for mosquito larvae and pupae to attach to the water's surface, causing them to drown. Surfactants affect only the uppermost layer of the water. The use of these materials is employed when absolutely necessary to prevent emergence of mosquito populations. They are nontoxic to most organisms at label application rates, but may impact other surface-breathing aquatic insects. The numbers of these nontarget surface-breathing insects were temporarily reduced following treatment, but recovered within a few days at Don Edwards Wildlife Area (Miles et al. 2002). These short-term impacts on a small portion of the food chain and in a limited area within a wetland are unlikely to result in substantive impacts to nontarget species in the aquatic environment.

[7] LD50 refers to the lethal single dose of a chemical (amount of chemical regardless of the volume of liquid in which it is delivered) that that would kill 50 percent of a group of test animals treated with that dose.

Impact AR-25: The Chemical Control Alternative's mosquito larvicides would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.

4.2.7.1.2 Mosquito Adulticides

In addition to chemical control of mosquito larvae, the District may use pesticides for control of adult mosquitoes as a component of the IVMP, for example, when other tools are not effective or appropriate and adult mosquito control guidelines are met, including species composition, abundance (as measured by landing count or other quantitative method), proximity to human populations, and/or human disease risk. Adulticide materials are used only as needed to control adult mosquito populations. However, adulticides are generally the last tool used, when mosquito populations cannot or have not been controlled at their source using physical control or larvicides. Adulticides are applied from the ground via truck, ATVs, utility vehicles, or handheld devices as an ULV application.

Aerial adulticiding could be used in the future to deal with a severe outbreak or risk of mosquito-borne disease transmission. Aerial applications would be made using ULV techniques. Aerial application of adulticide may be the only reliable means of obtaining effective control in areas bordered by extensive mosquito production sites with a small, narrow, or inaccessible network of roads, or to cover a very large area quickly in case of unusually severe mosquito outbreaks or vector-borne disease epidemics. In making the decision to use this technique, the District considers the potential effects on human health and the potential for environmental harm. For example, the maximum application rate of an adulticide that could be used is 0.87 ounce/acre, although maximum application rates are generally not required. The concentration of the active ingredient is 5 percent or less of this volume. This translates into a water concentration of 1.04 µg/L if the water is one foot deep or 4.14 µg/L if the water is three inches deep. This assumes all of the product contacts the water. Aerial applications are made over vegetated areas preferred by adult mosquitoes, so the amount of product encountering the water is generally a fraction of this. The chemicals used are selected for rapid breakdown and are typically present for a few hours to a couple of days after application.

Pyrethrins and Synthetic Pyrethroids

Pyrethrins are naturally occurring products distilled from the flowers of the *Chrysanthemum* species. Pyrethroid insecticides are synthetic compounds that are chemically similar to the pyrethrins that have been modified to increase stability and activity against insects. They are highly potent insecticides, that can be highly toxic to fish and aquatic invertebrates as well, sometimes at environmental concentrations of less than 1 µg/L. The presence of these pesticides in aquatic environments can result in lethal and sublethal effects on fish and aquatic invertebrates. Where substantial numbers of such organisms are affected, food supplies can be diminished, resulting in indirect effects to secondary and tertiary consumers dependent on the aquatic food web, including aquatic invertebrates, fish, amphibians, and birds. Both sets of compounds tend to break down relatively quickly in the environment, often within hours, and usually within a few days. Of the pyrethroids that are applied adjacent to aquatic environments, phenothrin and permethrin are more persistent than the other chemicals in this group, with half lives of days to months in water under aerobic conditions.

Pyrethrins and pyrethroids are applied in ULV applications by aircraft, truck, ATV, or handheld foggers and include pyrethrins, phenothrin, and permethrin. Numerous studies have found that these ULV applications result in concentrations in the aquatic environment of 0.23 to 3.77 µg/L and had little to no effect on fish or nontarget aquatic invertebrates (see Appendix B).

Piperonyl Butoxide

PBO is a synergist, a chemical applied with a pesticide to enhance the effectiveness of the pesticide (Appendix B). PBO works by interfering with an insect's ability to detoxify pyrethrins and pyrethroids. PBO is moderately toxic to fish (LD50=1.9 to 3.94 mg/L) and moderately to highly toxic) to aquatic invertebrates (0.51 to 12.0 mg/L). However, its toxicity is much lower than that of the pesticides it is used with. PBO can break down relatively rapidly by photolysis (half-life of 8.4 hours), but has a half-life exceeding 30 days based on aerobic metabolism in water. Although it degrades rapidly, release of PBO to the environment may "activate" persistent pyrethroids that are already present in the sediment. Field tests indicate that PBO concentrations were very low (~2 µg/L) immediately after 3 consecutive nights of treatment, declined rapidly thereafter, and was undetectable 8 days after application (see Appendix B). A number of studies indicate that PBO, when applied at the levels used for mosquito control, did not have any detectable effect on sentinel species (Appendix B). These studies also indicate that PBO does not persist in the environment very long after application. This information indicates that the use of PBO will not substantially affect aquatic organisms.

> **Impact AR-26**: The Chemical Control Alternative's mosquito adulticides would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.

4.2.7.1.3 Yellow Jacket and Tick Abatement

The District may use pesticides (typically pyrethrin and some pyrethroids) to control yellow jackets and ticks that pose an imminent threat to people or pets, generally because of public requests for assistance. These pesticides are highly toxic to fish and aquatic invertebrates, as described in Section 4.2.7.2. For control of yellow jackets and ticks, these pesticides are applied in highly localized, upland areas.

Examples of pesticides the District might employ to control yellow jackets and/or ticks in residential or upland environments are: allethrin and d-*trans* allethrin, deltamethrin, esfenvalerate, phenothrin, and tetramethrin. These compounds would only be expected to enter the aquatic environment through runoff. All degrade rapidly and bind readily to soil, so they are not anticipated to enter aquatic environments in sufficient quantities to result in adverse effects.

A few of the pyrethroids are bioaccumulative in fish, meaning that they can occur in organisms at higher concentrations than what occurs in the environment. These bioaccumulative pyrethroids include deltamethrin and esfenvalerate. However, these pyrethroids are applied directly into yellow jacket nests, and so would not enter the aquatic environment. The District typically does not engage in tick control activities, but could in the event of a tick borne disease outbreak. In such an event, the pesticides esfenvalerate and/or deltamethrin, would not be deployed close to water, as this is not preferred habitat for ticks. Therefore, these compounds are not expected to affect fish or other aquatic organisms.

Because of the small quantity of pesticide applied and because these chemicals are not applied directly to aquatic environments, this control method would have little impact on aquatic organisms.

> **Impact AR-27.** The Chemical Control Alternative's control of yellow jackets and ticks would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special- status species. No mitigation is required.

4.2.7.2 Impacts to Habitats

The Chemical Control Alternative would not affect the quantity or distribution of habitats, such as riparian areas, marshes, lakes or ponds, seasonal wetlands, or habitat types identified in local or regional plans, policies, regulations, or by the CDFW or USFWS. This alternative would not affect the composition of their vegetative communities, as the pesticides used would not be expected to affect plants or their physical or hydrologic attributes. This alternative would not result in any ground-disturbing activity and, therefore,

would not result in any removal, filling, or hydrologic interruption of federally protected wetlands (including but not limited to, marsh, vernal pool, coastal, etc.). The use of adulticides has not been required in direct association with mosquito production in vernal pools and this is not anticipated to be an issue in the foreseeable future. If adulticide use were to become necessary within close proximity (relative to swath widths of ULV application equipment) to vernal pools, applications would be performed in strict accordance with the product label, using the appropriate BMPs as listed in Table 4-6, and in consultation with property owners.

Impact AR-28. The Chemical Control Alternative would have **no impact** on any riparian habitat or other sensitive natural community

Impact AR-29. The Chemical Control Alternative would not result in the direct removal, filling, or hydrological interruption of federally protected wetlands as defined by CWA Section 404 and would have a have **no impact** on these resources.

4.2.7.3 Effects on Movement and Migration

Any disruption of migration patterns would be due to the presence of personnel and machinery in the environment. In all cases this would be a very short-term occurrence, generally not more than a few hours in any given location and, therefore, this effect would be minimal and would have little effect on the movement of wildlife and would not affect wildlife migration corridors or nursery areas, as no physical disturbance would occur.

Impact AR-30. The Chemical Control Alternative would have a **less-than-significant** impact on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites. No mitigation is required.

4.2.7.4 Conflict with Local Ordinances

The county and city general plans and their goals and policies pertaining to natural resources are protective of aquatic resources and focused on conservation of existing resources. Chemical control activities would not result in the conversion of natural habitats to other land uses or in the long-term or permanent dislocation of plant and animal species from natural areas except indirectly for mosquitoes and vectors of disease and discomfort. The Program would not affect trees more than 4 inches diameter breast height and, therefore, would not conflict with any tree ordinances.

Impact AR-31. The Chemical Control Alternative would have **no impact** on local policies or ordinances protecting biological resources.

4.2.7.5 Conflict with Conservation Plans

Two conservation plans, Turkey Road and the SRPCS, were identified whose action area is within the District's primary Service Area. The Turkey Road HCP provides for protection and mitigation of impacts to California red-legged frog associated with residential and vineyard development. The SRPCS provides for the protection and mitigation of impacts to California tiger salamander and four listed plant species from development on the Santa Rosa Plain.

The District may conduct chemical control operations within the area covered by the regional SRPCS. The District regularly communicates with and works collaboratively with the SRPCS IRT (also referred to as the Implementation Committee) and representatives from agencies such as RWQCB, USEPA, USACE, CDFW, and USFWS. The District receives training from agency staff and independent biologists (e.g., CDFW, USACE) to minimize impacts and conducts annual field training for field staff regarding precautionary and avoidance measures related to vernal pool habitat. The District uses specialized equipment in conjunction with vernal pool habitats.

Six conservation plans affect portions of adjacent counties. District activities are typically not among those covered by these HCPs. When called into these adjacent counties to perform work, the District would operate under the auspices of the county or that county's mosquito and vector control district and in compliance with their practices and permits, including compliance with all active HCP/NCCPs. Therefore, the District activities would not be in conflict with the provisions of any adopted HCP, NCCP, or other approved local, regional, or state-approved conservation plan.

Impact AR-32. The Chemical Control Alternative would have a **less-than-significant** impact on approved HCPs, NCCPs, or local conservation plans. No mitigation is required.

4.2.8 Other Nonchemical Control/Trapping Alternative

The trapping of rodents is conducted as part of disease surveillance/testing programs and may be utilized for surveillance and egregious situations regarding commensal rodents (e.g., roof rats and Norway rats) in the future. Rodent trapping is not and will not be performed routinely as a mass trapping control measure. Trapping of yellow jackets is conducted when these organisms pose a threat to public health and welfare. For yellow jackets, District staff place the tamper-resistant or baited trap(s) primarily at the request of the property owner or manager, although they also advise the landowner that trapping is generally ineffective at population control and that it is better to seek out and treat the nest. The District does not remove rats or yellow jackets that are in or on structures. When these requests for service are made, residents are referred to the local animal control or to a directory of private pest control companies.

4.2.8.1 Impacts to Special-Status Species

The Other Nonchemical Control/Trapping Alternative is focused on trapping rodents, yellow jackets, and other organisms not associated with aquatic environments. This activity would not impact aquatic environments or the species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS that occupy these environments and, therefore, would not affect them.

Impact AR-33. The Other Nonchemical Control/Trapping Alternative would have **no impact** either directly or through habitat modifications, on any aquatic species identified as a candidate, sensitive, or special-status species.

4.2.8.2 Impacts to Habitats

This alternative would not affect the quantity or distribution of habitats, such as riparian areas, marshes, lakes or ponds, seasonal wetlands, or other habitat types identified in local or regional plans, policies, regulations, or by the CDFW or USFWS. This alternative would not affect the composition of their vegetative communities as the placement of traps and baits would not affect plants. This alternative would not result in any ground-disturbing activity and, therefore, would not result in any removal, filling or hydrologic interruption of federally protected wetlands (including but not limited to, marsh, vernal pool, coastal, etc.).

Impact AR-34. The Other Nonchemical Control/Trapping Alternative would have **no impact** on any riparian habitat or other sensitive natural community.

Impact AR-35. The Other Nonchemical Control/Trapping Alternative would have **no impact** on federally protected wetlands as defined by CWA Section 404.

4.2.8.3 Effects on Movement and Migration

Any disruption of migration patterns would be due to the presence of personnel to set traps in the environment. In all cases this would be a very short-term occurrence, generally not more than a few hours in any given location and, therefore, this effect would be minimal and would have little effect on the movement of wildlife and would not affect wildlife migration corridors or nursery areas, as no physical disturbance would occur.

> **Impact AR-36.** The Other Nonchemical Control/Trapping Alternative would have **no impact** on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites.

4.2.8.4 Conflict with Local Ordinances

The county and city general plans and their goals and policies pertaining to natural resources are protective of aquatic resources and focused on conservation of existing resources. Nonchemical control/trapping activities would not result in the conversion of natural habitats to other land uses or in the long-term or permanent dislocation of plant and animal species from natural areas. The Program would not affect trees more than 4 inches diameter breast height and, therefore, would not conflict with any tree ordinances.

> **Impact AR-37.** The Other Nonchemical Control/Trapping Alternative would have **no impact** on local policies or ordinances protecting biological resources.

4.2.8.5 Conflict with Conservation Plans

Two conservation plans, Turkey Road and the SRPCS, were identified whose action area is within the District's primary Service Area. The Turkey Road HCP provides for protection and mitigation of impacts to California red-legged frog associated with residential and vineyard development. The SRPCS provides for the protection and mitigation of impacts to California tiger salamander and four listed plant species from development on the Santa Rosa Plain.

Nonchemical controls including trapping would not be implemented within the boundaries of these conservations plans, unless appropriate protocols as required by the USFWS demonstrated that special-status species did not occupy that habitat and such habitat did not connect to other waters that could support special-status species.

The District regularly communicates with and works collaboratively with the SRPCS IRT (also referred to as the Implementation Committee) and representatives from agencies such as RWQCB, USEPA, USACE, CDFW, and USFWS.

Six conservation plans affect portions of adjacent counties. The District would not implement biological controls within the boundaries of these plan areas. When called into these adjacent counties to perform work, the District would operate under the auspices of the county or that county's mosquito and vector control district and in compliance with their practices and permits, including compliance with all active HCP/NCCPs. Therefore, the District activities would not be in conflict with the provisions of any adopted HCP, NCCP, or other approved local, regional, or state-approved conservation plan.

> **Impact AR-38**. The Other Nonchemical Control/Trapping Alternative would have **no impact** on approved HCPs, NCCPs, or local conservation plans.

4.2.9 Cumulative Impacts

Cumulative impacts on aquatic resources are discussed in Section 13.2. The determination is whether a proposed project's incremental contribution to a cumulative impact results in a potentially "considerable" (i.e., significant) cumulative impact is summarized herein.

The following is a summary of the Program impacts that could become cumulatively considerable with other impacts in the region. To make this determination, consideration is given to the combined contribution of Program impacts considered together with impacts that exist outside of the Program Area.

4.2.9.1 Regional Fisheries Trends

4.2.9.1.1 Pelagic Organism Decline (POD)

POD refers to the recent (2002–present) steep decline of pelagic fishes (i.e., fish that occupy open-water habitats) within the Bay-Delta estuary (Armor et al. 2005; CDWR and CDFG 2007; Sommer 2007; Baxter et al. 2010). This environmental issue has emerged as one of overwhelming concern in the Delta.

As the District borders on San Pablo Bay, the Physical Control and Vegetation Management alternatives could contribute to landscape habitat modifications, while the Chemical Control Alternative could contribute to contaminants:

> The District's Physical Control and Vegetation Management alternatives are limited to small areas of highly modified habitat. Because these areas are not primary habitat for POD species and because the areas where these activities occur are very small relative to the overall area of wetlands in the region, these activities are not expected to have any substantive effect on food production for POD species. Therefore, these alternatives do not contribute substantially to POD.

> The Chemical Control Alternative includes the use of pyrethrin and pyrethroid pesticides, which have been linked to POD. The District uses pyrethrin and pyrethroid pesticides as part of an IPM approach, where application of these materials is several levels down in the selection of control measures, so the use of pyrethrins and pyrethroids is limited. When pyrethrins and pyrethroids are used, the District preferentially uses those with limited persistence in the environment. The District uses pyrethroids over aquatic habitats using only ULV applications, which results in the minimal effective amounts of these chemicals. Thus, the Chemical Control Alternative does not contribute substantially to the concentrations of pyrethroids in the environment or to the POD.

> The Surveillance, Biological Control, and Other Nonchemical Control Alternatives involve access, monitoring, and control activities with very limited potential to impact POD.

Therefore, all of the Program alternatives have a **less-than-significant cumulative impact on POD**.

4.2.9.1.2 Salmonid Population Trends

Salmonid population trends were evaluated in a number of 5-year status reviews completed by NOAA Fisheries in 2011 (NOAA Fisheries 2011 a-f). These reviews indicated that most populations of salmonids showed some evidence of decline. However, based on the status reviews for these species, the principal factors resulting in their listing include:

> Loss, degradation, simplification, and fragmentation of habitat caused by a variety of activities including logging, road construction, urban development, mining activities, agriculture, ranching, and recreation

> Reduction or elimination of habitat or blocked access to habitat caused by water storage, withdrawal, conveyance and diversion facilities for agriculture, flood control, and domestic and hydropower purposes

> Point and nonpoint sources of pollution

> Loss of riparian habitats

The Physical Control and Vegetation Management alternatives could contribute to the first and last factors, while the Chemical Control Alternative could contribute to the third factor. These activities generally occur over small areas and have little impact on primary salmonid habitat. The BMPs that would be implemented as part of these alternatives substantially reduces these potential effects, so that the resultant effect is less than significant at the Program level, and does not contribute substantially to the total amount of habitat loss for salmonids in the region. The Surveillance, Biological Control, and Other Nonchemical Control Alternatives involve access, monitoring, and control activities with no potential to impact salmonids. Therefore, all of the Program alternatives have a **less-than-significant cumulative impact on salmonid population trends**.

4.2.9.2 Program Alternatives

The Surveillance Alternative's maintenance of access routes and the sampling/ monitoring of mosquito and vector populations have less-than-significant impacts on aquatic habitats, native fish or aquatic invertebrates, special-status species, or HCPs and NCCPs. This alternative, along with the Biological Control Alternative's use of mosquitofish in artificial/man-made waterbodies and the trapping associated with the Other Nonchemical Control Alternative are not cumulatively considerable given their minimal disruption to natural habitats. Consequently, the focus of the analysis below is on the Physical Control, Vegetation Management, and Chemical Control Alternatives.

4.2.9.2.1 Physical Control Alternative

The draining or filling of shallow-water habitats in natural areas under the Physical Control Alternative would be cumulative with historic and ongoing impacts to these habitats from other land management practices including flood control, urbanization, and channelization. The majority of such activities occurring as part of the action would occur in artificial environments such as drainage ditches, retention ponds, etc.

Activities affecting wetlands are subject to permitting requirements from a variety of agencies including the USACE, SWRCB or RWQCBs, CDFW, BCDC, and others. However, wetlands continue to be affected by urban and agricultural development, roadwork, and other activities (Resource Agency 2010), an existing significant cumulative impact. The District's activities within this context do not contribute substantially to the cumulative effects of other activities within the region in part due to the constraints of required permits. Therefore, the Program would have a **less-than-significant cumulative impact on the amount or quality of aquatic habitat**.

4.2.9.2.2 Vegetation Management Alternative

The vegetation within and around aquatic habitats is an important component of the aquatic ecosystem, as described in Section 4.2.5.

Invasive weeds and vegetation can disrupt native habitats. They compete with and may displace native plants, which may interfere with ecosystem functions, by altering and reducing the food resources available to primary and secondary consumers. Vegetation control activities the District(s) perform would be cumulative with those performed by other entities. These activities would focus on areas with dense concentrations of weeds and not on individual weed plants distributed broadly in otherwise natural habitats. Thus, vegetation control activities may affect native plants, as these species may lie within treatment areas, but the effects on individuals of native species are minimized, and the overall effect is likely beneficial, as native species will have less competition in treated areas and, thus, would be expected to be more successful. Therefore, there is not an existing significant cumulative impact to native habitats. The District's incremental activities associated with the **control of invasive weeds and vegetation would not be cumulatively considerable or less than significant**.

4.2.9.2.3 Chemical Control Alternative

The uses of pesticides under the Chemical Control Alternative would be cumulative with uses of pesticides by agricultural, industrial, governmental, and residential users, an existing significant cumulative impact. Contaminants and pesticides have been hypothesized to contribute to declines in fish populations. The District's relative contribution to the loads of such concentrations is small compared with other users. Applications of pesticides for vector control are most often at concentrations less than the maximum allowed on the product label, and nontarget species are not substantially affected and acute toxicities are avoided. The amounts applied by the District for vector control are often substantially less than the amounts used in the laboratory 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 for vector control. The District preferentially uses nonchemical alternatives and when using chemical alternatives, uses chemicals that are not persistent in the environment when chemicals are applied. As such, the District's Chemical Control Alternative does not contribute substantively to pesticide and herbicide loads in the aquatic environment. The Chemical Control Alternative has a **less-than-significant cumulative impact on herbicide and pesticide loads**.

4.2.10 Environmental Impacts Summary

Table 4-9 provides a summary of the environmental impacts of the Program alternatives on aquatic resources. Discussion of these impacts is provided in the preceding sections.

Table 4-9 Summary Biological Aquatic Impacts by Alternative

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Effects on Biological Resources – Aquatic						
Impact AR-1. The Surveillance Alternative would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.	LS	na	na	na	na	na
Impact AR-2. The Surveillance Alternative would have a **less-than-significant** impact on any riparian habitat or other sensitive natural community No mitigation is required.	LS	na	na	na	na	na
Impact AR-3. The Surveillance Alternative would have a **less-than-significant** impact on federally protected wetlands as defined by Section 404 of the Clean Water Act. No mitigation is required.	LS	na	na	na	na	na
Impact AR-4. The Surveillance Alternative would have **no impact** on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites.	N	na	na	na	na	na
Impact AR-5. The Surveillance Alternative would have **no impact** on local policies or ordinances protecting biological resources.	N	na	na	na	na	na
Impact AR-6. The Surveillance Alternative has a **less-than-significant** impact on any adopted HCPs or NCCPs. No mitigation is required.	LS	na	na	na	na	na
Impact AR-7. The Physical Control Alternative, would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.	na	LS	na	na	na	na
Impact AR-8. The Physical Control Alternative would have a **less-than-significant** impact on any riparian habitat or other sensitive natural community. No mitigation is required.	na	LS	na	na	na	na

Table 4-9 Summary Biological Aquatic Impacts by Alternative

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Impact AR-9. The Physical Control Alternative would have a **less-than-significant** impact on federally protected wetlands as defined by Section 404 of the Clean Water Act. No mitigation is required.	na	LS	na	na	na	na
Impact AR-10. The Physical Control Alternative would have a **less-than-significant impact on** the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites. No mitigation is required.	na	LS	na	na	na	na
Impact AR-11. The Physical Control Alternative would have **no impact** on local policies or ordinances protecting aquatic resources.	na	N	na	na	na	na
Impact AR-12. The Physical Control Alternative would have a **less-than-significant** impact on adopted HCPs or NCCPs. No mitigation is required.	na	LS	na	na	na	na
Impact AR-13. The Vegetation Management Alternative would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.	na	na	LS	na	na	na
Impact AR-14. The Vegetation Management Alternative would have a **less-than-significant** impact on any riparian habitat or other sensitive natural community. No mitigation is required.	na	na	LS	na	na	na
Impact AR-15. The Vegetation Management Alternative would not result in the direct removal, filling, or hydrological interruption of federally protected wetlands as defined by CWA Section 404. As such, this alternative and would have a have a **less-than-significant** impact on these resources. No mitigation is required.	na	na	LS	na	na	na

Table 4-9 Summary Biological Aquatic Impacts by Alternative

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Impact AR-16. The Vegetation Management Alternative would have **a less-than-significant** impact on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites. No mitigation is required.	na	na	LS	na	na	na
Impact AR-17. The Vegetation Management Alternative would have **no impact** on local policies or ordinances protecting biological resources.	na	na	N	na	na	na
Impact AR-18. The Vegetation Management Alternative would have a **less-than-significant** impact on adopted HCPs or NCCPs. No mitigation is required.	na	na	LS	na	na	na
Impact AR-19. The Biological Control Alternative would have **no impact** either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species.	na	na	na	N	na	na
Impact AR-20. The Biological Control Alternative would have **no impact** on any riparian habitat or other sensitive natural community.	na	na	na	N	na	na
Impact AR-21. The Biological Control Alternative would have **no impact** on federally protected wetlands as defined by CWA Section 404.	na	na	na	N	na	na
Impact AR-22. The Biological Control Alternative would have **no impact** on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites.	na	na	na	N	na	na
Impact AR-23. The Biological Control Alternative would have **no impact** on local policies or ordinances protecting biological resources.	na	na	na	N	na	na
Impact AR-24. The Biological Control Alternative would have **no impact** on approved HCPs, NCCPs, or local conservation plans.	na	na	na	N	na	na

Table 4-9 Summary Biological Aquatic Impacts by Alternative

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Impact AR-25: The Chemical Control Alternative's mosquito larvicides would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.	na	na	na	na	LS	na
Impact AR-26: The Chemical Control Alternative's mosquito adulticides would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.	na	na	na	na	LS	na
Impact AR-27. The Chemical Control Alternative's control of yellow jackets and ticks would have a **less-than-significant** impact either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. No mitigation is required.	na	na	na	na	LS	na
Impact AR-28. The Chemical Control Alternative would have **no impact** on any riparian habitat or other sensitive natural community	na	na	na	na	N	na
Impact AR-29. The Chemical Control Alternative would not result in the direct removal, filling, or hydrological interruption of federally protected wetlands as defined by CWA Section 404 and would have a have **no impact** on these resources.	na	na	na	na	N	na
Impact AR-30. The Chemical Control Alternative would have a **less-than-significant** impact on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites. No mitigation is required.	na	na	na	na	LS	na
Impact AR-31. The Chemical Control Alternative would have **no impact** on local policies or ordinances protecting biological resources.	na	na	na	na	N	na

Table 4-9 Summary Biological Aquatic Impacts by Alternative

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Impact AR-32. The Chemical Control Alternative would have a **less-than-significant** impact on approved HCPs, NCCPs, or local conservation plans. No mitigation is required.	na	na	na	na	LS	na
Impact AR-33. The Other Nonchemical Control/Trapping Alternative would have **no impact** either directly or through habitat modifications, on any aquatic species identified as a candidate, sensitive, or special-status species.	na	na	na	na	na	N
Impact AR-34. The Other Nonchemical Control/Trapping Alternative would have **no impact** on any riparian habitat or other sensitive natural community.	na	na	na	na	na	N
Impact AR-35. The Other Nonchemical Control/Trapping Alternative would have **no impact** on federally protected wetlands as defined by CWA Section 404.	na	na	na	na	na	N
Impact AR-36. The Other Nonchemical Control/Trapping Alternative would have **no impact** on the movement of any native resident or migratory fish or wildlife species. Nor would it impact any native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites.	na	na	na	na	na	N
Impact AR-37. The Other Nonchemical Control/Trapping Alternative would have **no impact** on local policies or ordinances protecting biological resources.	na	na	na	na	na	N
Impact AR-38. The Other Nonchemical Control/Trapping Alternative would have **no impact** on approved HCPs, NCCPs, or local conservation plans.	na	na	na	na	na	N

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

4.2.11 Mitigation and Monitoring

The implementation of the alternatives would not result in any significant impacts on aquatic or wetland resources. All impacts are either less-than-significant or none. Therefore, no mitigation is required.