CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD

AMENDMENTS TO THE WATER QUALITY CONTROL PLAN FOR THE SACRAMENTO AND SAN JOAQUIN RIVER BASINS

FOR

THE CONTROL OF DIAZINON AND CHLORPYRIFOS DISCHARGES

FINAL STAFF REPORT

MARCH 2014

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
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List of Acronyms and Abbreviations

§	Section
µg/L	Micrograms per liter (0.1µg/L = 100 ng/L)
ACR	Acute to chronic ratio
avg.	Average
APCD	Air Pollution Control District
AQMD	Air Quality Management District
Basin Plan	Water Quality Control Plan for the Sacramento River and San Joaquin River Basins
CCC	Criterion Continuous Concentration
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CMC	Criterion Maximum Concentration
CRWQCB-CVR	California Regional Water Quality Control Board – Central Valley Region (or Central Valley Water Board)
CWA	Federal Clean Water Act
Delta	Sacramento-San Joaquin Delta
DPR	California Department of Pesticide Regulation
DWR	California Department of Water Resources
ESA	Endangered Species Act
g/day	grams/day
GHG	Greenhouse Gas
Koc	Organic carbon adsorption coefficient
LA	Load Allocation
lbs.	Pounds
LC	Loading Capacity
MAA	Management Agency Agreement
MS4	Municipal Separate Storm Sewer System
ng/L	Nanograms per liter (100 ng/L = 0.1µg/L)
NPDES	National Pollution Discharge Elimination System
NPS	nonpoint source
nr	Near
OP	Organophosphate
ppm	parts per million
PERA	Probabilistic Ecological Risk Assessment
Porter-Cologne	Porter-Cologne Water Quality Control Act
QA	quality assurance
QC	quality control
PUR	Pesticide Use Report

Sac R	Sacramento River
SJR	San Joaquin River
SNARL	Suggested No Adverse Response Level
State Water Board	State Water Resources Control Board
TEQ	toxic equivalents
TMDL	Total Maximum Daily Load
UCCE	University of California Cooperative Extension
UC Davis	University of California, Davis
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
Water Code	California Water Code
WDR	Waste Discharge Requirements
WLA	Wasteload Allocation
WQC	Water Quality Criteria
WQO	Water Quality Objective

TABLE OF CONTENTS

APPENDICES

- Appendix A: Summary Of Water Quality Monitoring Programs, Studies, and Databases Used As Sources Of Diazinon and Chlorpyrifos Concentration Data
- Appendix B: Cost Calculations
- Appendix C: Proposed Basin Plan Amendment

LIST OF FIGURES

LIST OF TABLES

Executive Summary

Diazinon and chlorpyrifos are insecticides that are currently widely used in agriculture in the Central Valley. Though these insecticides were also once widely used in urban settings, the United States Environmental Protection Agency has recently cancelled almost all of their nonagricultural uses.

Since the early 1990s, these insecticides have impaired surface water bodies in the Central Valley. A surface water body is considered impaired by diazinon and chlorpyrifos when data indicate that these insecticides are found at concentrations that exceed applicable narrative water quality objectives established in the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (Basin Plan). In order to address diazinon and chlorpyrifos impairments throughout a large portion of the Central Valley Region, staff of the Central Valley Regional Water Quality Control Board (Central Valley Water Board or Board) have developed the proposal that is discussed in this Staff Report.

The proposal involves the adoption of a proposed Basin Plan Amendment (the Proposed Amendment) that would establish numeric water quality objectives for diazinon and chlorpyrifos in many water bodies in the Central Valley. The Proposed Amendment would also establish a control program that will ensure that the numeric water quality objectives will be achieved. The Proposed Amendment is provided in Appendix C.

Generally speaking, the federal Clean Water Act requires that the Board establish Total Maximum Daily Loads (TMDLs) to address pollutant exceedances that result in water quality impairments (i.e., federal Clean Water Act section 303(d) listings). However, if the Board can demonstrate that other pollution control requirements will successfully address an impairment, then a TMDL is not necessary. The Proposed Amendment will establish pollution control requirements for 31 water bodies that are currently on the 303(d) list due to diazinon and/or chlorpyrifos impairments. These include 5 constructed water bodies and 1 natural water body where the Basin Plan has not designated an aquatic life beneficial use, but where the evidence in the Board's files indicates that such uses currently exist.

The geographic scope for the Proposed Amendment, or the Project Area, is the Sacramento and San Joaquin River Basins below the major dams. This is where the Board has found diazinon and chlorpyrifos concentrations at levels that exceed applicable narrative water quality objectives. All of the diazinon and chlorpyrifos water quality impairments are found in these lower elevations, because these are the areas where there is the most pesticide use and where there is the most runoff from agricultural and urban sources. In addition to the water bodies in the Project Area that are currently on the 303(d) list due to diazinon and/or chlorpyrifos impairments, the Proposed Amendment would establish the numeric water quality objectives in all water bodies in the Project Area where the Basin Plan has designated an aquatic life beneficial use or where such a use is existing, as that term is defined in the federal regulations. (40 C.F.R. §131.3(e).)

In addition to establishing pollution control requirements for the 31 water bodies that are currently on the 303(d) list due to diazinon and/or chlorpyrifos impairments, the Proposed Amendment also establishes provisions to prevent or quickly address future impairments in water bodies that are not currently on the 303(d) list. The Proposed Amendment is fully consistent with previous amendments addressing that diazinon and chlorpyrifos in the Sacramento and Feather Rivers, the San Joaquin River, and the Sacramento-San Joaquin Delta. The Proposed Amendment contains monitoring requirements for municipal storm water, domestic wastewater, and agricultural dischargers, allows for representative monitoring, and contains provisions that address potential replacement pesticides. The Board's implementation of the control program and the Board's coordination with the California Department of Pesticide Regulations, the United States Environmental Protection Agency's Office of Pesticide Programs, and the county agricultural commissioners, is expected to fully address all diazinon and chlorpyrifos impairments in the Project Area.

The Proposed Amendment represents the first phase of the Board's effort to establish a comprehensive program to control discharges of pesticides that pose a significant risk to surface water quality in the Sacramento and San Joaquin River Basins. The Board is currently developing amendments to address additional pesticides of concern, such as pyrethroid insecticides and the herbicide diuron.

1. Background

1.1 Introduction

Diazinon and chlorpyrifos are organophosphate insecticides that are widely used in agriculture and, until recently, urban settings. Monitoring conducted since the early 1990s by the Central Valley Water Board, US Geological Survey, the California Department of Pesticide Regulation and others, has identified diazinon and chlorpyrifos at levels of concern in numerous Sacramento and San Joaquin Valley water bodies. Concentrations of diazinon and chlorpyrifos in ambient water samples from rivers, streams, and the Delta exceed narrative water quality objectives designed to ensure the protection of aquatic life.

As a result of this widespread diazinon and chlorpyrifos pollution, the Central Valley Water Board has placed numerous water bodies in the Sacramento and San Joaquin River Basins on the State Water Board's Clean Water Act Section 303(d) list due to diazinon and chlorpyrifos impacts (CRWQCB, CVR, 2011). Generally speaking, the federal Clean Water Act requires that the Board establish Total Maximum Daily Loads (TMDLs) to address pollutant exceedances that result in water quality impairments, unless other pollution control requirements will successfully address the impairments.

Previous Basin Plan amendments (Karkoski et al., 2003; Beaulaurier et al., 2005; McClure et al., 2006; Hann et al., 2007) have addressed diazinon and chlorpyrifos in the Sacramento, Feather, and San Joaquin Rivers, and in the Sacramento-San Joaquin Delta through the adoption of numeric water quality objectives, implementation provisions, and TMDLs. The Board also adopted a TMDL for diazinon and chlorpyrifos in Sacramento County Urban Creeks (Spector et al., 2004), but adopted this TMDL as a resolution, since this TMDL is implemented solely through the municipal storm water permit for Sacramento County.

These previously-adopted Basin Plan amendments and TMDLs impose requirements on the sources of these pesticides: agricultural discharges and municipal storm water and wastewater discharges. These include monitoring requirements, limits on pesticides concentrations in discharges and in receiving waters, and requirements for follow-up on exceedances. The Board imposed these requirements to ensure that the water bodies will ultimately achieve applicable water quality objectives.

Concentrations of diazinon and chlorpyrifos have decreased in many water bodies in the Central Valley (discussed in Section 1.5) as a result of the implementation of existing Basin Plan provisions, the implementation of the Board's Irrigated Lands Regulatory Program (which has been in place since the early 2000s), the phase-out of almost all non-agricultural uses of diazinon and chlorpyrifos in the early 2000s (discussed in Section 1.4.1), and the changes in registrations and regulations affecting pesticide use (described in Section 1.6). A description of the progress in implementing existing Basin Plan requirements is in Section 5.2.

However, there are still numerous water bodies listed on the 303(d) list where diazinon and chlorpyrifos concentrations that exceed applicable water quality standards, and where the Board has not established TMDLs or numeric water quality objectives (SWRCB, 2010). Additionally, there are numerous water bodies in the Sacramento and San Joaquin River Basins where there are no monitoring data, but where there is potential for elevated levels of diazinon and chlorpyrifos due to land uses in the watershed.

Subsequent to the development of the previous Basin Plan amendments addressing diazinon and chlorpyrifos, the Board determined that a comprehensive Basin Plan amendment addressing multiple water bodies would be more cost-effective and efficient than developing Basin Plan amendments and TMDLs for individual water bodies. The Board also envisioned that it would be beneficial to simultaneously address multiple pesticides in one Basin Plan amendment. Therefore, the Board initiated a comprehensive basin planning effort, the Central Valley Pesticide TMDL and Basin Plan Amendment project, to address multiple pesticides of concern throughout the Sacramento and San Joaquin River Basins.

Since diazinon and chlorpyrifos impairments can be more quickly addressed (due to the availability of information from the development of previous amendments), and since these pesticides account for the largest number of current-use pesticide impairments in the Central Valley Region, the Basin Plan Amendment being proposed in this Staff Report focuses on diazinon and chlorpyrifos. Provisions are also included in the Proposed Amendment to address replacement products and additive toxicity. In the near future, the Board will propose additional Basin Plan amendments to address other high priority pesticides. The primary goal of these pesticide Basin Plan amendments is to provide a clear regulatory framework for the protection of water quality from pesticides in surface waters in the Sacramento and San Joaquin River Basins, including the Sacramento-San Joaquin Delta.

Previous drafts of the Proposed Amendment contained TMDLs for the water bodies that are on the 303(d) list due to diazinon and/or chlorpyrifos impairments. However, the Irrigated Lands Regulatory Program (ILRP) and other regulatory programs are currently effectively addressing diazinon and chlorpyrifos impairments, and so the Proposed Amendment was changed. The Board has shifted the Proposed Amendment's focus from the establishment of TMDL wasteload and load allocations to the establishment of water quality objectives, compliance timeframes, and monitoring and implementation requirements.

The Board proposes to rely on existing regulatory programs (such as the ILRP) that have proved effective at rectifying water quality impairments once the Board establishes compliance parameters in the Basin Plan. Because diazinon and chlorpyrifos water quality impairments will be resolved by existing regulatory programs within a set compliance timeframe, this will obviate the need for the Board to establish TMDLs for these constituents. (40 C.F.R. §130.7(b)(1)(iii).)

1.2 **Watershed Areas to Be Considered**

The Sacramento and San Joaquin River Basins are bound by the crests of the Sierra Nevada on the east and the Coast Range and Klamath Mountains on the west. They extend some 400 miles from the California - Oregon border southward to the headwaters of the San Joaquin River. The geographic scope or "Project Area" for the Proposed Amendment is shown, along with the Central Valley Region's boundaries, in Figure 1-1. All documented pesticide impairments in the Sacramento and San Joaquin River Basins are down in the valleys, where there is more potential for pesticide runoff from urban and/or agricultural areas. In order to broadly cover the water bodies in the Sacramento and San Joaquin River Basins with the greatest potential for pesticide pollution, the Project Area for this Amendment was broadly defined to include all areas downstream of major reservoirs. The Tulare Lake Basin was not included, as it is covered by a separate Basin Plan.

The Project Area can be described as having a Mediterranean climate, with most of the precipitation occurring between the months of November and March and hot, dry summers. Overall, annual precipitation in the Project Area generally increases from south to north. In addition to the natural hydrologic processes of rainfall runoff, snowmelt, and base flow from groundwater discharge, flows in many water bodies in the Project Area, including the Delta and all of the rivers except the Cosumnes are highly managed and are affected by reservoir releases, water diversions, irrigation return flows, and sometimes diversions through bypasses. All of the rivers and many of the streams in the Project Area receive runoff from agricultural and/or urban land. The runoff from the agricultural land is often conveyed in a series of ditches before finally discharging to a river or stream. In some cases, the discharge may collect in a common conveyance maintained by a water or drainage district. In other instances, the conveyances to a river or stream may be operated by a single discharger.

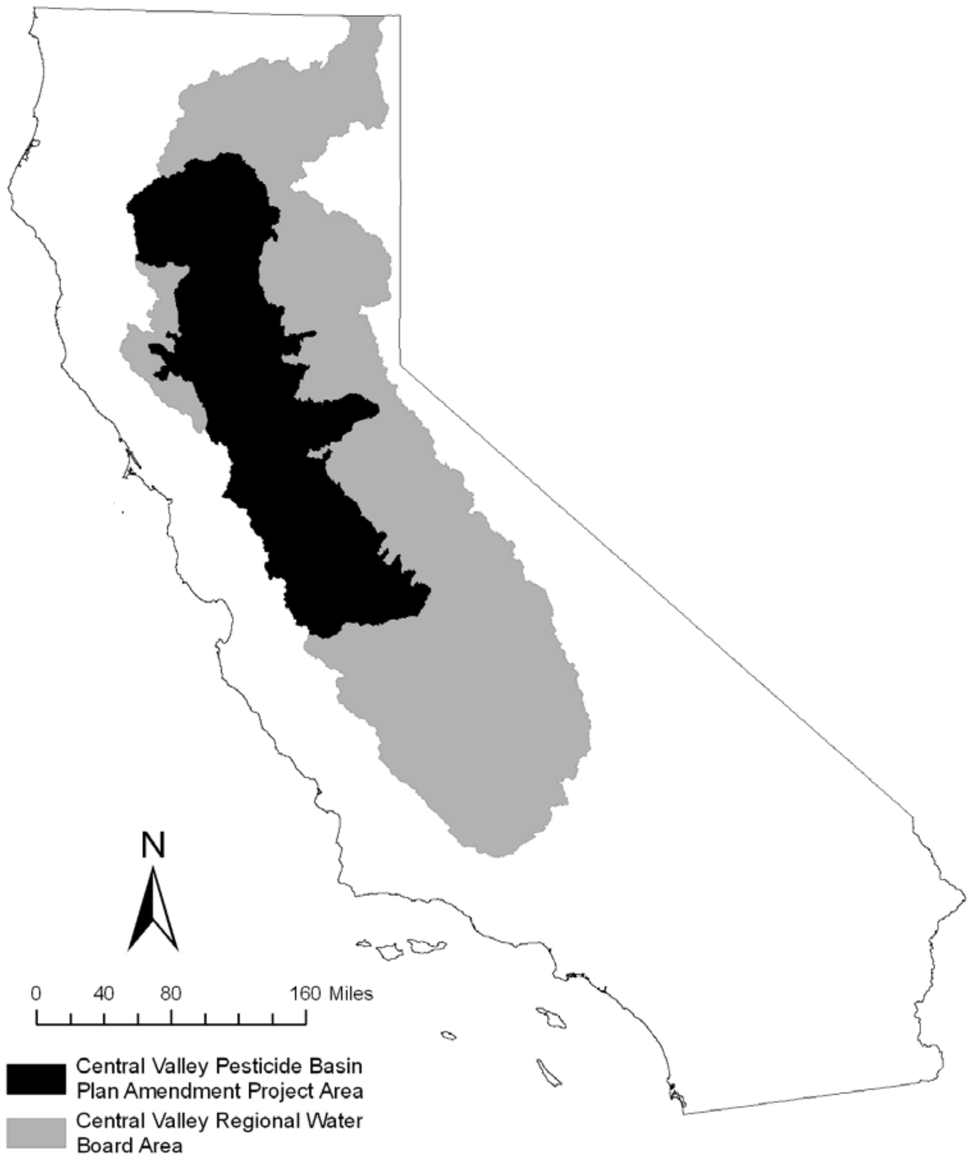

Figure 1-1 Central Valley Pesticide Basin Plan Amendment Project Area (Project Area) Nested Within the Regional Water Quality Control Board – Central Valley Region Boundaries.

Since the geographic scope under consideration is large and varied in terms of topography, hydrology, and water sources, it is divided into three large subareas for the purpose of analysis and discussion of sources. The three watersheds, described below, are the Lower Sacramento River watershed, the Lower San Joaquin River watershed, and the Lower Sacramento-San Joaquin Delta watershed (Figure 1-2).

For the purposes of this report, the terms Lower Sacramento River watershed, Lower San Joaquin River watershed, and Lower Delta watershed refer to the areas shown in Figure 1-2. These areas include all the areas below major reservoirs which drain to the Sacramento River, San Joaquin River or the Delta. These areas generally correspond to the areas addressed as tributary source areas in previous Basin Plan amendments addressing diazinon and chlorpyrifos in the Sacramento River, San Joaquin River and the Delta.

Figure 1-2 Watersheds within the Central Valley Pesticide Basin Plan Amendment Project Area – Lower Sacramento River Watershed, Lower Delta Watershed, and Lower San Joaquin River Watershed.

Figure 1-3 summarizes land use in the Project Area for the three watersheds based on data from the United State Department of Agriculture (USDA), National Agricultural Statistics Service (NASS, 2009). The Project Area is approximately 12.5 million acres (roughly 19,500 square miles) and contains over 4.8 million acres (roughly 7,500 square miles) of agricultural land. There are also over 1.1 million acres (roughly 1,700 square miles) of urban land in the Project Area. Over 60 municipal wastewater treatment plants discharge to surface waters within the Project Area, and a similar number of municipal storm water systems.

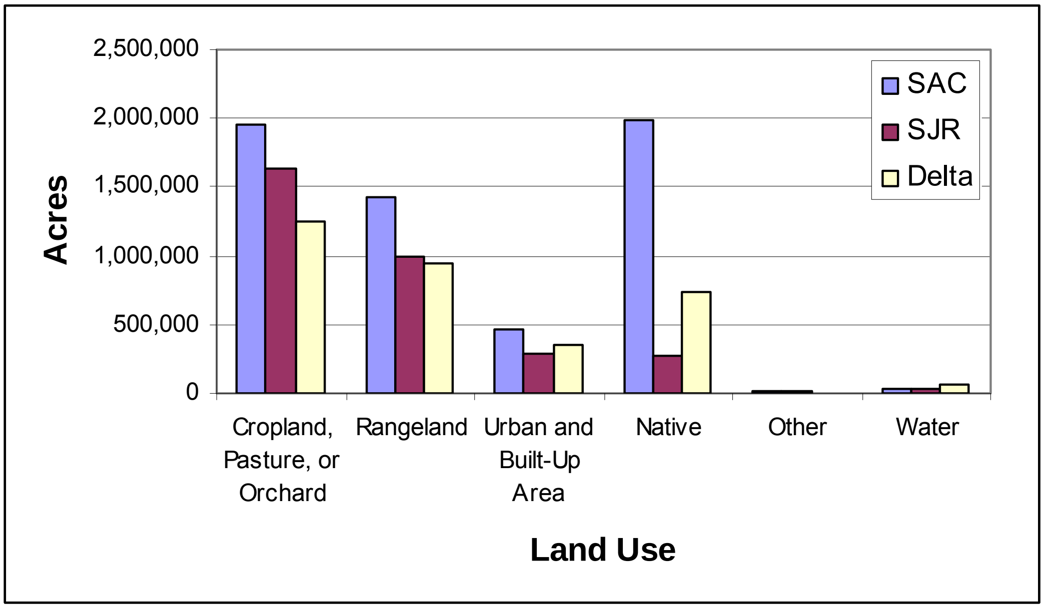

Figure 1-3 Land Uses in the Project Area.

1.2.1. Lower Sacramento River Watershed

The Lower Sacramento River watershed, as it is defined for the purposes of this Staff Report and shown in Figure 1-2, is approximately 9,200 square miles (5.9 million acres) and extends from below Keswick Reservoir in the north to the Sacramento-San Joaquin Delta in the south, and from the crest of the Coast Range in the west to the dams in the foothills of the Sierra Nevada in the east. The Lower Sacramento River watershed includes the cities of Redding, Red Bluff, Chico, Willows, Colusa, Knights Landing, Yuba City, Marysville, Roseville, and about half of the greater Sacramento Area. Hydrologically, the Lower Sacramento River watershed is a highly managed area, with reservoirs that are used for water supply and flood control on all the major tributaries of the Lower Sacramento River, as well as diversions for municipal and agricultural uses and levees and bypasses for additional flood control. Both the Sutter and Yolo Bypasses can convey excess flow from the main channel of the Sacramento River and have the capacity to carry larger volumes of water than the Sacramento River channel when they are utilized to prevent flooding. Areas reclaimed by these hydrologic manipulations are now highly productive agricultural lands and urban areas that are located in the historic flood plains of the Sacramento and Feather Rivers.

1.2.2. Lower San Joaquin River Watershed

The Lower San Joaquin River watershed, as it is defined for the purposes of this report and shown in Figure 1-2, is approximately 5,000 square miles (3.2 million acres). Briefly described, the Lower San Joaquin River watershed is bounded by the reservoirs in the foothills of the Sierra Nevada Mountains on the east, the crest of the Coast Range on the west, the Delta to the north, the Tulare Lake Basin to the south, and Friant Dam to the Southeast. The Lower San Joaquin River watershed includes the cities of Modesto, Merced, Turlock, and part of the City of Fresno. Below Friant Dam, the San Joaquin River (SJR) flows westerly to the center of the SJR Valley near Mendota, where it turns northwesterly to eventually join the Sacramento River within the Delta. The San Joaquin River feeds into the Delta at the southern border of the Delta subarea. The principal streams in the Lower San Joaquin River watershed are the San Joaquin River and its larger tributaries: the Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers.

Several smaller, ephemeral streams flow into the SJR from the west side of the SJR basin. These streams include Hospital, Ingram, Del Puerto, Orestimba, Panoche, and

Los Banos Creeks. All have drainage basins in the Coast Range, flow intermittently, and contribute sparsely to water supplies. Mud Slough (north) and Salt Slough drain the Grassland watershed on the west side of the SJR basin. During the irrigation season, surface and subsurface agricultural return flows contribute greatly to these creeks and sloughs.

1.2.3. Lower Delta Watershed

The Lower Delta watershed, as it is defined for the purposes of this report and shown in Figure 1-2, refers to the area that includes the Legal Sacramento-San Joaquin Delta, as defined in Water Code section 12220, as well as the areas downstream of reservoirs that drain directly to the Legal Delta, excluding the Lower Sacramento and San Joaquin watersheds described above. The Lower Delta watershed is approximately 5,200 square miles (3.3 million acres). Briefly described, the Lower Delta watershed extends from the crest of the Coast Range and the boundary of the Central Valley Region with the San Francisco Bay Region in the Delta near the city of Antioch in the West to the foothills of the Sierra Nevada in the East. To the north, the boundary is the Sacramento River watershed, where the Sacramento River enters the Legal Delta near downtown Sacramento. To the south, the boundary is the San Joaquin watershed, where the San Joaquin River enters the Legal Delta near the city of Vernalis. The Lower Delta watershed includes part of the Sacramento area, and the cities of Antioch, Vacaville, Woodland, Rio Vista, Davis, West Sacramento, Elk Grove, Lodi, Galt, Stockton, Tracy and Manteca.

The Delta, along with the San Francisco Bay, forms the largest estuary on the North American western coast. The Delta encompasses a maze of river channels and diked islands encompassing roughly 738,000 acres (1,153 square miles) in Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo counties. The Delta forms the lowest part of the Central Valley, lying between the Sacramento and San Joaquin Rivers and extending from the confluence of the two rivers inland as far as Sacramento and Stockton. Many of the waterways in the Delta follow natural courses while others have been constructed to provide deep-water navigation channels, to improve water circulation, or to obtain material for levee construction (DWR, 1995). The Delta supports communities, agriculture, and recreation, and provides essential habitat for fish and wildlife (DWR, 1995). Over five hundred species of wildlife inhabit the Delta, making it one of the state’s most important wildlife habitats (DWR, 1995).

The Delta is the major source of freshwater to the San Francisco Bay and supplies over half of the drinking water for the state. The Sacramento, San Joaquin, Mokelumne, Cosumnes, and Calaveras rivers all flow into the Delta, carrying approximately 47% of the state's total runoff (DWR, 1995). The average annual inflows and outflows of the Delta are shown in Tables 1-1 and 1-2. The average annual inflow to the Delta during the 1980 to 1991 period was 27,840 thousand acre-feet (TAF). The Sacramento River contributed approximately 62% of the total Delta inflow, and the San Joaquin River contributed approximately 15% (DWR, 1995). The Yolo Bypass, which drains water from the Sacramento River during flood events, as well as water from the areas northwest of the Delta, including, occasionally, the Colusa Basin Drain, contributed approximately 15%. The East Side Sierra streams that drain directly to the Delta, including the Cosumnes, Mokelumne, and Calaveras Rivers, contribute approximately 5% of the Delta's inflows.

The Delta is at sea level. Water levels vary greatly during each tidal cycle, and during the tidal cycle, flows can vary in direction and amount. The tidal flows into and out of the Delta are much greater than the "net" Delta outflow. The average tidal flow (ebb or flood) at Chipps Island is 170,000 cfs, while the average winter outflow is 32,000 cfs., and the average summer outflow is 6,000 cfs. (DWR, 1995). Flows in Delta Waterways are also greatly affected by the export of water from the Delta by the two major pumping facilities located in the south Delta: the Harvey O. Banks Pumping Plant of the State Water Project and the Tracy Pumping Plant of the Central Valley Project. Much of the land in and around the Delta is below sea level, and is dependent on hundreds of miles of levees to prevent flooding. Because most agricultural areas in the Delta are at or below sea level, agricultural drainage water from these low-lying areas must be pumped over levees into nearby channels (DWR, 1995).

Table 1-1 Average Annual Delta Inflows 1980-1991 (DWR, 1995).

Source	**Avg. Inflow (TAF)**
Sacramento River	17,220
East Side Sierra Streams	1,360
San Joaquin River	4,300
Delta Precipitation	990
Yolo Bypass	3,970
Total Inflows	27,840

Table 1-2 Average Annual Delta Outflows and Diversions 1980-1991 (DWR, 1995).

Outflow or Diversion	Avg. Outflow (TAF)
Delta Outflow to Bay	21,020
Consumptive Use and Channel Depletion	1,690
Tracy Pumping Plant	2,530
Banks Pumping Plant	2,490
Contra Costa Pumping Plant	110
Total Outflows	27,840

1.3 Sources, Transport and Effects of Diazinon and Chlorpyrifos in Surface Water

Diazinon and chlorpyrifos are synthetic pesticides. The sources of the diazinon and chlorpyrifos found in Sacramento River and San Joaquin River Basins are urban and agricultural applications. In the Central Valley, diazinon and chlorpyrifos are used to exterminate destructive pests and insects such as aphids, spider mites, fleas, ants, roaches, and boring insects. A fraction of urban and agricultural diazinon and chlorpyrifos applications can reach surface water during rainfall or irrigation events, when residual diazinon and chlorpyrifos can migrate with storm water runoff, irrigation return water, or rainwater, and enter streams, rivers, creeks and sloughs in the three watersheds.

1.3.1. Environmental Transport of Diazinon

Diazinon is moderately mobile and persistent in the environment and has been detected in air, rain, fog, soil, surface water, and groundwater (USEPA, 2000a). Diazinon has a moderately low vapor pressure (ranging from 6.4 to 18.7 milliPascals (mPa) at 20 degrees C (USDA, 1995a)) and Henry's law constant (estimated at 0.072 Pa-m^3/mol (USDA, 1995a)), indicating that a small fraction of applied diazinon is expected to volatilize from soil, crops, surface water, or other surfaces into the atmosphere. Atmospheric diazinon can exist in particulate and vapor forms, as well as a solute dissolved in fog (Seiber et al., 1993). Atmospheric vapor-phase diazinon is degraded by reacting with photochemically-produced hydroxyl radicals, and the estimated half-life for this reaction is four hours (NLM, 2002). Particulate-phase diazinon may be removed from the air by wet and dry deposition (NLM, 2002). Diazinon also absorbs light in the environmental spectrum and has the potential for direct photolysis in the atmosphere (NLM, 2002). Once in the atmosphere, diazinon can be transported by bulk movement of air and is subject to deposition processes (Larkin and Tjeerdema, 2000). Atmospheric transport of diazinon from the Central Valley to the Sierra Nevada Mountains has been observed, although diazinon levels decreased significantly with distance and elevation (Zabik and Seiber, 1993). Both dry and wet deposition processes can transport atmospheric diazinon onto the ground surface, vegetation, or directly into surface waters.

Diazinon has a low to moderate tendency to adsorb to soil, with reported organic carbon adsorption coefficient (K_{oc}) values of 1,007 to 1,842 (USDA, 1995a). In soils, diazinon can be degraded by hydrolysis, microbial degradation and photolysis, lost to surface and/or groundwater via runoff and/or leaching, and lost to the atmosphere via volatilization. Diazinon degrades more rapidly in acidic soils than neutral or alkaline soils (Larkin and Tjeerdema, 2000). Field dissipation half-life is a measure of the overall rate of disappearance of a pesticide from soil by leaching, runoff, hydrolysis, photolysis, and microbial degradation. Reported diazinon field dissipation half-lives range from three to 54 days, with the range of 3 to 13 days considered to be the most representative of actual field conditions (USDA, 1995a). As a rule of thumb, the time needed for about 90 percent of the pesticide residue to dissipate is four times the field dissipation half-life (USDA, 1995a). Reported values for diazinon's half-life on vegetation range between two and 14 days (Sheipline, 1993).

Diazinon is moderately soluble in water with reported solubility values ranging from 40 to 60 parts per million (ppm) at 20 to 30ºC (USDA, 1995a). The solubility of diazinon is relatively high for a pesticide (Larkin and Tjeerdema, 2000), indicating that solubility is probably not limiting the movement of diazinon into solution for transport in moving water. Due to diazinon's moderate solubility and low to moderate tendency to adsorb to soil, it can move off of crops, soil, and other surfaces and into surface water in runoff from rainfall and irrigation. Atmospheric deposition has the potential to directly contribute to surface water concentrations. Sediment-associated diazinon can also be mobilized by sediment runoff and transport of sediments in surface waters, but this transport mechanism may be less important, since approximately 98% of the diazinon in San Francisco Bay is reported to occur in the dissolved phase (Domagalski and Kuivila, 1993). In water, diazinon can be degraded by hydrolysis, photolysis, and microbial degradation, and lost via volatilization. All of these processes are strongly influenced by the pH, temperature, salinity, and purity of water. The rate of hydrolysis of aqueous diazinon increases with high or low pH. Hydrolysis half-lives in water have been reported at 12 days (pH 5), 138 days (pH 7), and 77 days (pH 9) (Giddings et al., 2000). Reported values for diazinon's photolysis half-life in water range from 15 to 25 days (Giddings et al., 2000). Estimates of diazinon's half-life in water in incubated bottles range from 14 to 99 days, and from five to 25 days in larger, open, outdoor experimental systems (Giddings et al., 2000).

Diazinon has a low to moderate potential to bioconcentrate in aquatic organisms with reported bioconcentration factors ranging from 4.9 to 152 (NLM, 2002). Depuration of accumulated diazinon is rapid, with experimental results showing 96 to 97 percent of accumulated diazinon residues eliminated from fish tissues within seven days (USEPA, 2000a).

1.3.2. Environmental Transport of Chlorpyrifos

Chlorpyrifos can pollute surface water via spray drift at the time of application or as runoff up to several months after application (USEPA, 2000b). Degradation of chlorpyrifos in soil, water and air may occur by hydrolysis, photolysis, and microbial degradation. Chlorpyrifos has a moderately low volatility, with reported vapor pressures ranging from 2.3 to 12 mPa at 20 to 35ºC (USDA, 1995b), and a moderately low Henry's law constant of 0.743 Pa-m^3/mol at 25ºC (USDA, 1995b), indicating that a small fraction of applied chlorpyrifos is expected to volatilize from soil, crops, surface water or other surfaces into the atmosphere. When released into the atmosphere, the half-life of the vapor phase of chlorpyrifos is 6.43 hours when reacting with photochemically produced hydroxyls (Linde, 1994).

Reported field dissipation half-lives of chlorpyrifos in soil range from 4 to 139 days (USDA, 1995b), with an average half-life in soil of 30 days (USEPA, 2000b). Chlorpyrifos has a greater tendency than diazinon to adsorb to soil and sediment, with reported K_{oc} values of 6,070 to 14,000 (USDA, 1995b). Chlorpyrifos is moderately soluble in water for a pesticide, with reported solubility values ranging from 0.45 to 1.18 parts per million at temperatures between 10 and 30ºC (USDA, 1995b). Available data indicate that most chlorpyrifos runoff is generally via adsorption to eroding soil rather than by dissolution in runoff water. However, under some conditions, dissolution in runoff water may be significant (USEPA, 2000b).

The relatively low to moderate susceptibility of chlorpyrifos to hydrolysis (half-life of 72 days at pHs 5 and 7, and 16 days at pH 9), direct aqueous photolysis (half-life of 30 days in sunlight), degradation under aerobic conditions, and low volatilization indicate that it will be somewhat persistent in the water columns of some aqueous systems that have relatively long hydrological residence times (USEPA, 2000b). However, volatilization and/or adsorption to sediment may substantially reduce the persistence of dissolved chlorpyrifos in shallow waters and in waters receiving influxes of uncontaminated sediment, respectively (USEPA, 2000b). The relatively low-to-moderate susceptibility of chlorpyrifos to degradation under anaerobic conditions indicates that it will also be somewhat persistent in anaerobic bottom sediment (USEPA, 2000b). Chlorpyrifos half-lives in pond sediment typically range from 14 to 64 days, with some longer times observed (Poletika and Robb, 1998).

Atmospheric transport and deposition of diazinon and chlorpyrifos can significantly affect surface water concentrations in the Central Valley (Majewski et al., 2005). Atmospheric deposition tends to be correlated to proximity to application areas as well as the timing and amount of pesticide used (Majewski et al., 2005). In the Central Valley, wet deposition appears to be the more important mechanism of diazinon deposition, while dry deposition appears to be the more important mechanism of chlorpyrifos deposition (Majewski et al., 2005).

1.3.3. Toxic Effects in Surface Water

Diazinon and chlorpyrifos can be acutely toxic to aquatic life, wildlife, and humans. Aquatic invertebrates appear to be the aquatic organisms most sensitive to chlorpyrifos and diazinon exposure (Giddings et al., 2000). When ingested by an organism, diazinon and chlorpyrifos cause toxicity through inactivation of the enzyme acetylcholinesterase (AChE) that is involved in nerve impulse transmission. Inactivation of the AChE enzyme results in a variety of lethal and sub-lethal toxic effects (Larkin and Tjeerdema, 2000).

When present in a mixture, diazinon and chlorpyrifos display additive toxicity (Bailey et al., 1997). After uptake, aquatic organisms remove diazinon and chlorpyrifos from the body relatively rapidly (Giddings et al., 2000). Partly due to these rapid depuration rates, diazinon and chlorpyrifos have only a moderate tendency to bioconcentrate in aquatic organisms (Giddings et al., 2000), and are not expected to significantly biomagnify in aquatic food webs. As discussed in Section 4 below, aquatic life appears to be the beneficial use of water most sensitive to diazinon and chlorpyrifos, and thresholds for protection of aquatic organisms are orders of magnitude lower than those for protection of drinking water.

There are, however, concerns about potential human health effects of chlorpyrifos in drinking water. Chlorpyrifos can transform to chlorpyrifos-oxon during the chlorination step of drinking water treatment. Chlorpyrifos-oxon is more toxic than the parent compound and is therefore the focus of the USEPA's continuing drinking water assessment (USEPA, 2011a; USEPA, 2011b), which is being performed as part of the registration review for chlorpyrifos discussed in Section 1.6.5. There is also a growing body of literature, currently being reviewed by USEPA, indicating that gestational and/or early postnatal exposure of laboratory animals (rats and mice) to chlorpyrifos may cause persistent behavioral effects into adulthood. The results of both in vivo and in vitro studies on chlorpyrifos have led some research groups to propose that changes in brain neurochemistry may underlie behavioral changes into adulthood (USEPA 2011a).

1.4 Diazinon and Chlorpyrifos Use in the Sacramento and San Joaquin River Basins

Pesticide use data compiled and analyzed in this report were from December 2000 through November 2009. The more recent pesticide use data (December 2005 through November 2009 (Dec05-Nov09)) are generally relied upon in the analysis to describe current sources, but earlier use data (December 2000 through November 2005) are also discussed to describe trends in use. Chlorpyrifos and diazinon use data were obtained from the Pesticide Use Report (PUR) database maintained by the California Department of Pesticide Regulation (DPR, 2010). Geographic Information Systems (GIS) and database software were used to select, filter, and total reported pesticide use data for the Project Area to analyze the timing and locations of application, sites of application (crops, etc.), and trends in uses. Agricultural uses are reported to DPR and are included in the PUR database with detailed information on application location (in terms of MTRS, Median/Township/Range/Section).

Non-agricultural professional pesticide applications by pest control companies, etc. are reported to DPR and are included in the PUR database by county without detailed location information. The reported non-agricultural uses data for Sacramento, San Joaquin, and Stanislaus counties are used to examine relative importance of these non-agricultural uses. Individual non-professional pesticide applications by homeowners and local businesses, etc. are not reported to DPR, and therefore are not included in the PUR database, but these uses are generally not considered important due to the recent use cancellations, as discussed below.

1.4.1. Chlorpyrifos and Diazinon Use in the Project Area

Chlorpyrifos and diazinon are applied in agricultural areas to control insects such as aphids, spider mites, and boring insects. These pesticides were also formerly used heavily in urban areas for control of common pests such as ants and roaches, but sales of these pesticides for nearly all non-agricultural uses have been phased out so that non-agricultural uses of these pesticides have dropped to what may now be close to negligible amounts, as discussed below.

The annual average agricultural chlorpyrifos use[1] in the study area for recent years (December 2005 through November 2009) was approximately 424,000 pounds per year, with an average of about 7,000 applications per year and with the highest uses, in terms of pounds applied, being walnuts, almonds, and alfalfa. The annual average agricultural diazinon use in the study area for this time period was approximately 55,000 pounds per year, with an average of about 1,200 applications per year and with the highest uses, in terms of pounds applied, being stone fruit and nuts trees (e.g., plums and prunes, peaches, almonds, walnuts) and tomatoes.

The United States Environmental Protection Agency (USEPA) cancelled the sales of diazinon for all non-agricultural uses in 2004, and cancelled the sales of chlorpyrifos for almost all non-agricultural uses in 2000. Since that time, non-agricultural uses have declined drastically. Reported non-agricultural uses in Sacramento, San Joaquin, and Stanislaus counties from December 2005 through November 2009 were about 0.5% and 0.1% of all reported uses for chlorpyrifos and diazinon, respectively. There are still a few unreported uses for which chlorpyrifos can be sold, but they are expected to be relatively minor. Some unreported uses of existing stocks of diazinon and chlorpyrifos products that are no longer sold, such as products for homeowner uses, may still occur, but these uses will continue to decline as these supplies are used up.

Since sales of diazinon and chlorpyrifos for nearly all non-agricultural uses have been cancelled for several years, these non-agricultural uses are generally far less important than agricultural uses and are not likely significant sources for most water bodies in the Sacramento and San Joaquin River Basins. For this reason, unless otherwise specified, the subsequent quantitative use summaries in this report refer to the reported agricultural diazinon and chlorpyrifos uses. Non-agricultural uses could still be relevant sources in smaller water bodies that are highly influenced by local non-agricultural sources.

1.4.2. Trends in Chlorpyrifos and Diazinon Use

In recent years, agricultural uses of diazinon have declined significantly while agricultural uses of chlorpyrifos have increased slightly. These pesticides remain among the more highly used pesticides in California, with chlorpyrifos the 17th highest

[1] Annual average use was determined by totaling the reported use in the study area for each year, and then calculating the mean of these annual totals

use and diazinon the 85th highest use, by pounds of active ingredient in 2009, out of the approximately 1,000 pesticide active ingredients registered for use in California (DPR, 2010).

Before the phase-outs of residential uses in the early 2000s, diazinon and chlorpyrifos were two of the most commonly used residential insecticides. Statewide sales data and local population data were used to estimate the unreported diazinon and chlorpyrifos uses for Sacramento County before these uses were phased out. These unreported uses were estimated to be approximately 12,000 pounds of diazinon per year and 900 pounds of chlorpyrifos per year, or approximately 46% and 4% for diazinon and chlorpyrifos, respectively, of total uses in Sacramento County in 2000 through 2002 (Spector et al., 2004). These unreported uses have very likely declined severely as existing stocks are used up. Reported non-agricultural uses, such as industrial and landscaping applications, have also declined severely following the USEPA cancellations and use restrictions in the early 2000s.

Table 1-3 shows the reported non-agricultural diazinon and chlorpyrifos annual uses from December 2000 through November 2009 for Sacramento, San Joaquin, and Stanislaus Counties. Overall, non-agricultural uses have declined severely in the last ten years, but some minor uses still exist, which could be relevant sources to some smaller water bodies. This decline in non-agricultural use is reflected in the concentration data for urban areas, discussed below, which shows an extreme decrease in diazinon and chlorpyrifos concentrations.

Table 1-3 Reported Annual Non-Agricultural Diazinon and Chlorpyrifos Uses in Sacramento, San Joaquin and Stanislaus Counties by Year, Dec 2000-Nov 2009.

	Sacramento County		San Joaquin County		Stanislaus County	
Year	Chlorpyrifos	Diazinon	Chlorpyrifos	Diazinon	Chlorpyrifos	Diazinon
Dec2000-Nov2001	27,663	10,632	15,277	5,150	9,466	55,988
Dec2001-Nov2002	5,157	5,418	8,696	995	5,810	19,568
Dec2002-Nov2003	4,030	5,684	269	144	495	264
Dec2003-Nov2004	568	594	540	24	886	80
Dec2004-Nov2005	585	11	223	0	169	30
Dec2005-Nov2006	198	2	18	0	177	0
Dec2006-Nov2007	40	11	4	1	4	0
Dec2007-Nov2008	25	0	221	0	44	9
Dec2008-Nov2009	13	0	104	5	146	9

To analyze trends in agricultural chlorpyrifos and diazinon use, the pesticide use data in the Project Area from December 2000 through November 2009 were assembled and then grouped into two time periods; the first time period is December 2000 through

November 2005 (Dec00-Nov05) and the second time period is December 2005 through November 2009 (Dec05-Nov09). In this analysis, time periods running December through November are used to keep the pesticide applications in each dormant season (December through February) and irrigation season (February through November) grouped together.

Table 1-4 shows reported agricultural diazinon and chlorpyrifos use for Dec00-Nov05 and Dec05-Nov09. Between Dec00-Nov05 and Dec05-Nov09, the average annual diazinon use decreased about 54% in the Project Area, with reductions of 50%, 52%, and 64% for the Lower Sacramento River, Delta, and SJR watersheds, respectively.

Between Dec00-Nov05 and Dec05-Nov09, the average annual agricultural chlorpyrifos use increased about 2% in the Project Area, with a 16% increase in use in the Lower Sacramento River watershed, but decreases of 5% and 2% in the Delta and SJR watersheds, respectively. The average number of applications per year generally follows the same patterns as the pounds applied, with the number of diazinon applications being reduced by about half in the latter period and the number of chlorpyrifos applications being about the same between the two time periods (Table 1-4). Ten crops account for the majority (over 95%) of annual average diazinon and chlorpyrifos use in each of these three watersheds. Therefore, changes in use on the top ten crops for each watershed are detailed below in Sections 1.4.4-1.4.6.

Table 1-4 Average Annual Agricultural Chlorpyrifos and Diazinon Use in the Three Project Area Watersheds in Dec00-Nov05 and Dec05-Nov09.

Watershed	December 2000-November 2005		December 2005–November 2009			
	Chlorpyrifos (lbs./yr.)	**Diazinon (lbs./yr.)**	**Chlorpyrifos (lbs./yr.)**	**Chlorpyrifos % Change**	**Diazinon (lbs./yr.)**	**Diazinon % Change**
Lower Sacramento River	**113,203**	**55,808**	**131,447**	**16%**	**28,101**	**- 50%**
Delta	**95,964**	**29,330**	**90,955**	**- 5%**	**13,959**	**- 52%**
Lower San Joaquin River	**204,500**	**36,068**	**201,246**	**- 2%**	**13,107**	**- 64%**
Total (Project Area)	**413,667**	**121,206**	**423,648**	**2%**	**55,167**	**- 54%**
	7,396 applications	**2,267 applications**	**7,005 applications**	**- 5%**	**1,171 applications**	**- 48%**

1.4.3. Seasonal Patterns of Diazinon and Chlorpyrifos Use

Figures 1-4 and 1-5 show the reported recent (Dec05 - Nov09) average agricultural chlorpyrifos and diazinon use in the Project Area for each month. Chlorpyrifos and diazinon applications have strong seasonal use patterns in the Project Area. Two pesticide-use seasons were defined for this analysis: the dormant season (December through February) and the irrigation season (March through November). In this period, about 96% of the total reported chlorpyrifos uses were during the irrigation season, mostly in March and May through September. The highest chlorpyrifos use was in July. In this same period, about 56% of the reported diazinon uses were during the dormant season, mostly in January and February, with the remaining diazinon uses spread fairly evenly throughout the rest of the year, except for very low diazinon use in September and November.

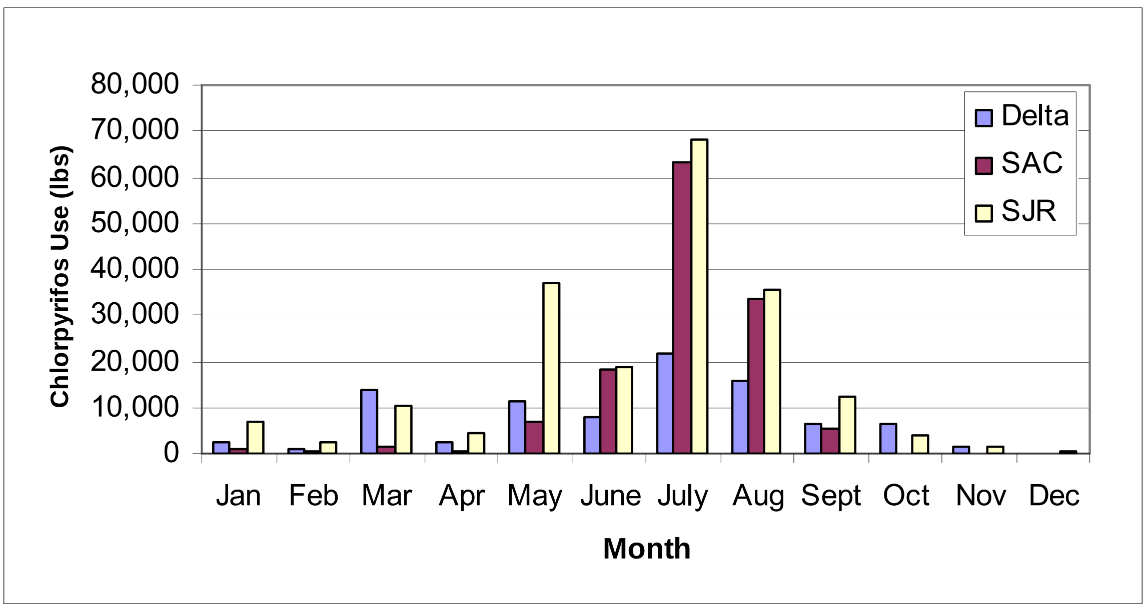

Figure 1-4 Average Monthly Chlorpyrifos Use by Watershed (Dec05-Nov09).

The seasonal average chlorpyrifos and diazinon uses on the top ten crops for each watershed are shown in Tables 1-5 and 1-6. Diazinon use in the dormant seasons for the Sacramento River, Delta, and SJR watersheds were 66%, 33%, and 67%, of total annual reported diazinon use, respectively. Chlorpyrifos uses in the irrigation season accounted for 99%, 96%, and 95% of total annual reported chlorpyrifos use in the Sacramento River, Delta, and SJR watersheds, respectively.

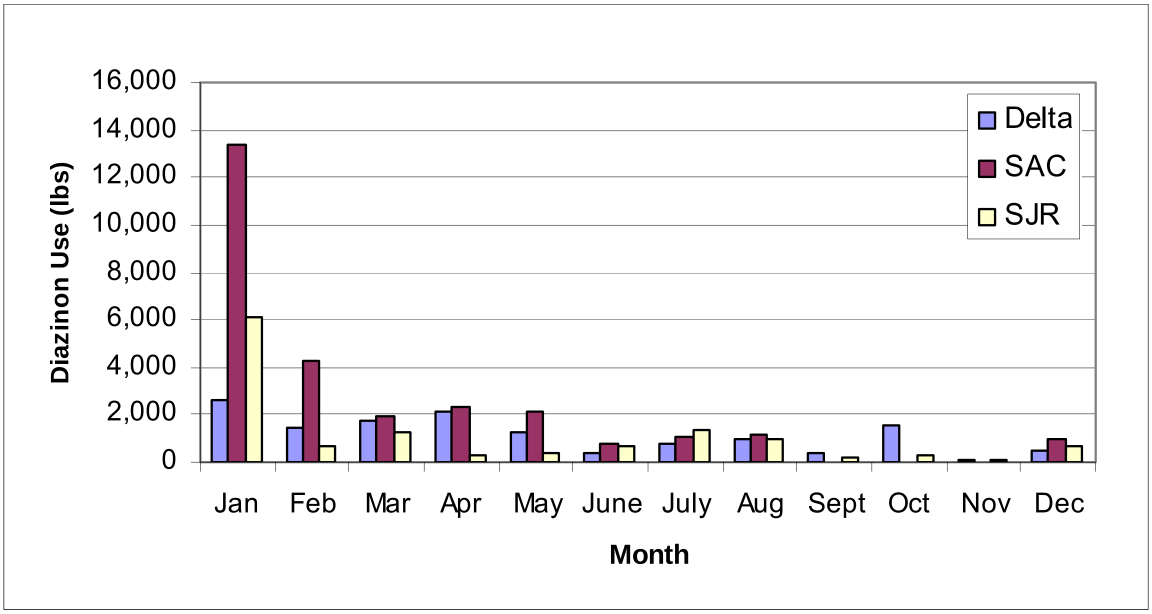

Figure 1-5 Average Monthly Diazinon Use by Watershed (Dec05-Nov09)

Table 1-5 shows chlorpyrifos use on the top ten crops in the dormant and irrigation seasons. Except for peaches and plums, almost all chlorpyrifos applications occurred during irrigation season. The highest amounts of chlorpyrifos were applied to walnuts, alfalfa, and almonds. Most chlorpyrifos applications to walnuts were between May and September, applications to alfalfa were in March, and to almonds were between June and August.

Table 1-6 shows the comparison of diazinon use on the top ten crops between the dormant and irrigation seasons. Plums, peaches, and almonds had the highest amounts of diazinon used in the Sacramento River and SJR watersheds, while almonds, tomatoes, and pears had the highest diazinon use in the Delta watershed. Plums had 76% of annual diazinon use in the dormant season in the Sacramento River watershed, and 52% in the dormant season in the Delta, and 57% in the SJR watershed. Peaches and almonds had almost 100% of diazinon applied during the dormant season in all three watersheds. In the Delta watershed, tomatoes had high diazinon use and 98% of applications were during the irrigation season, particularly between March and May.

Table 1-5 Chlorpyrifos Average Annual Use (Dec05-Nov09) on the Top Ten Crops in the Three Watersheds by Season.

Watershed	Crops (Chlorpyrifos Applied)	Dormant (lbs)	Irrigation (lbs)	Dormant (%)	Irrigation (%)
SAC	WALNUTS	44	87742	0%	100%
	ALMONDS	95	36425	0%	100%
	ALFALFA	9	3922	0%	100%
	PLUMS	825	161	84%	16%
	PEACHES	642	1	100%	0%
	SUNFLOWERS	0	397	0%	100%
	CITRUS	0	267	0%	100%
	CORN	0	258	0%	100%
	PECANS	0	222	0%	100%
	COTTON	0	218	0%	100%
Delta	WALNUTS	0	39396	0%	100%
	ALFALFA	5	19260	0%	100%
	GRAPES	276	11674	2%	98%
	ALMONDS	2065	6885	23%	77%
	CORN	0	6426	0%	100%
	APPLES	579	1485	28%	72%
	ASPARAGUS	15	1282	1%	99%
	PLUMS	361	0	100%	0%
	NURSERY_OUTDOOR GROWN	2	310	1%	99%
	PEARS	0	240	0%	100%
SJR	ALMONDS	6469	83859	7%	93%
	WALNUTS	36	35152	0%	100%
	ALFALFA	58	31004	0%	100%
	CORN	0	14579	0%	100%
	GRAPES	1998	8749	19%	81%
	CITRUS	0	6278	0%	100%
	COTTON	0	4647	0%	100%
	SUGARBEETS	160	2784	5%	95%
	SWEET POTATOES	0	2137	0%	100%
	PEACHES	936	23	98%	2%

Table 1-6. Diazinon Average Annual Use (Dec05-Nov09) on the Top Ten Crops in the Three Watersheds by Season.

Watershed	Crops (Diazinon Applied)	Dormant (lbs)	Irrigation (lbs)	Dormant (%)	Irrigation (%)	Total use (lbs)
SAC	PLUMS	8301	2651	76%	24%	10952
	PEACHES	7409	26	100%	0%	7434
	ALMONDS	1564	10	99%	1%	1574
	TOMATOES	585	3754	13%	87%	4339
	WALNUTS	53	2857	2%	98%	2909
	CHERRIES	684	0	100%	0%	684
	PEARS	12	9	57%	43%	21
	APPLES	2	5	29%	71%	8
	ONION	0	55	0%	100%	55
	MELONS	0	44	0%	100%	44
Delta	ALMONDS	2522	4	100%	0%	2526
	TOMATOES	64	3458	2%	98%	3522
	PEARS	37	1549	2%	98%	1586
	CHERRIES	1303	1231	51%	49%	2534
	APPLES	169	1033	14%	86%	1202
	WALNUTS	13	568	2%	98%	581
	PLUMS	259	234	52%	48%	493
	CORN	0	923	0%	100%	923
	NURSERY_OUTDOOR GROWN	38	103	27%	73%	141
	WATERMELONS	0	16	0%	100%	16
SJR	ALMONDS	4120	212	95%	5%	4331
	PEACHES	1989	29	99%	1%	2017
	PLUMS	729	550	57%	43%	1279
	CANTALOUPES	0	1319	0%	100%	1319
	MELONS	0	1555	0%	100%	1555
	TOMATOES	0	843	0%	100%	843
	NECTARINES	318	6	98%	2%	324
	GRAPES	37	62	38%	62%	99
	APPLES	5	150	3%	97%	155
	WALNUTS	0	26	0%	100%	26

1.4.4. Chlorpyrifos and Diazinon Use in the Lower Sacramento River Watershed

Figure 1-6 shows the annual average agricultural chlorpyrifos uses in the Lower Sacramento River watershed for the ten highest use crops during the two time periods examined. The top ten crops accounted for 99.5% of total reported chlorpyrifos use in the Lower Sacramento River watershed, with walnuts and almonds accounting for most of the reported use. Annual average chlorpyrifos use increased 16%, from 113,203 to 131,447 pounds, between Dec00-Nov05 and Dec05-Nov09 in this watershed. Walnuts had an 18% increase and almonds had a 59% increase in annual average chlorpyrifos use between Dec00-Nov05 and Dec05-Nov09. For the other crops with significant chlorpyrifos use in the Lower Sacramento River watershed (alfalfa, peaches, plums, and cotton), chlorpyrifos use in Dec05-Nov09 was significantly less than in Dec00-Nov05.

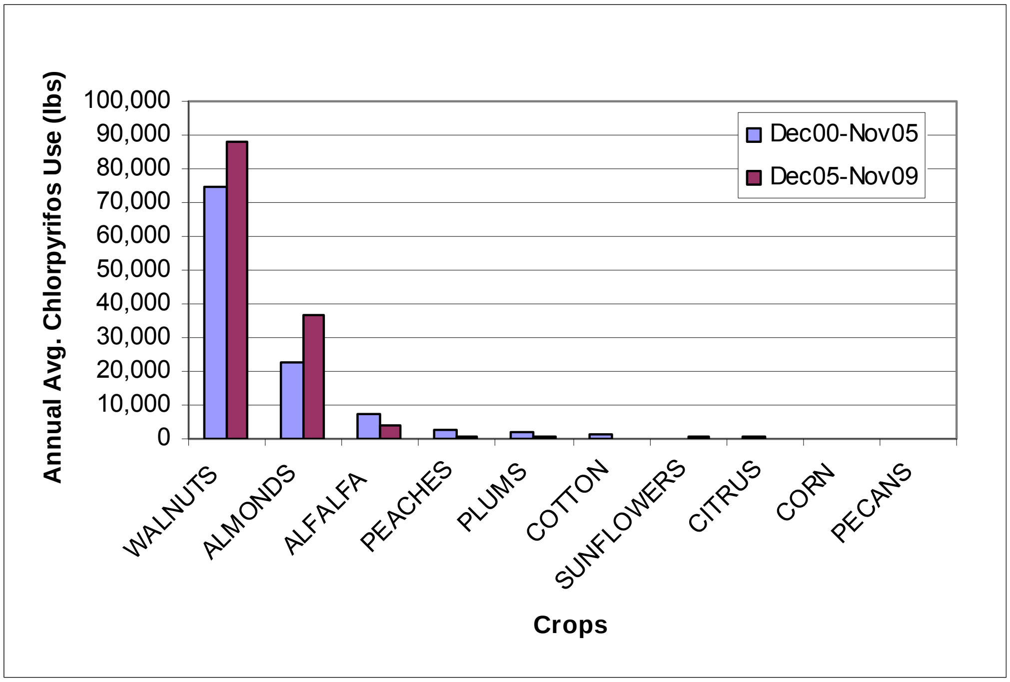

Figure 1-6 Annual Average Chlorpyrifos Use on the Top Ten Crops in Dec00-Nov05 and Dec05-Nov09 in the Lower Sacramento River Watershed.

Figure 1-7 shows the annual average agricultural diazinon uses in the Lower Sacramento River watershed for the ten highest use crops during the two time periods examined. The highest amounts of diazinon were applied, in decreasing order, to plums, peaches, and almonds. In the Lower Sacramento River watershed, the annual average total use of diazinon was reduced about 50% from 55,808 to 28,101 pounds per year between the two time periods. Annual average diazinon use on plums and peaches in Dec05-Nov09 was about half of the use in Dec00-Nov 05. Almonds had a notable 83% reduction in diazinon use between the two time periods. Diazinon use was lower for all crops except cherries, on which use increased about 50% but was still a minor portion of the overall use.

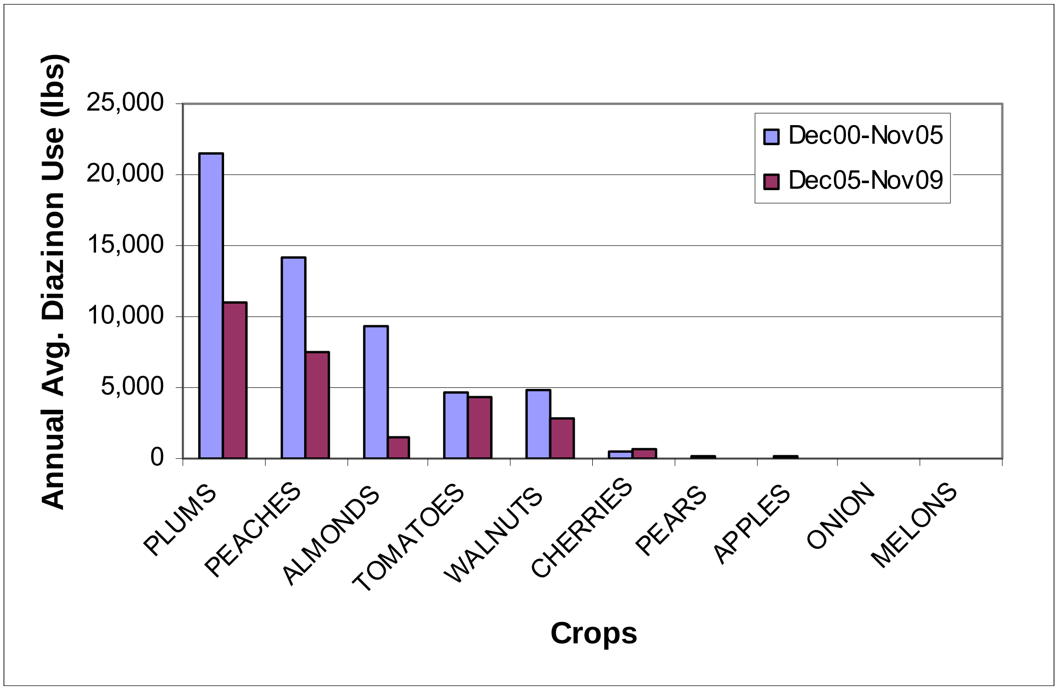

Figure 1-7 Average Annual Diazinon Use for the Top Ten Crops in Dec00-Nov05 and Dec05-Nov09 in the Lower Sacramento River Watershed.

1.4.5. Chlorpyrifos and Diazinon Use in the Lower Delta Watershed

Figure 1-8 shows the annual average agricultural chlorpyrifos uses in the Lower Delta watershed for the two time periods examined. In the Delta watershed, the top ten crops account for about 99% of total reported chlorpyrifos use. The highest uses were, in descending order, walnuts, alfalfa, grapes, almonds, and corn. In the Lower Delta watershed, annual average chlorpyrifos use decreased 5% from 95,964 to 90,955 pounds per year between Dec00-Nov05 and Dec05-Nov09. Walnuts had a slight decline in chlorpyrifos use between Dec00-Nov05 and Dec05-Nov09. Alfalfa chlorpyrifos use declined about 18% between the two time periods. Grapes had a notable increase in chlorpyrifos use (about 262%) between Dec00-Nov05 and Dec05-Nov09, making it the third highest use of chlorpyrifos in the Delta watershed in Dec05-Nov09. The increase in chlorpyrifos use on grapes was likely due to the presence of a newer pest in the Central Valley, the grapevine mealybug.

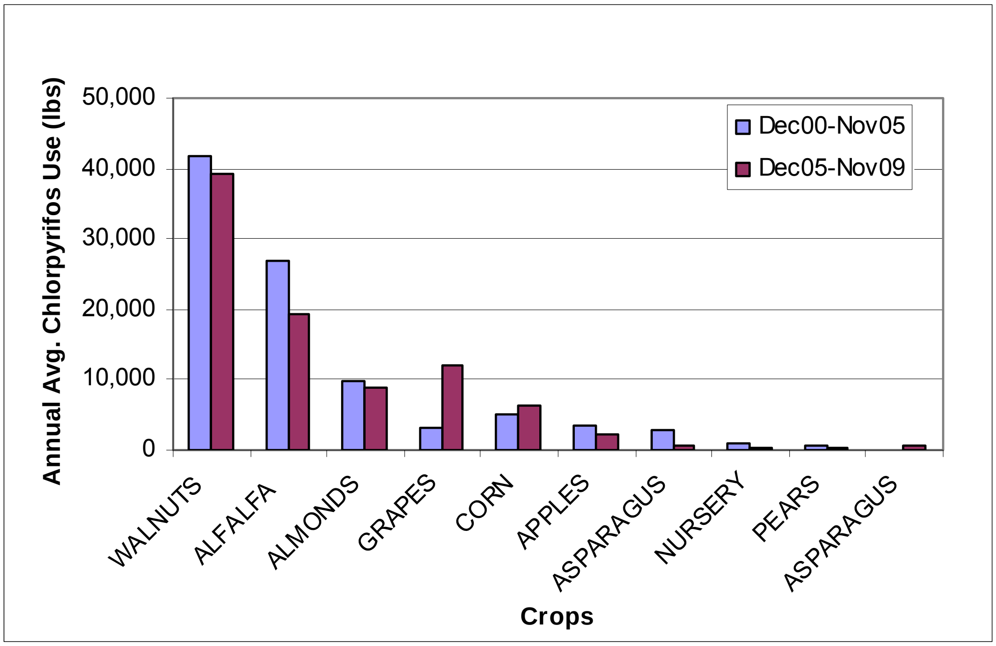

Figure 1-8 Average Annual Chlorpyrifos Use for the Top Ten Crops in Dec00-Nov05 and Dec05-Nov09 in the Lower Delta Watershed.

Figure 1-9 shows the annual average agricultural diazinon use on the ten highest use crops in the Lower Delta watershed for the two time periods examined. In the Lower Delta watershed, the top ten crops account for about 96% of total reported diazinon use, with tomatoes, almonds, and cherries being the main uses. In the Lower Delta watershed, annual average diazinon use decreased 52% from 29,330 to 13,959 pounds per year between Dec00-Nov05 and Dec05-Nov09. Among the top ten crops, all crops except for corn had lower diazinon use in Dec00-Nov05 than in Dec05-Nov09. Almonds had the highest overall use, but this use declined about 69% between Dec00-Nov05 and Dec05-Nov09. Pears, walnuts, plums, and nurseries had similar significant declines in use. The remainder of the top ten crops had minor reductions, except for corn, on which diazinon use increased about 283%.

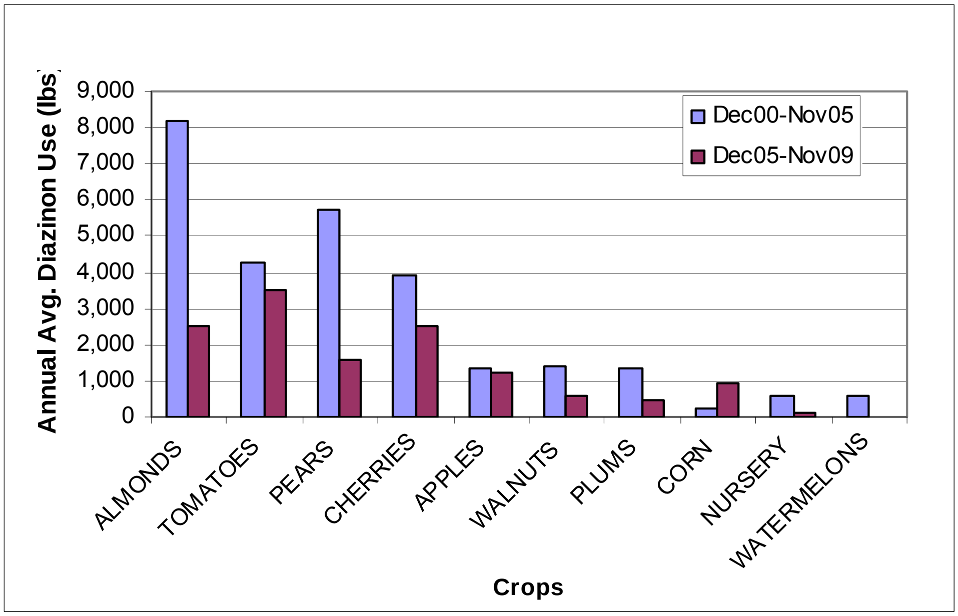

Figure 1-9 Average Annual Diazinon Use for the Top Ten Crops in Dec00-Nov05 and Dec05-Nov09 in the Lower Delta Watershed.

1.4.6. Chlorpyrifos and Diazinon Use in the Lower San Joaquin River Watershed

In the Lower San Joaquin River watershed, annual average chlorpyrifos use decreased 2% from approximately 204,500 to 201,246 pounds per year between Dec00-Nov05 and Dec05-Nov09 (Figure 1-10). In the Lower SJR watershed the top ten crops account for about 98% of total reported chlorpyrifos use. Almonds had the highest chlorpyrifos use, and chlorpyrifos use on almonds declined slightly between the two time periods. Chlorpyrifos use on walnuts, alfalfa, corn, and grapes increased between the two time periods. Use on cotton and peaches decreased significantly, while use on sugarbeets and sweet potatoes had relatively minor decreases in use between the two time periods.

Annual average diazinon use decreased 64% from 36,068 to 13,107 pounds per year between Dec00-Nov05 and Dec05-Nov09 (Figure 1-11). In the San Joaquin River watershed, the top ten crops account for about 95% of total reported diazinon use. Annual average diazinon use declined on all of the top ten crops between Dec00-Nov05 and Dec05-Nov09. Almonds had the highest diazinon use and also the highest reduction (about 71%) between the two time periods.

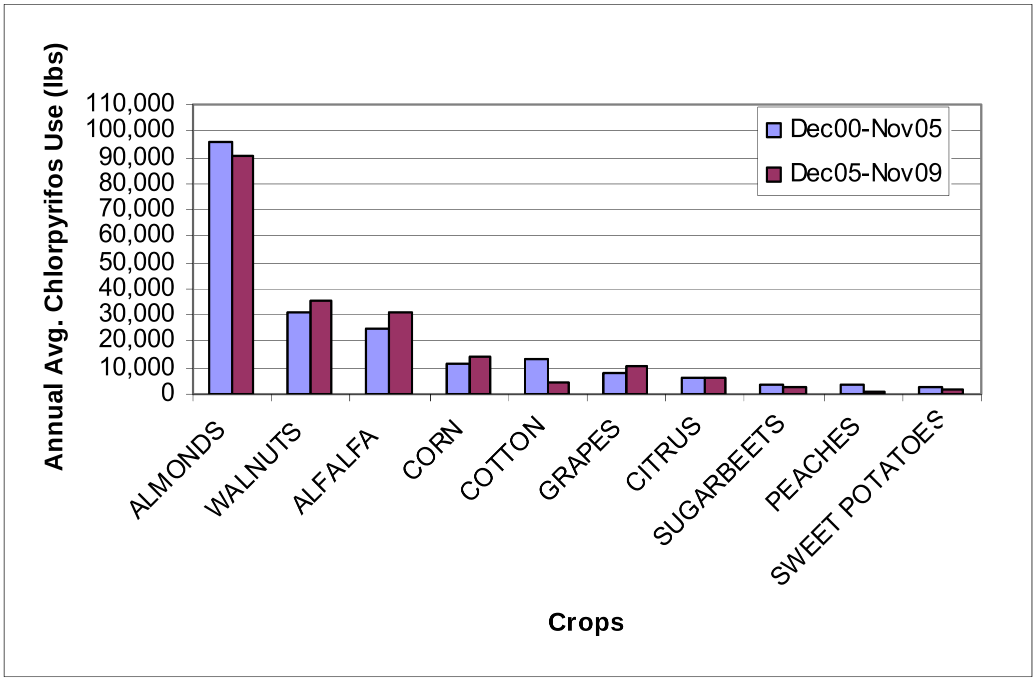

Figure 1-10 Average Annual Chlorpyrifos Use on the Top Ten Crops in the Lower SJR Watershed in Dec00-Nov05 and Dec05-Nov09.

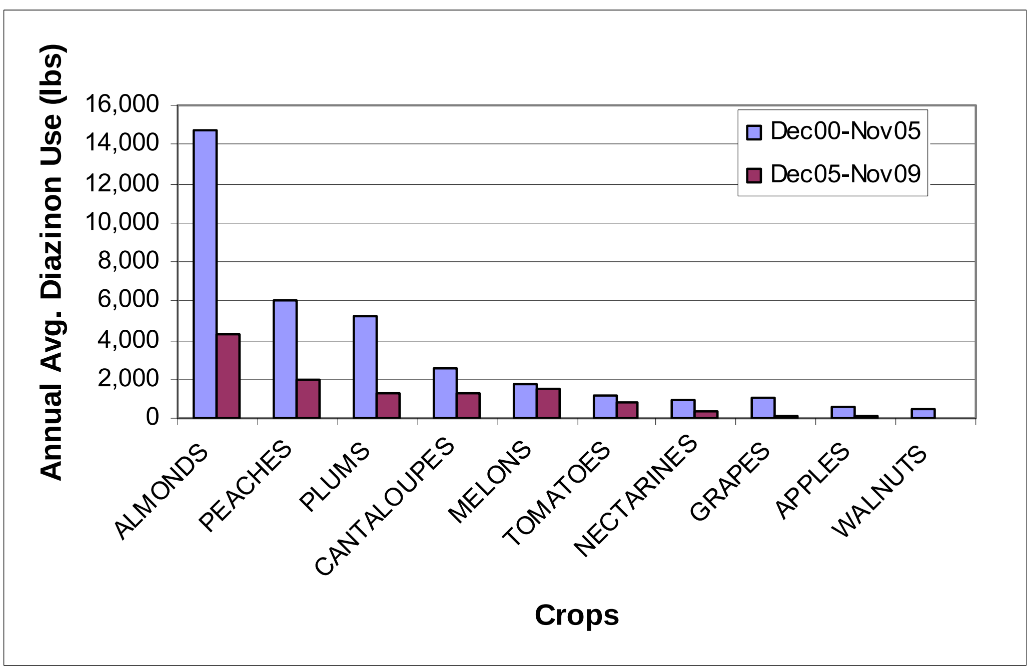

Figure 1-11 Average Annual Diazinon Use on the Top Ten Crops in the Lower SJR Watershed in Dec00-Nov05 and Dec05-Nov09.

1.5 Diazinon and Chlorpyrifos Concentrations in Surface Water in the Sacramento and San Joaquin River Basins

Chlorpyrifos and diazinon are present in several water bodies within the Project Area at concentrations that exceed water quality standards, meaning that they exceed the applicable numeric and/or narrative water quality objectives, discussed below, established in the Basin Plan for the protection of aquatic life. Table 1-7 lists the water bodies in the Project Area that are on the current (2010) Clean Water Act section 303(d) list of water bodies not meeting water quality standards due to diazinon or chlorpyrifos (SWRCB, 2010). There are 105 listings (each listing is a unique water body segment-pollutant combination) in the Project Area. Except for four listings for chlorpyrifos in the Tulare Lake basin[2], all of the 303(d) listings for diazinon and chlorpyrifos in the Central Valley Region were for water bodies within the Project Area. Forty-seven of these listings are addressed by the previously adopted Basin Plan Amendments discussed above. Under section 303(d) of the Clean Water Act, TMDLs are required for the remaining 58 303(d) listings in the Project Area unless data indicate that diazinon and chlorpyrifos concentrations are no longer exceeding standards, or unless other pollution control requirements will successfully address the impairments.

In order to describe current diazinon and chlorpyrifos concentrations, available surface water concentration data from throughout the Project Area from 2000 to 2011 were compiled from multiple sources. Appendix A lists the references for the data source. Only data where detection limits were low enough to assess compliance with criteria shown in Table 1-9 were included in the compilation. Storm water discharge concentrations were compiled for the Sacramento region, the City of Stockton, and the City of Modesto. Wastewater treatment plant (WWTP) discharge concentrations were compiled for WWTPs throughout the Project Area, and included data from the following WWTPs: Sacramento County Regional, Stockton, Oroville, Modesto, Rio Vista, Turlock, Yuba City, and UC Davis. When available, data from more recent years are emphasized to describe current conditions.

While the current 303(d) listings are informative, it should be noted that the most recent update to the 303(d) list was based on data from before March 2007. In addition to the overall data summaries, a more detailed examination of data from the 303(d)-listed water bodies (not addressed by existing TMDLs) is included below to assess the current status of the diazinon and chlorpyrifos in these water bodies.

[2] Addressing listings in the Tulare Lake Basin was outside the scope of this proposed Basin Plan Amendment. The Tulare Lake Basin is covered by a different Basin Plan.

Table 1-7 Project Area Water Bodies on California's 303(d) List Due to Diazinon and Chlorpyrifos Concentrations (SWRCB, 2010).

Water Body Segment	Chlorpyrifos 303(d) listing	Diazinon 303(d) listing	Listing(s) Addressed by Existing TMDL
Delta Watershed			
Bear Creek (San Joaquin and Calaveras Counties; partly in Delta Waterways, eastern portion)		X	
Calaveras River, Lower (from Stockton Diverting Canal to the San Joaquin River; partly in Delta Waterways, eastern portion)	X	X	X
Delta Waterways (central portion)	X	X	X
Delta Waterways (eastern portion)	X	X	X
Delta Waterways (export area)	X	X	X
Delta Waterways (northern portion)	X	X	X
Delta Waterways (northwestern portion)	X	X	X
Delta Waterways (southern portion)	X	X	X
Delta Waterways (Stockton Ship Channel)	X	X	X
Delta Waterways (western portion)	X	X	X
Duck Creek (San Joaquin County)	X		X
Duck Slough (in Delta Waterways, northern portion)	X		X
Elder Creek	X	X	X
Elk Grove Creek	X	X	X
Five Mile Slough (Alexandria Place to Fourteen Mile Slough; in Delta Waterways, eastern portion)	X	X	X
French Camp Slough (confluence of Littlejohns and Lone Tree Creeks to San Joaquin River)	X	X	
Lone Tree Creek	X		
Marsh Creek (Marsh Creek Reservoir to San Joaquin River; partly in Delta Waterways)		X	X
Mokelumne River, Lower (in Delta Waterways, eastern portion)	X		X
Mormon Slough (from Stockton Diverting Canal to Bellota Weir--Calaveras River)	X		
Morrison Creek		X	X
Mosher Slough (downstream of I-5; in Delta Waterways, eastern portion)	X	X	X
Old River (San Joaquin River to Delta-Mendota Canal; in Delta Waterways, southern portion)	X		X
Pixley Slough (San Joaquin County; partly in Delta Waterways, eastern portion)	X	X	
Sand Creek (tributary to Marsh Creek, Contra Costa County; partly in Delta Waterways, western portion)	X		
Ulatis Creek (Solano County)	X	X	
Winters Canal (Yolo County)		X	

Water Body Segment	Chlorpyrifos 303(d) listing	Diazinon 303(d) listing	Listing(s) Addressed by Existing TMDL
Delta Watershed Total	***23***	***20***	***31***
Sacramento River Watershed			
Arcade Creek	X	X	X
Bear River, Lower (below Camp Far West Reservoir)	X	X	
Butte Slough		X	
Chicken Ranch Slough	X	X	X
Colusa Basin Drain		X	
Coon Creek, Lower (from Pacific Avenue to Main Canal, Sutter County)	X		
Feather River, Lower (Lake Oroville Dam to Confluence with Sacramento River)	X		X
Gilsizer Slough (from Yuba City to downstream of Township Road, Sutter County)		X	
Jack Slough		X	
Live Oak Slough		X	
Main Drainage Canal		X	
Morrison Slough		X	
Natomas East Main Drainage Canal (aka Steelhead Creek, downstream of Arcade Creek)		X	
Sacramento Slough	X		
Spring Creek (Colusa County)	X	X	
Stony Creek	X		
Strong Ranch Slough	X	X	X
Wadsworth Canal	X	X	
Yankee Slough (Placer and Sutter Counties)	X		
Sacramento River Watershed Total	***11***	***14***	***7***
San Joaquin River Watershed			
Ash Slough (Madera County)	X		
Berenda Creek (Madera County)	X		
Berenda Slough (Madera County)	X		
Deadman Creek (Merced County)	X		
Del Puerto Creek	X	X	
Dry Creek (tributary to Tuolumne River at Modesto, E Stanislaus County)	X	X	
Duck Slough (Merced County)	X		
Harding Drain	X		
Highline Canal (from Mustang Creek to Lateral No 8, Merced and Stanislaus Counties)	X		
Ingram Creek (from confluence with San Joaquin River to confluence with Hospital Creek)	X	X	

Water Body Segment	Chlorpyrifos 303(d) listing	Diazinon 303(d) listing	Listing(s) Addressed by Existing TMDL
Merced River, Lower (McSwain Reservoir to San Joaquin River)	X	X	
Mustang Creek (Merced County)	X	X	
Newman Wasteway	X		
Orestimba Creek (above Kilburn Road)	X	X	
Orestimba Creek (below Kilburn Road)	X	X	
Salt Slough (upstream from confluence with San Joaquin River)	X		
San Joaquin River (Mendota Pool to Bear Creek)	X	X	X
San Joaquin River (Bear Creek to Mud Slough)	X		X
San Joaquin River (Mud Slough to Merced River)	X	X	X
San Joaquin River (Merced River to Tuolumne River)	X		X
San Joaquin River (Tuolumne River to Stanislaus River)	X	X	X
San Joaquin River (Stanislaus River to Delta Boundary)	X		X
Stanislaus River, Lower	X	X	
Tuolumne River, Lower (Don Pedro Reservoir to San Joaquin River)	X	X	
Westley Wasteway (Stanislaus County)	X		
San Joaquin River Watershed Total	***25***	***12***	***9***
Grand Total	59	46	Total 303 (d) listings: 105
Addressed by Existing TMDLs	26	21	Total Addressed by Existing TMDLs: 47
Listings Requiring TMDLs or other pollution control requirements	33	25	Total Listings Yet to be Addressed: 58

It is important to note that the increase in the number of 303(d) listings for diazinon and chlorpyrifos in recent years is the result of increased monitoring data, especially data from the Irrigated Lands Regulatory Program (ILRP), and is not an indication of increasing concentration trends. Diazinon and chlorpyrifos concentrations actually appear to be declining in water bodies throughout the Sacramento and San Joaquin River Basins, including those which are still 303(d) listed. In the 303(d) list updates which occurred in 2006 and 2010, a number of diazinon listings and one chlorpyrifos listing were removed because the concentrations in these water bodies were found to meet water quality objectives. These “de-listings” are shown in Table 1-8. More recent data also indicate there may be additional “de-listings” during the next update of the 303(d) list, as discussed below.

Table 1-8 Project Area Diazinon and Chlorpyrifos Listings Removed from the 303(d) List Due to Attainment of Water Quality Objectives.

Water Body Segment	Year Chlorpyrifos 303(d) listing removed	Year Diazinon 303(d) listing removed
Delta Watershed		
Morrison Creek	2010	Still Listed
Sacramento River Watershed		
Sacramento River (Knights Landing to the Delta)	Never Listed	2010
Feather River, Lower (Lake Oroville Dam to Confluence with Sacramento River)	Still listed	2010
Sacramento Slough	Still Listed	2008
Sutter Bypass	Never Listed	2008
San Joaquin River Watershed		
Harding Drain	Still Listed	2006
Newman Wasteway	Still Listed	2010
Salt Slough (upstream from confluence with San Joaquin River)	Still Listed	2010
San Joaquin River (Merced River to Tuolumne River)	Still Listed	2010
San Joaquin River (Bear Creek to Mud Slough)	Still Listed	2010
San Joaquin River (Stanislaus River to Delta Boundary)	Still Listed	2010
Total Water Body Segments Delisted	**1 chlorpyrifos**	**9 diazinon**

As discussed in Section 4, out of all of the beneficial uses delineated in the Basin Plan, it is the aquatic life beneficial uses of water that are the most sensitive to diazinon and chlorpyrifos. In this section, concentration data are compared to aquatic life water quality criteria. The water quality criteria currently used by the Central Valley Water Board to interpret narrative water quality objectives (in the ILRP, for example) are those developed by the California Department of Fish and Game, shown in Table 1-9 (CDFG; Siepmann and Finlayson, 2000, Finlayson 2004). In addition to being used to interpret narrative water quality objectives, these criteria are also formally established in the Basin Plan as the numeric water quality objectives for the Lower Sacramento, Feather, and San Joaquin Rivers and the Delta. Other water quality criteria for the protection of aquatic life, discussed in Section 4, are also available and are generally similar in magnitude to the CDFG criteria.

Table 1-9 CDFG Water Quality Criteria for the Protection of Aquatic Life.

Pesticide	Maximum Concentration and Averaging Period
Chlorpyrifos	0.025 µg/L ; 1-hour average (acute) 0.015 µg/L ; 4-day average (chronic) Not to be exceeded more than once in a three year period.
Diazinon	0.16 µg/L ; 1-hour average (acute) 0.10 µg/L ; 4-day average (chronic) Not to be exceeded more than once in a three year period.

When diazinon and chlorpyrifos appear in water at the same time, they exhibit additive toxicity to aquatic organisms (Bailey et al., 1997). When both diazinon and chlorpyrifos concentration data were available for the same time and sampling site, Equation 1 was used to calculate the additive toxic potential of the combination of diazinon and chlorpyrifos.

$$\frac{C_D}{WQO_D} + \frac{C_C}{WQO_C} = S, \qquad S \leq 1 \quad \text{(Equation 1)}$$

Where:

C_D = Diazinon concentration in the receiving water.
C_C = Chlorpyrifos concentration in the receiving water.

WQO_D = Acute or chronic diazinon water quality objective or criterion.
WQO_C = Acute or chronic chlorpyrifos water quality objective or criterion
S = The sum. A sum (S) exceeding one (1.0) indicates a potential exceedance of water quality objectives.

Equation 1 is currently established in the Basin Plan as the loading capacity for the Sacramento, Feather, and San Joaquin Rivers and the Delta. Equation 1 is used in this report to assess attainment of narrative water quality objectives for co-occurring concentrations of diazinon and chlorpyrifos.

When evaluating the available concentration data, it is important to keep in mind the following key factors:

1) Monitoring in this large Project Area has been highly variable and the available data are a result of the monitoring studies and programs implemented. The concentrations observed in a particular water body or site are highly dependent on the timing and frequency of sampling, and the data for a particular watershed or geographic area are highly dependent on which water bodies and sites are sampled.
2) Monitoring tends to occur in sites downstream of potential sources. Therefore, monitoring tends to be more representative of water bodies in areas with higher pesticide use.
3) Many of the data have analytical detection limits that are above levels of concern, particularly for chlorpyrifos. Data in which diazinon or chlorpyrifos was not detected and the detection limit was greater than the criterion were excluded from the data summaries.
4) The sites and time periods with more frequent and well-timed data collection (especially during key runoff events) and lower analytical detection limits are better characterized than the sites and time periods with few data and/or higher detection limits.
5) The dynamics of pesticide use patterns, management practice implementation, and changes in the registered uses of these pesticides have affected and will continue to affect the presence of these pesticides in surface waters.

With these factors in mind, the available data can be used to make informed observations about the concentrations in surface waters, since there is a large amount of high quality concentration data and much of that data was collected under programs and studies that included in their design the characterization of diazinon and chlorpyrifos sources and concentrations.

Table 1-10 shows concentrations in the different types of water bodies and in municipal wastewater treatment plant effluent in recent years, 2006 through 2010. In Table 1-10, there are distinctions between “agricultural drains,” “urban storm drains,” and “Sacramento and San Joaquin Valley water bodies.” This distinction, which is further described in Section 2 below, was made to separate minor constructed drainages and conveyances from the surface water bodies where the diazinon and chlorpyrifos water quality objectives will be established. It should be noted that data were not available for many agricultural drains and drains closer to the application sites would likely show higher concentrations. Concentrations in Sacramento and San Joaquin Valley water bodies are further described below for the three major watersheds in the Project Area.

Chlorpyrifos was detected in 24% of the samples from agricultural drains and 15% of samples from Sacramento and San Joaquin Valley water bodies. Criteria exceedances in agricultural drains were fairly frequent; chlorpyrifos concentrations exceeded acute or chronic criteria in 10% or 14% of samples, respectively. Chlorpyrifos criteria exceedances in Sacramento and San Joaquin Valley water bodies were also somewhat frequent, with chlorpyrifos concentrations exceeding acute or chronic criteria in 6% or 8% of samples, respectively.

Chlorpyrifos was detected in WWTP effluent or urban storm drains in 16% or 21% of the samples, respectively. Chlorpyrifos concentrations exceeded acute and chronic criteria rarely in municipal storm water (exceedances in 2% or 4% of samples, respectively) and somewhat more frequently in WWTP effluent (5% or 8% of samples, respectively). Exceedances in WWTP effluent were all from the Sacramento Regional County Sanitation District, which discharges secondary treated effluent and receives influent from both domestic wastewater and storm water. Since almost all non-agricultural uses were phased out over a decade ago, the source of chlorpyrifos in municipal storm water and wastewater is not known. The source could include runoff from sites of the remaining few registered non-agricultural uses or residential uses of remaining stocks that were purchased before the phase out. Sources could also include agricultural uses within urban areas, or atmospheric transport from agricultural uses in the region. In the city of Stockton, chlorpyrifos concentrations above the CDFG criteria have been measured in recent rainwater samples (0.040 and 0.120 ug/L in samples collected in March 2009; City of Stockton (LWA, 2009).

The readily available data for 2006 through 2010 show only one diazinon detection and no exceedances of diazinon criteria in WWTP effluent. Diazinon was sometimes detected in municipal storm water, but did not exceed the acute criterion and only exceeded the chronic criterion in one of 66 4-day average concentrations. Diazinon was detected in 5% of samples from agricultural drains, with only two measured exceedances in 488 samples. Diazinon was detected in 16% of samples from the Valley water bodies and 1% of those samples exceeded criteria.

Table 1-10 Concentrations in Valley Water Bodies and Sources (2006-2011).

Type of Water Body		Chlorpyrifos		Diazinon	
Agricultural Drains	Number of Samples	556		488	
	Detections	136	24%	22	5%
	Exceedances of CDFG acute criterion	55	10%	2	0.4%
	Number of 4-day Averages	556		488	
	Exceedances of CDFG chronic criterion	76	14%	2	0.4%
	Maximum Concentration (ug/L)	1.7		0.28	
Sacramento and San Joaquin Valley Water Bodies (excludes minor constructed Agricultural and Urban Drains)	Number of Samples	3219		3269	
	Detections	478	15%	513	16%
	Exceedances of CDFG acute criterion	178	6%	26	1%
	Number of 4-day Averages	2853		2903	
	Exceedances of CDFG chronic criterion	224	8%	37	1%
	Maximum Concentration (ug/L)	3.7		4.3	
Urban Storm Drains	Number of Samples	121		72	
	Detections	26	21%	11	15%
	Exceedances of CDFG acute criterion	3	2%	0	0%
	Number of 4-day Averages	114		66	
	Exceedances of CDFG chronic criterion	4	4%	1	2%
	Maximum Concentration (ug/L)	0.065		0.13	
Municipal Wastewater Treatment Plant Effluent	Number of Samples	120		174	
	Detections	19	16%	1	1%
	Exceedances of CDFG acute criterion	6	5%	0	0%
	Number of 4-day Averages	73		127	
	Exceedances of CDFG chronic criterion	6	8%	0	0%
	Maximum Concentration (ug/L)	0.039		0.088	
All Data	Number of Samples	4016		4003	
	Detections	659	16%	547	14%
	Exceedances of CDFG acute criterion	242	6%	28	1%
	Number of 4-day Averages	3596		3584	
	Exceedances of CDFG chronic criterion	310	9%	40	1%
	Maximum Concentration (ug/L)	3.7		4.3	

Comparing recent concentrations with historical concentrations, it is apparent that reductions in pesticide uses and the implementation of practices that control pesticide discharges have been effective at reducing diazinon and chlorpyrifos concentrations in surface water. Recent concentrations of diazinon and chlorpyrifos are significantly reduced from the early 1990s, when concentrations were frequently above water quality criteria and toxic to test organisms in samples from major rivers and the Delta ((Foe et al., 1995; Kuivila and Foe, 1995; Deanovic, et al., 1998), and in urban streams (Spector et al., 2005).

Water quality objectives for diazinon and chlorpyrifos are routinely met in the Sacramento River and in the lowermost reach of the San Joaquin River upstream of the Delta. As these rivers are the major tributaries of the Delta, concentrations and loads to the Delta have also been reduced significantly since peak measured concentrations in the 1990s (McClure et al., 2006). Declines in concentrations of diazinon in Valley water bodies in urban, agricultural, and mixed watersheds, and declines of chlorpyrifos in Valley water bodies in all urban and some agricultural and mixed watersheds were also reported in a recent data review by the US Geological Survey (Johnson et al., 2010).

In response to reductions in concentrations, a number of water body segments were removed from the 303(d) list in the most recent (2010) update, as shown in Table 1-8. Despite these reductions, concentrations of chlorpyrifos, and to a much lesser extent, diazinon, are still frequently at levels of concern, particularly in some smaller tributaries in agricultural areas, which are represented in the current 303(d) listings. As discussed below, some reaches of the San Joaquin River still occasionally exceed the water quality objectives for chlorpyrifos, as do some Delta Waterways, indicating that more effort will be needed to achieve the existing Basin Plan requirements for the San Joaquin River and the Delta.

Tables 1-11 and 1-12 summarize, by month, recent (2006-2011) chlorpyrifos and diazinon concentration data for Sacramento and San Joaquin Valley water bodies. For both diazinon and chlorpyrifos, detections and exceedances of criteria correspond with the periods of high use shown in Figures 1-4 and 1-5, with the most chlorpyrifos detections and exceedances occurring in July and August, and the most diazinon exceedances occurring in January and February. There were multiple chlorpyrifos exceedances in every month except December. There were diazinon exceedances in every month except May, August, September, and November, but only January, February, and July had multiple exceedances. While chlorpyrifos use and exceedances are generally concentrated in the summer and diazinon use and exceedances are generally concentrated in the winter, there are months when concentrations of both pesticides can co-occur at levels of concern.

Table 1-11 Chlorpyrifos Data for Valley Water Bodies (2006-2011), Summarized by Month.

month	Samples Analyzed	Detections	Exceedances of CDFG 1-hour Criterion (0.025 ug/L)	4-day average Concentrations[3]	Exceedances of CDFG 4-day Criterion
1	277	56	12	207	13
2	445	51	10	318	13
3	339	30	5	274	9
4	270	24	5	255	7
5	312	44	21	289	25
6	315	36	13	306	12
7	336	119	50	329	68
8	309	67	36	301	45
9	197	35	19	193	24
10	150	12	4	144	5
11	96	3	3	93	3
12	173	1	0	144	0
Total	3219	478	178	2853	224

Table 1-12 Diazinon Data for Valley Water Bodies (2006-2011), Summarized by Month.

month	Samples Analyzed	Detections	Exceedances of CDFG 1-hour Criterion (0.025 ug/L)	4-day average Concentrations	Exceedances of CDFG 4-day Criterion
1	293	108	9	222	11
2	462	146	10	334	14
3	349	71	2	283	3
4	291	49	1	276	1
5	312	18	0	289	0
6	322	27	0	313	1
7	324	25	4	318	5
8	301	21	0	294	0
9	192	8	0	190	0
10	156	12	0	149	1
11	95	9	0	92	0
12	172	19	0	143	1
Total	3269	513	26	2903	37

To examine potential toxicity of combinations of diazinon and chlorpyrifos, the additive toxicity formula (Equation 1) was applied to recent (2006-2011) samples where both diazinon and chlorpyrifos were measured. The results in Table 1-13 are classified into

[3] 4-day average concentrations were calculated by taking the average (mean) of all concentrations measured within a 4-day period.

columns indicating whether one, both, or neither of the pesticides was detected. The samples in which both pesticides were detected are of most interest because the additive toxicity formula would be more protective than the individual criteria in these samples. For the samples in which only one pesticide was detected, the individual criteria yield the same result as the additive toxicity formula. Table 1-13 summarizes the results of applying the additive toxicity formula for samples from the different classifications of water bodies and in municipal wastewater treatment plant effluent.

While the data sources for Table 1-13 are the same as those used to summarize individual concentrations in Table 1-10, not all of the samples were analyzed for both pesticides. There were 3,108 samples from Valley water bodies that were analyzed for both diazinon and chlorpyrifos and only these data are included in Table 1-13. Diazinon and chlorpyrifos were both detected in 147 (4.7%) of the 3,108 samples and 37 of those exceeded the 1-hour additive toxicity formula. There were an additional 153 acute exceedances that were due to the concentration of one pesticide. For the Valley water bodies, there were 2,744 4-day periods with data for both pesticides and diazinon and chlorpyrifos co-occurred in 134 (4.8%) of those 4-day periods. There were a total of 244 chronic exceedances and 43 of these samples contained both pesticides. Chlorpyrifos and diazinon did not frequently co-occur in the Valley water bodies, but both pesticides were detected in18% of chronic and 25% of acute exceedances of the additivity formula.

In agricultural drains monitored in recent years, there were 478 samples that were analyzed for both diazinon and chlorpyrifos. These pesticides were both detected in 8 (about 2%) of these samples. Forty-eight of these 478 samples exceeded the 1-hour additive toxicity formula and six of those exceedances were due to the presence of both pesticides. Both pesticides were detected in 8 of the 478 available 4-day averages. Seven of those 4-day averages exceeded the additive toxicity formula due to the presence of both pesticides, while there were 56 exceedances due to a single pesticide. For agricultural drains, the pesticides did not co-occur frequently, but when they did it was highly likely that the additive toxicity formula would be exceeded.

In urban storm drains both diazinon and chlorpyrifos were detected in 2 of 72 samples from recent years (2006-2011). Three samples exceeded the 1-hour additive toxicity formula, and both pesticides were present during 2 of those exceedances. There were 66 4-day periods with data available for both pesticides. Both pesticides were detected during 2 of these 4-day periods. Five samples exceeded the 4-day additive toxicity formula, and both pesticides were present during two of those exceedances. In municipal wastewater treatment plant effluent data from recent years, diazinon was not detected, so all the exceedances were due to chlorpyrifos alone.

Table 1-13 Additive Toxicity Formula (Equation 1) Results (S values) Based recent (2006-2011) Diazinon and Chlorpyrifos Monitoring.

Type of Water Body		Pesticides Detected				All Samples
		both	chlorpyrifos	diazinon	Neither	
Agricultural Drains	Number of Samples	**8**	83	13	374	478
	Acute Exceedances (1-hr S >1)	**6**	41	1	0	48
	Number of 4-Day Averages	**8**	83	13	374	478
	Chronic Exceedances (4-d S>1)	**7**	55	1	0	63
	Maximum 1-hr S –value	**4.8**	68	1.75	0	68
	Maximum 4-day S-value	**8**	113	3	0	113
Sacramento and San Joaquin Valley Water Bodies (excludes minor constructed Agricultural and Urban Drains)	Number of Samples	**147**	296	359	2306	3108
	Acute Exceedances (1-hr S >1)	**37**	135	18	0	190
	Number of 4-Day Averages	**134**	277	257	2076	2744
	Chronic Exceedances (4-d S>1)	**43**	175	26	0	244
	Maximum 1-hr S –value	**69**	148	27	0	148
	Maximum 4-day S-value	**115**	247	25	0	247
Urban Storm Drains	Number of Samples	**2**	3	9	58	72
	Acute Exceedances (1-hr S >1)	**2**	1	0	0	3
	Number of 4-Day Averages	**2**	3	9	52	66
	Chronic Exceedances (4-d S>1)	**2**	2	1	0	5
	Maximum 1-hr S –value	**2.8**	1.7	0.8	0	2.8
	Maximum 4-day S-value	**4.6**	2.9	1.3	0	4.6
Municipal Wastewater Treatment Plant Effluent	Number of Samples		13		86	99
	Acute Exceedances (1-hr S >1)		6		0	6
	Number of 4-Day Averages		5		47	52
	Chronic Exceedances (4-d S>1)		5		0	5
	Maximum 1-hr S –value		1.6		0	1.6
	Maximum 4-day S-value		1.8		0	1.8

1.5.1. Chlorpyrifos and Diazinon Concentrations in the Sacramento River Watershed

Table 1-14 describes recent (2006-2011) chlorpyrifos and diazinon concentrations in Valley water bodies (surface waters excluding minor constructed drains and conveyances) in the Lower Sacramento River watershed. The data are parsed by watershed land uses to describe concentrations in water bodies where the land uses are primarily urban, primarily agricultural, or a mixture of urban and agricultural land uses.

In the urban streams in the Lower Sacramento River watershed, diazinon was detected in about 20% of samples from 2006-2011, but the CDFG acute and chronic criteria were each exceeded in only two of those samples, or about 1%. Chlorpyrifos was occasionally detected in urban streams and exceeded each criterion in 2 (about 1%) of the samples. Therefore it appears that most urban streams in the Sacramento River watershed are no longer impaired by diazinon or chlorpyrifos, and the available data would likely warrant the removal of some or all of these diazinon and chlorpyrifos listings from the 303(d) list.

In water bodies with both urban and agricultural sources in the Lower Sacramento River basin, chlorpyrifos and diazinon were detected in 3 and 30% of samples, respectively, from 2006-2011. Chlorpyrifos only exceeded the chronic criterion once and did not exceed the acute criterion. Diazinon exceeded acute and chronic criteria in 3% of samples.

Chlorpyrifos and diazinon were detected in 6 and 11% of samples, respectively, from agricultural streams monitored in the Lower Sacramento River basin. The acute criteria for chlorpyrifos and diazinon were exceeded in 2% and 0.5% of samples, respectively. It should be noted that there was little recent data from several water bodies in agricultural areas of the Sacramento River watershed that are currently 303(d)-listed for diazinon and/or chlorpyrifos, such as Butte Slough, Gilsizer Slough, Live Oak Slough, Jack Slough, Bear River, Sacramento Slough, Spring Creek, and Wadsworth Canal. In addition, the attainment of the chlorpyrifos objectives in the Feather River is currently unknown, as it has not been monitored in the summer since 2007. The most recent 2007 summer data for chlorpyrifos in the Feather River had no exceedances in monthly sampling, but there was one exceedance of the chronic criterion in 2006. More recent data for these water bodies would provide a more complete picture of concentrations in the Lower Sacramento River watershed.

Table 1-14 Concentrations in Lower Sacramento River Basin Water Bodies (2006-2011).

Watershed Type		Chlorpyrifos		Diazinon	
Agricultural	Number of Samples	205		206	
	Detections	12	6%	22	11%
	Exceedances of CDFG acute criterion	4	2%	1	0.5%
	Number of 4-day Averages	199		200	
	Exceedances of CDFG chronic criterion	6	3%	2	1%
	Maximum Concentration (ug/L)	0.05		0.222	
Mixed	Number of Samples	449		448	
	Detections	13	3%	136	30%
	Exceedances of CDFG acute criterion	0	0%	14	3%
	Number of 4-day Averages	341		339	
	Exceedances of CDFG chronic criterion	1	0.3%	11	3%
	Maximum Concentration (ug/L)	0.0176		4.2863	
Urban	Number of Samples	186		188	
	Detections	11	6%	39	21%
	Exceedances of CDFG acute criterion	2	1%	2	1%
	Number of 4-day Averages	185		187	
	Exceedances of CDFG chronic criterion*	2	1%	2	1%
	Maximum Concentration (ug/L)	0.043		2.50	
All Data	Number of Samples	840		842	
	Detections	36	4%	197	23%
	Exceedances of CDFG acute criterion	6	1%	17	2%
	Number of 4-day Averages	725		726	
	Exceedances of CDFG chronic criterion*	9	1%	15	2%
	Maximum Concentration (ug/L)	0.05		4.3	

The Sacramento River has been sampled extensively, and in recent years no exceedances of diazinon criteria have been observed, which resulted in the Sacramento River diazinon listing being recently removed from the 303(d) list. The reduction in diazinon in the Lower Sacramento River and its largest tributary, the Feather River, and their tributaries was recently written up as a watershed success story by USEPA (USEPA, 2010). This document gives an extensive history of the efforts by the agricultural community, the Sacramento River Watershed Program and other watershed groups, University of California researchers, and government agencies that contributed to the efforts to control diazinon runoff in the Lower Sacramento River.

The reductions of diazinon concentrations in the Sacramento River show that the diazinon loading from the Sacramento River watershed has declined substantially. However, there are still exceedances of diazinon criteria in the Sacramento River watershed, including a notable diazinon concentration of over 4 ug/L in the Colusa Basin Drain measured in February 2008 (SVWQC, 2008). This concentration, measured in a significant tributary of the Sacramento River, indicates that there are still sources in the watershed that could potentially cause the diazinon concentrations in the Sacramento River to exceed diazinon water quality objectives during the dormant season.

A more detailed examination of data from the 303(d)-listed water bodies not addressed by existing TMDLs in the Sacramento River watershed is included below to assess their current status. The data included in these descriptions is not constrained to the 2006-2011 time period used above to summarize the more recent data.

1.5.1.1. The Lower Bear River

Bear River flows from Camp Far West Reservoir into the Feather River near Nicolaus, through mostly agricultural lands. This segment was listed for diazinon in 2002 based on samples collected in the dormant season in 1994 and 2000, and it remains listed for diazinon. More recent data contain no diazinon exceedances, but were not sufficient to justify delisting during the 2006 or the 2010 303(d) list updates. Based on the most recent data available from 2005, Bear River was also listed for chlorpyrifos in 2010. While there are sparse data from Bear River in recent years, the available data indicate that diazinon and chlorpyrifos concentrations exceed water quality standards. Therefore, this impairment needs to be addressed through the establishment of specific pollution control requirements.

1.5.1.2. Butte Slough

Butte Slough is located in Butte County west of the Sutter Buttes, and flows between Butte Creek and the Sutter Bypass. It receives agricultural and urban drainage. Butte Slough was 303(d)-listed for diazinon in 2002 based on data from January and February 1994 showing multiple exceedances. Subsequent monitoring in 2000 (9 samples), 2001 (12 samples), 2002 (7 samples), 2003 (17 samples, all in the dormant season), 2005 (7 samples, 2 in the dormant season), and 2006 (7 samples, none in the dormant season) showed no exceedances. Chlorpyrifos concentrations in Butte Slough samples have never exceeded criteria. Since the available data have shown no exceedances since 1994, it appears diazinon concentrations in Butte Slough are no longer exceeding water quality standards. Therefore, a TMDL or other specific pollution control requirements for diazinon in Butte Slough are not required and it is recommended that the diazinon listing for Butte Slough should be considered for removal from the 303(d) list the next time it is updated.

1.5.1.3. Coon Creek (Sutter County)

Coon Creek is located in an agricultural area southeast of Nicolaus in Sutter County. Coon Creek was 303(d)-listed for chlorpyrifos in 2010 based on data from 2005, which had exceedances in 2 of 15 samples. Subsequent monitoring in 2006, 2007, 2008, and 2009 showed no chlorpyrifos detections or exceedances in 27 samples, and the management plan was deemed complete for Coon Creek. However, new monitoring in 2011 had two new chlorpyrifos exceedances. These recent data indicate that chlorpyrifos concentrations in Coon Creek are exceeding water quality standards, and specific pollution control requirements should be established for Coon Creek.

1.5.1.4. Colusa Basin Drain

Colusa Basin Drain is a major agricultural drain that drains a large agricultural area west of the Sacramento River. During high flows, the Colusa Basin drain flows into the Yolo Bypass via the Knight's Landing Ridge Cut. The Colusa Basin Drain was 303(d)-listed for diazinon in 2002 and the listing was re-confirmed in the 2006 and 2010 303(d) list updates based on multiple exceedances in the 1990s and early 2000s. Samples from 2005, 2006, and 2007 contained no diazinon exceedances, but samples from 2008 contained two exceedances with very high diazinon concentrations (762 ng/L and 4,286 ng/L during February 2008). Monitoring data from 2010 contained no exceedances but only had two dormant season samples. The available data indicate that diazinon concentrations in the Colusa Basin Drain are exceeding water quality standards. Therefore, this impairment must be addressed through the establishment of specific pollution control requirements.

1.5.1.5. Gilsizer Slough

Gilsizer Slough is located in Sutter County and flows from the city of Gridley into the Sutter Bypass and receives both urban and agricultural drainage. Gilsizer Slough was 303(d)-listed for diazinon in 2010 based on data from 2000, 2004, and 2006 showing exceedances. More recent data from 2009 from the Sacramento Valley Coalition contains additional diazinon exceedances during the dormant season. These data indicate that diazinon concentrations in Gilsizer Slough are exceeding water quality standards, and specific pollution control requirements must be established to address the diazinon impairment in Gilsizer Slough. Gilsizer Slough is under a management plan for diazinon developed by the Sacramento Valley Coalition. The area has also received significant USDA grant funding to reduce diazinon dischargers.

1.5.1.6. *Jack Slough*

Jack Slough is an eastern tributary to the Feather River flowing through mostly agricultural land near Marysville. Jack Slough was listed for diazinon in 2002 due to high diazinon concentrations measured in the dormant seasons in 1994 and 2000. Subsequent monitoring in 2002 contained additional diazinon exceedances. Four samples were collected during the dormant season in 2006 in which diazinon was detected at concentrations below criteria. While concentrations of diazinon in Jack Slough appear to be declining, the available data indicate that diazinon concentrations in Jack Slough are exceeding water quality standards, and specific pollution control requirements must be established for Jack Slough.

1.5.1.7. *Live Oak Slough*

Live Oak Slough flows through mostly agricultural areas near the city of Live Oak in Sutter County into Wadsworth Canal, which flows into the Sutter Bypass. Live Oak Slough was 303(d)-listed for diazinon in 2010 based on exceedances during two winter storms in 2006. No subsequent data have been collected. Therefore the available data indicate that diazinon concentrations in Live Oak Slough are exceeding water quality standards, and specific pollution control requirements must be established for Live Oak Slough.

1.5.1.8. *Main Drainage Canal*

Main Drainage Canal is a large agricultural drain that flows through agricultural land in Butte and Sutter Counties and into Cherokee Canal. Main Drainage Canal was listed for diazinon in 2006 based on data from 1994, 2000, 2001, and 2002 showing multiple exceedances. Subsequent monitoring in January and February 2006 (four samples) had one exceedance. Monitoring in 2007 (nine samples, two during the dormant season) had no exceedances. The available data indicate that diazinon concentrations in Main Drainage Canal are exceeding water quality standards, and specific pollution control requirements must be established for the Main Drainage Canal.

1.5.1.9. *Natomas East Main Drainage Canal (aka Steelhead Creek)*

Natomas East Main Drainage Canal (aka Steelhead Creek) receives flow from several rural and urban water bodies north of Sacramento and flows into the Sacramento River north of the American River. It was 303(d)-listed for diazinon in 1996 based on data from the early 1990s. Data from 2003, 2004, 2005, 2006, 2007, and 2008 contain no exceedances for diazinon or chlorpyrifos, which is consistent with data from urban streams in the area. Since the available data have shown no exceedances and would support delisting, a TMDL or specific pollution control requirements for diazinon are not necessary and the diazinon listing for Natomas East Main Drainage Canal should be considered for removal from the 303(d) list during the next update.

1.5.1.10. Sacramento Slough

Sacramento Slough drains the Butte Basin and Sutter Bypass into the Sacramento River near Verona. It was listed in 2002 for diazinon, and then delisted for diazinon in 2006. Sacramento Slough was listed for chlorpyrifos in 2010 based data showing two exceedances of chronic criteria in June and July of 2004. More recent data from monthly monitoring in 2005, 2006, 2007, and 2008 have no diazinon or chlorpyrifos exceedances. Therefore a TMDL or specific pollution control requirements for chlorpyrifos in Sacramento Slough are not necessary and the chlorpyrifos listing for Sacramento Slough should be considered for removal from the 303(d) list during the next update.

1.5.1.11. Spring Creek (Colusa County)

Spring Creek is located in Colusa County, flowing east out of the inner coast range near the city of Williams. Spring Creek was 303(d)-listed for diazinon and chlorpyrifos in 2010. The chlorpyrifos listing was based on two exceedances in July 2004. The diazinon listing was based on multiple exceedances during the dormant season in January and February 2005. Subsequent monitoring in the summers of 2005 and 2007 contained no chlorpyrifos or diazinon exceedances. There was no additional diazinon dormant season monitoring available following the exceedances measured in 2005. Therefore the available data indicate that diazinon concentrations in Spring Creek are exceeding water quality standards, and specific pollution control requirements must be established for Spring Creek.

1.5.1.12. Stony Creek

Stony Creek is located in northern Glenn County and flows east from Black Butte Reservoir through mostly agricultural lands into the Sacramento River near Hamilton City. Stony Creek was 303(d)-listed for chlorpyrifos based on two exceedances out of 13 samples in 2004 and 2005. The chlorpyrifos exceedances were detected in July 2004 and July 2005. Subsequent monitoring in 2006 (11 samples) and 2007 (three samples) and 2012 (two samples) had no chlorpyrifos detections or exceedances, but did have one diazinon exceedance in March 2006. The most recent three years' available data have no chlorpyrifos exceedances and only one diazinon exceedance. Therefore the available evidence indicates that concentrations of diazinon and chlorpyrifos in stony creek are not exceeding water quality objectives. Therefore, a TMDL or specific pollution control requirements are not necessary for chlorpyrifos in

Stony Creek and the chlorpyrifos listing for Stony Creek should be considered for removal from the 303(d) list during the next update.

1.5.1.13. Wadsworth Canal

Wadsworth Canal is located southeast of the Sutter Buttes in Sutter County and flows through mostly agricultural areas into the Sutter Bypass. Wadsworth Canal was listed for diazinon in 2006 based on multiple exceedances in the dormant spray season in the 1990s and early 2000s. Wadsworth Canal was also listed for chlorpyrifos in 2010 based on multiple exceedances in 2003 and 2004. Additional diazinon and chlorpyrifos monitoring was conducted in 2005 (10 samples), 2006 (seven samples), and 2010 (2 samples) during which no exceedances were measured. These data only included three samples from the dormant season and therefore would not support delisting. The available data indicate that diazinon concentrations in Wadsworth Canal are exceeding water quality standards, and specific pollution control requirements must be established for Wadsworth Canal.

1.5.1.14. Yankee Slough

Yankee Slough is a tributary of the Bear River which flows through agricultural areas in Sutter and Placer Counties. Yankee Slough was 303(d)-listed for chlorpyrifos in 2010 based on data from July, August, and September 2004 in which four of five samples exceeded the acute chlorpyrifos criterion. There was also one diazinon criteria exceedance in the same samples. No subsequent data was available. The available data indicate that chlorpyrifos concentrations in Yankee Slough are exceeding water quality standards. Therefore, it is this impairment must be addressed through the establishment of specific pollution control requirements.

1.5.2. Chlorpyrifos and Diazinon Concentrations in the Delta Watershed

Table 1-15 describes recent (2006-2011) diazinon and chlorpyrifos concentrations in Valley water bodies in the Delta watershed. The data are parsed by watershed land uses to describe concentrations in water bodies where the land uses are primarily urban, primarily agricultural, or a mixture of urban and agricultural land uses.

In agricultural streams in the Delta watershed, chlorpyrifos was detected in 26% of samples, and exceeded acute or chronic criteria in 9% or 12% of samples, respectively. In agricultural streams in the Delta watershed, diazinon was detected in 15% of samples, but exceeded acute or chronic criteria rarely, in 1% or 2% of samples, respectively.

In the urban streams in the Delta watershed, diazinon was detected in 16% of samples, but concentrations never exceeded the CDFG criteria in all of the sampling from 2006-2011. Thus it appears that urban streams in the Delta watershed are no longer impaired by diazinon, and the available data would likely warrant the removal of all diazinon listings from the 303(d) list. Chlorpyrifos was detected in 5% of samples in urban streams and exceeded the acute or chronic criteria in 3% or 4% of the samples, respectively.

In recent years (2006-2011), in water bodies with mixed urban and agricultural sources in the Delta watershed, chlorpyrifos was detected in 11% of samples and exceeded acute or chronic criteria in 4% or 7% of samples, respectively. Diazinon was detected more frequently, in 20% of samples, but exceeded acute or chronic criteria in only 1% or 2% of samples, respectively.

Table 1-15 Concentrations in Lower Delta Watershed Water Bodies (2006-2011).

Watershed Type		Chlorpyrifos		Diazinon	
Agricultural	Number of Samples	239		227	
	Detections	61	26%	34	15%
	Exceedances of CDFG acute criterion	22	9%	2	1%
	Number of 4-day Averages	230		219	
	Exceedances of CDFG chronic criterion*	27	12%	4	2%
	Maximum Concentration (ug/L)	1.7		0.246	
Mixed	Number of Samples	623		591	
	Detections	70	11%	120	20%
	Exceedances of CDFG acute criterion	27	4%	3	1%
	Number of 4-day Averages	477		444	
	Exceedances of CDFG chronic criterion*	34	7.1%	10	2%
	Maximum Concentration (ug/L)	0.42		0.45	
Urban	Number of Samples	73		76	
	Detections	4	5%	12	16%
	Exceedances of CDFG acute criterion	2	3%	0	0%
	Number of 4-day Averages	73		76	
	Exceedances of CDFG chronic criterion*	3	4%	0	0%
	Maximum Concentration (ug/L)	0.060		0.08	
All Data	Number of Samples	935		894	
	Detections	135	14%	166	19%
	Exceedances of CDFG acute criterion	51	5%	5	1%
	Number of 4-day Averages	780		739	
	Exceedances of CDFG chronic criterion*	64	8%	14	2%
	Maximum Concentration (ug/L)	1.7		0.5	

Compliance with the water quality objectives and allocations for diazinon and chlorpyrifos in the Delta Waterways, as defined in Appendix 42 of the Basin Plan, was required by December 2011. The recent (2006-2011) data for Delta Waterways is somewhat sparse in some areas of the Delta, and most of the recent data from Delta Waterways is from sites around the periphery of the Delta. Some Delta Waterways monitored in recent years appear to be consistently attaining diazinon and chlorpyrifos objectives, including the Sacramento River within the Northern Delta, the Mokelumne River within the Eastern Delta, Marsh Creek, Smith Canal, and Morrison Creek. Diazinon and/or chlorpyrifos listings for these specific Delta water bodies should be considered for removal from the 303(d) list during the next update. However, the recent concentration data included exceedances of the chlorpyrifos water quality objectives in some Delta Waterways, such as Shag Slough, French Camp Slough, Mosher Slough, the lower Calaveras River, White Slough and Fivemile Slough, and exceedances of diazinon water quality objectives in Mosher Slough and Sand Creek. There were no recent (2006-2011) data available for many Delta Waterways, including waterways where diazinon and or chlorpyrifos had been issues in the past, such as Old River, Middle River, San Joaquin River within the Delta, and Paradise Cut. Having data for more of these water bodies would allow a more complete assessment of the overall attainment of the chlorpyrifos and diazinon water quality objectives for the Delta Waterways.

A more detailed examination of data from the 303(d)-listed water bodies not addressed by existing TMDLs in the Delta watershed is given below to assess their current status. The data included in these descriptions is not constrained to the 2006-2011 time period used above to summarize the more recent data.

1.5.2.1. Bear Creek (San Joaquin and Calaveras Counties; partly in Delta Waterways, eastern portion)

Bear Creek flows from the foothills northeast of Stockton through agricultural lands and into Pixley Slough in the eastern Delta. This segment was 303(d)-listed for diazinon in 2010 based on exceedances in two of 17 samples measured in 2005 (SWRCB, 2010). Recent monitoring has no diazinon exceedances, but there were few samples from the dormant season. Recent coalition monitoring has also detected multiple chlorpyrifos exceedances (SJDWQC, 2012). Therefore the data indicate that this segment should be addressed by a specific pollution control program. Due to the chlorpyrifos exceedances in samples collected from Bear Creek, the Coalition has updated its schedule for focused management plan outreach and management practice evaluation to include Bear Creek during the years 2013-2015.

1.5.2.2. French Camp Slough

French Camp Slough is located south of Stockton and flows from the confluence of Littlejohns and Lone Tree Creeks to the San Joaquin River in the Delta. Its watershed is mostly agricultural land but includes some urban areas on the downstream end near Stockton. French Camp Slough was listed for diazinon in 2010 based on data from 2002 through 2006. Subsequent diazinon data were collected in 2007, 2008, 2009, 2011 and 2012. There were exceedances in February 2007 and January 2008, but no diazinon detections or exceedances in 2009, 2011 or 2012. Therefore it appears that diazinon concentrations are no longer exceeding water quality standards in French Camp Slough and this diazinon listing should be considered for removal from the 303(d) list during the next update.

French Camp Slough was listed for chlorpyrifos in 2010 based on data from 2002 through 2006 showing multiple chlorpyrifos exceedances throughout those years, and diazinon exceedances in 2004. Subsequent monitoring in 2007, 2008, 2009, and 2010 had chlorpyrifos exceedances every year. The available data indicate that chlorpyrifos concentrations in French Camp Slough are exceeding water quality standards, and this impairment should be addressed by the establishment of specific pollution control requirements.

1.5.2.3. Lone Tree Creek

Lone Tree Creek flows through agricultural land southeast of Stockton into French Camp Slough. Lone Tree Creek was 303(d) listed for chlorpyrifos in 2010 based on data from 2004–2006 with multiple chlorpyrifos exceedances, but only one diazinon exceedance. Subsequent data from 2007, 2008, 2009 and 2010 had chlorpyrifos exceedances every year and one diazinon exceedance each year in 2007 and 2008. Based on these exceedances, Lone Tree Creek should be addressed by the establishment of site specific pollution control requirements for diazinon and chlorpyrifos.

1.5.2.4. Mormon Slough

Mormon Slough flows through agricultural areas east of Stockton and urban areas in Stockton, and flows into the Stockton Deepwater Ship Channel/San Joaquin River in the Delta. Calaveras River flows are diverted into Mormon Slough at Bellota Weir and storm water flows from Stockton and the Calaveras River are diverted to Mormon Slough via the Stockton Diverting Canal. The downstream portion of Mormon Slough within the legal Delta boundary already has a TMDL for diazinon and chlorpyrifos established in the Basin Plan (Mormon Slough is named in Appendix 42 of the Basin Plan). The segment of Mormon Slough upstream of the Stockton Diverting Canal, which is located in the upstream agricultural area, was 303(d)-listed for chlorpyrifos in 2010 based on data from 2004 and 2006 with four of ten samples exceeding the chronic chlorpyrifos criterion. Subsequent data collected in 2007 and 2008 included six additional exceedances. The available data indicate that chlorpyrifos concentrations in Mormon Slough upstream of Stockton Diverting Canal are exceeding water quality standards and specific pollution control requirements must be established for this segment.

1.5.2.5. Pixley Slough

Pixley Slough flows through agricultural land and urban areas north of Stockton, and into the eastern Delta. The downstream portion of Pixley Slough within the legal Delta boundary already has a TMDL for diazinon and chlorpyrifos established in the Basin Plan. Pixley Slough was 303(d)-listed for chlorpyrifos and diazinon in 2010 based on data from 2004, 2005, and 2006 showing multiple exceedances for both pesticides in Pixley Slough upstream from the urban areas. Eight subsequent samples collected in 2007 contained no exceedances for either pesticide. While the samples collected in 2007 indicate concentrations are decreasing, these data are not sufficient to delist this segment for diazinon or chlorpyrifos. Therefore, specific pollution control requirements are required to address this impairment in for Pixley Slough.

1.5.2.6. Sand Creek (Contra Costa County)

Sand Creek is a stream located south of Antioch that flows through urban and agricultural lands into Marsh Creek in the Delta. Urban development had replaced much of the agriculture in the Marsh Creek watershed in recent years. The downstream portion of Sand Creek within the legal Delta boundary already has a TMDL for diazinon and chlorpyrifos established in the Basin Plan. Sand Creek was 303(d)-listed for chlorpyrifos in 2010, based on data from 2006 (2 of 6 samples exceeding the chronic criterion). There was also one significant diazinon exceedance in 2006 (450 ng/L in June 2006). Subsequent monitoring in 2007 and 2008 had no chlorpyrifos exceedances and one diazinon exceedance in January 2008. As a result of these exceedances, management plans for these pesticides were developed and implemented by the San Joaquin County and Delta Water Quality Coalition. No subsequent exceedances were observed in monitoring in 2011 and 2012, which included samples collected during the months of previous recent exceedances. There have been no reported uses of either of these pesticides in the Sand Creek watershed since 2008. Central Valley Water Board staff has determined that the management plans for these pesticides in Sand Creek are complete (CRWQCB-CVR, 2013a). Since the available recent information indicates that neither of these pesticides is causing exceedances of water quality standards in Sand Creek, specific pollution control requirements are not necessary and the chlorpyrifos listing for Sand Creek should be considered for removal from the 303(d) list during the next update.

1.5.2.7. Ulatis Creek

Ulatis Creek is a natural stream that has been largely reconstructed for flood control and is actively managed for flood control by the Solano County Water Agency. Ulatis Creek flows in an east-southeasterly direction from the foothills above Vacaville, through Vacaville, then through agricultural areas and into Cache Slough in the Delta. Ulatis Creek was designated in the Bay Protection Program Toxic Hot Spot Cleanup Plan as a toxic hot spot due to toxic chlorpyrifos concentrations in agricultural runoff (CRWQCB-CVR, 2003). The downstream portion of Ulatis Creek within the legal Delta already has a TMDL for diazinon and chlorpyrifos established in the Basin Plan. Ulatis Creek was 303(d)-listed for chlorpyrifos and diazinon in 2005 based on data from 2002 through 2005 that had multiple exceedance for both pesticides.

There were few detections and no exceedances in subsequent monitoring in 2006, 2007, 2008, and 2009, but monitoring in 2011 had two chlorpyrifos exceedances (SVWQC, 2012). The phase-out of residential uses may have contributed to decreases in diazinon and chlorpyrifos concentrations because Ulatis Creek receives storm water discharges from Vacaville, but agricultural chlorpyrifos discharges appear to still be an important source. Because chlorpyrifos concentrations continue to exceed water quality standards in Ulatis Creek, this impairment must be addressed by the establishment of specific pollution control requirements.

1.5.2.8. Winters Canal (Yolo County)

Winters Canal is a canal near Winters in Yolo County that flows south from Cache Creek to several water delivery canals. It was 303(d)-listed for diazinon in 2010 based on data from 2005 with three exceedances out of nine samples. No subsequent monitoring is available. The available data indicate that diazinon concentrations in Winters Canal are exceeding water quality standards. Therefore, this impairment must be addressed through the establishment of specific pollution control requirements.

1.5.3. Diazinon and Chlorpyrifos Concentrations in the San Joaquin River Watershed

Table 1-16 describes recent (2006 through 2011) diazinon and chlorpyrifos concentrations in Valley water bodies in the San Joaquin River watershed. The data are parsed by watershed land uses to describe concentrations in water bodies where the land uses are primarily urban, primarily agricultural, or a mixture of urban and agricultural land uses. Outside of minor urban storm drains, which were not included in the Valley water bodies, none of the monitored water bodies in the San Joaquin River basin were classified as solely urban, since all had some agricultural inputs.

Chlorpyrifos was detected in 22% of samples from water bodies in agricultural watersheds within the San Joaquin River watershed, and exceeded the acute or chronic criteria in 13% or 16% of samples, respectively. Chlorpyrifos was detected in 20% of water bodies in mixed use watersheds and the rates of acute or chronic chlorpyrifos criteria exceedances were fairly frequent, at 4% or 6%, respectively. Recent exceedances of chlorpyrifos criteria have been measured in the Stanislaus, Tuolumne and Merced Rivers, which are the three major tributaries of the San Joaquin River, as well as a number of smaller tributaries flowing from lands on both the east and west sides of the San Joaquin Valley.

Diazinon was detected in 5% of samples from water bodies in agricultural areas in the watershed and in 16% of samples in water bodies with both urban and agricultural uses. In part, this may be due to the fact that water bodies in mixed land use watersheds tend to be larger and therefore incorporate discharges from more sources. Diazinon exceeded the CDFG criteria very rarely in the San Joaquin River watershed. The chronic diazinon criterion was exceeded in 1% of samples from smaller water bodies in agricultural areas, and 0.2% of samples in water bodies with urban and agricultural land uses.

In the main-stem San Joaquin River, concentrations of diazinon have declined significantly from those observed in the 1990s and early 2000s, when exceedances of diazinon criteria were frequently observed. In 2006-2010 diazinon was only detected once in the main-stem San Joaquin River, and this detection was the sole exceedance of the diazinon water quality objective in that time period. Two reaches of the San Joaquin River were de-listed for diazinon in 2010. The reduction in diazinon in the San Joaquin River was recently written up as a nonpoint source program success story by USEPA (USEPA, 2013). This EPA document describes efforts by the agricultural community, University of California researchers, DPR, the Central Valley Water Board and others that contributed to the reduction of diazinon runoff in the San Joaquin Valley.

Chlorpyrifos concentrations have also declined significantly in the main-stem San Joaquin River. Compliance with the objectives and TMDL allocations for diazinon and chlorpyrifos in the Lower San Joaquin River was required by December 2010. Monitoring from 2010 showed multiple exceedances of chlorpyrifos water quality objectives in the main stem San Joaquin River, but there were no exceedances in 2011. Monitoring to determine compliance with the San Joaquin River TMDL is discussed in more detail in Section 5.2.3.

Table 1-16 Concentrations in Lower SJR Watershed Water Bodies (2006-2011).

Watershed Type		Chlorpyrifos		Diazinon	
Agricultural	Number of Samples	698		793	
	Detections	157	22%	41	5%
	Exceedances of CDFG acute criterion*	94	13%	4	0.5%
	Number of 4-day Averages	693		788	
	Exceedances of CDFG chronic criterion*	112	16%	7	1%
	Maximum Concentration (ug/L)	1.8		1.3	
Mixed	Number of Samples	746		740	
	Detections	150	20%	109	15%
	Exceedances of CDFG acute criterion*	27	4%	0	0%
	Number of 4-day Averages	655		650	
	Exceedances of CDFG chronic criterion*	39	6%	1	0.2%
	Maximum Concentration (ug/L)	3.7		0.12	
All Data	Number of Samples	1444		1533	
	Detections	307	21%	150	10%
	Exceedances of CDFG acute criterion*	121	8%	4	0.3%
	Number of 4-day Averages	1348		1438	
	Exceedances of CDFG chronic criterion*	151	11%	8	1%
	Maximum Concentration (ug/L)	3.7		1.3	

A more detailed examination of data from the 303(d)-listed water bodies not addressed by existing TMDLs in the San Joaquin River watershed is included below to assess their current status. The data included in these descriptions is not constrained to the same 2006-2011 time period used above to summarize the more recent data.

1.5.3.1. Ash Slough

Ash Slough is a distributary of the Chowchilla River located on the east side of the San Joaquin Valley in Madera County near Chowchilla. Ash Slough flows from the Chowchilla River through agricultural lands and past the city of Chowchilla to the Eastside Bypass, which connects to the San Joaquin River. Ash Slough was 303(d)-listed for chlorpyrifos in 2010 based on data from 2005 and 2006 that showed four of ten samples exceeding criteria. No chlorpyrifos was detected in subsequent monthly monitoring from 2007 to 2010. . During this time Ash Slough was dry for all but two sampling events in April, both of which had no detection of diazinon or chlorpyrifos.. Following this, Ash Slough was removed from the management plan for the East San Joaquin Water Quality Coalition because there were no exceedances and chlorpyrifos use had decreased significantly in the watershed (CRWQCB-CVR, 2012a). Since the available recent data and information indicates that neither diazinon or chlorpyrifos concentrations are exceeding of water quality standards in Ash Slough, the proposed amendment contains no specific pollution control requirements for Ash Slough, and this chlorpyrifos listing should be considered for removal from the 303(d) list during the next update.

1.5.3.2. Berenda Creek

Berenda Creek is located on the east side of the San Joaquin Valley in Madera County. Berenda Creek extends from the foothills through agricultural lands and typically dries up just west of the Eastside Bypass of the San Joaquin River. It is highly modified and used as a water delivery channel by the Madera Irrigation District. Berenda Creek was 303(d)-listed in 2010 based on data from 2005 in which three of six 4-day averages exceeded the chronic chlorpyrifos criterion. No subsequent data were available. Based on the available data, chlorpyrifos concentrations are exceeding water quality standards in Berenda Creek and specific pollution control requirements must be established to address this impairment.

1.5.3.3. Berenda Slough

Berenda Slough is a distributary of the Chowchilla River located on the east side of the San Joaquin Valley in Madera County. Berenda Slough was 303(d)-listed for chlorpyrifos in 2010 based on data from 2006 with two of five samples exceeding criteria. Subsequent data collected in 2007 had one of five samples exceeding criteria. One sample collected in 2008 did not exceed criteria, and no other data are available. The available data indicate that chlorpyrifos concentrations are exceeding water quality standards and therefore specific pollution control requirements must be established to address this impairment in Berenda Slough.

1.5.3.4. Deadman Creek

Deadman Creek is located on the east side of the San Joaquin Valley in Merced County. Deadman Creek was 303(d)-listed for chlorpyrifos in 2010 based on data from 2006 with two of ten samples exceeding the chronic criterion. Subsequent monitoring in 2007, 2008, 2009, and 2010 had one or more chlorpyrifos exceedances in all years except 2009. The available data indicate that chlorpyrifos concentrations are exceeding water quality standards. Therefore specific pollution control requirements must be established for Deadman Creek.

1.5.3.5. Del Puerto Creek

Del Puerto Creek is located on the west side of the San Joaquin Valley in Stanislaus County. Del Puerto Creek flows from the foothills through rural and irrigated agricultural lands into the San Joaquin River. Del Puerto Creek was 303(d)-listed in 2002 for diazinon and chlorpyrifos. Subsequent data from more recent years continue to show exceedances, including two chlorpyrifos exceedances in 2010. The available data indicate that diazinon and chlorpyrifos concentrations are exceeding water quality standards. Therefore specific pollution control requirements must be established for Del Puerto Creek.

1.5.3.6. Dry Creek (Stanislaus County, tributary to Tuolumne River)

While there are multiple Dry Creeks in the Central Valley, this discussion is for Dry Creek located in Stanislaus County, which is tributary to the Tuolumne River in Modesto. Dry Creek flows through both agricultural and urban areas. Dry Creek was 303(d)-listed for chlorpyrifos and diazinon in 2010 based on data from 2000 through 2006 that had multiple exceedances for both pesticides. Subsequent data from 2007-2011 continue to show chlorpyrifos exceedances during the irrigation season. The available data indicate that chlorpyrifos concentrations are exceeding water quality standards. Therefore specific pollution control requirements must be established for Dry Creek.

1.5.3.7. Duck Slough (Merced County)

Duck Slough in Merced County is located in agricultural lands on the east side of the San Joaquin River and connects Mariposa Creek to the Eastside Bypass, which connects to the San Joaquin River. Duck Slough was 303(d)-listed for chlorpyrifos in 2010 based on data from 2004-2006 with three exceedances out of 21 samples. Subsequent data had one exceedance per year in 2007 and 2008, but no exceedances in eight samples in 2009, five samples in 2010 and 14 samples in 2011. Duck Slough Road was removed from the management plan for the East San Joaquin Water Quality Coalition because there were no exceedances in 2009, 2010 and 2011 (CRWQCB-CVR, 2012a). Because the available data would support delisting, a TMDL or other pollution control requirements are not required for Duck Slough, and the chlorpyrifos listings for Duck Slough should be considered for removal from the 303(d) list during the next update.

1.5.3.8. Harding Drain

Harding Drain is a major drain located on the east side of the San Joaquin Valley. Harding Drain conveys irrigation return flow and storm drainage from agricultural and urban areas around Turlock and treated wastewater from the city of Turlock into the San Joaquin River near Patterson. Harding Drain was 303(d)-listed for chlorpyrifos and diazinon in 1998. In the 2000s, Turlock Irrigation District implemented the Harding Drain Watershed Agricultural and Urban Impacts Evaluation and Outreach Program, funded by Proposition 50, which resulted in significant data collection and likely contributed to a decrease in pesticide concentrations and toxicity in Harding Drain. The decreases in toxicity, diazinon, and chlorpyrifos in Harding Drain are also likely partly due to the phase-out of non-agricultural chlorpyrifos uses, since Harding Drain receives urban storm water and wastewater discharges. The diazinon listing for Harding Drain was removed in the 2010 303(d) list update based on more recent data. The chlorpyrifos listing for Harding Drain was not removed during the 2010 303(d) list update because there were data from 2001-2004 that had 36 exceedances out of 319 samples, and data from 2006-2008 that had three exceedances out of 64 samples. Subsequent data from 2009, 2010, and 2011 had no chlorpyrifos exceedances out of eight samples. Since the available data would likely support delisting, specific control requirements are not recommended for Harding Drain, and the chlorpyrifos listings for Harding Drain should be considered for removal from the 303(d) list during the next update.

1.5.3.9. Highline Canal

Highline Canal is located on the east side of the San Joaquin Valley in Stanislaus and Merced Counties. Highline Canal was 303(d)-listed for chlorpyrifos in 2010 based on data from 2005 and 2006. Subsequent data collected in 2007, 2008, 2009, and 2010 had chlorpyrifos exceedances every year. There was one measured chlorpyrifos exceedance in Highline Canal in 2010. Monthly monitoring in 2011 and 2012 at multiple sites on Highline Canal had no exceedances. Chlorpyrifos at one site on Highline Canal (Highway 99) was removed from the management plan for the East San Joaquin Water Quality Coalition because there were no exceedances at that site in the most recent two years (CRWQCB-CVR, 2012a). Coalition monitoring is continuing for the other site on Highline Canal at Lombardy Road. Since there was only one exceedance in Highline Canal in the last three years, and adequate data are available, it can be concluded that neither diazinon nor chlorpyrifos concentrations are exceeding of water quality standards in Highline Canal. Therefore the proposed amendment contains no specific pollution control requirements for Highline Canal, and this chlorpyrifos listing should be considered for removal from the 303(d) list during the next update.

1.5.3.10. Ingram Creek

Ingram Creek is a stream on the west side of the San Joaquin Valley that flows from the Coast Range through rural and agricultural lands and into the San Joaquin River. Ingram Creek was 303(d)-listed for chlorpyrifos and diazinon in 2002 based on data from the 1990s. More recent monitoring from 2001 through 2010 had no diazinon exceedances, but one or more chlorpyrifos exceedances in every year for which chlorpyrifos data were available (2001, 2005, 2007, 2008, 2009, and 2010). The available data indicate that chlorpyrifos concentrations are exceeding water quality standards. Therefore specific pollution control requirements must be established for Ingram Creek.

1.5.3.11. Merced River, Lower

The Lower Merced River flows from McSwain Reservoir into the San Joaquin River. Its watershed is mostly agricultural and rural, but does include some urban areas, such as Atwater and Livingston. The Merced River was 303(d)-listed for diazinon and chlorpyrifos in 1998 based on data from the 1990s. More recent data from 2000-2009 contained only one diazinon exceedance in 2001, but chlorpyrifos exceedances in 2000, 2001, 2003, 2004, 2005, 2006, 2007, and 2008. The available data indicate that chlorpyrifos concentrations are exceeding water quality standards. Therefore specific pollution control requirements must be established for the Lower Merced River.

1.5.3.12. Mustang Creek

Mustang Creek is located on the east side of the San Joaquin Valley and flows through rural and agricultural lands into Highline Canal, which flows into the Merced River. Mustang Creek was 303(d)-listed for chlorpyrifos and diazinon in 2010 based on data from 2002 through 2006. Subsequent data were collected in 2007, 2008, 2009, and 2010. There were no exceedances in 2007 and two chlorpyrifos exceedances during storm events in 2008. There were no detections or exceedances in 2009-2010, with over 33 site visits and 8 samples collected (Mustang Creek was dry during the other site visits). Mustang Creek was removed from the management plan for the East San Joaquin Water Quality Coalition because there were no exceedances or detections in the most recent data from 2009 and 2010 (CRWQCB-CVR, 2012). Based on the recent data, neither diazinon nor chlorpyrifos concentrations are exceeding water quality standards in Mustang Creek. Therefore the proposed amendment contains no specific pollution control requirements for Mustang Creek, and the chlorpyrifos and diazinon listings for Mustang Creek should be considered for removal from the 303(d) list during the next update.

1.5.3.13. Newman Wasteway

Newman Wasteway carries drainage from mostly agricultural areas on the west side of the San Joaquin Valley in Stanislaus and Merced Counties into the San Joaquin River. Newman Wasteway is also a dewatering channel for the Delta-Mendota Canal. Newman Wasteway was 303(d)-listed for diazinon and chlorpyrifos in 2002 based on data from the 1990s showing multiple exceedances for both pesticides. In the 2010 303(d) list update, the diazinon listing for Newman Wasteway was removed because data from 2000-2006 had no diazinon exceedances. There have been no subsequent diazinon exceedances. Looking at the more recent chlorpyrifos data, there were two exceedances in February and March of 2007, one exceedance in 2008, and no exceedances in 2009, 2010, or 2011. It appears chlorpyrifos concentrations in Newman Wasteway are no longer in exceedance of water quality standards, therefore specific pollution control requirements are likely not necessary and the chlorpyrifos listings for Newman Wasteway should be considered for removal from the 303(d) list during the next update.

1.5.3.14. Orestimba Creek

Orestimba Creek is an ephemeral stream draining the west side of the San Joaquin Valley, carrying storm water flows in the winter and irrigation return flows in the spring and summer. Orestimba Creek was listed for chlorpyrifos and diazinon in 1998 based on data from the early 1990s. More recent data from Orestimba Creek from 2000-2010 contains chlorpyrifos exceedances every year, as well as occasional diazinon exceedances. These recent data indicate that chlorpyrifos and diazinon concentrations continue to exceed water quality standards. Therefore, this impairment must be addressed through the establishment of specific pollution control requirements.

1.5.3.15. Salt Slough

Salt Slough is located in Merced County, which conveys irrigation return flows and wetland drainage into the San Joaquin River. Salt Slough was 303(d)-listed for chlorpyrifos and diazinon in 1998 based on data from the early 1990s. The diazinon 303(d) listing was removed in the 2010 update, but chlorpyrifos concentrations from the most recent data from 2001 through 2010 show one or more exceedances in each year. The recent data indicate that chlorpyrifos concentrations continue to exceed water quality standards. Therefore specific pollution control requirements must be established for Salt Slough.

1.5.3.16. Stanislaus River, Lower

The Stanislaus River is a major eastside tributary to the San Joaquin River. Its watershed is mostly agricultural and rural areas, but contains some urban areas as well. The Lower Stanislaus River was 303(d)-listed for diazinon in 1998 based on data from the early 1990s, and listed for chlorpyrifos in 2010 based on data from 2000-2006. No more recent data are available. Therefore, the available data indicate that the chlorpyrifos and diazinon concentrations exceed water quality standards. Therefore specific pollution control requirements must be established for the lower Stanislaus River.

1.5.3.17. Tuolumne River, Lower

The Tuolumne River is a major eastside tributary to the San Joaquin River. The Tuolumne flows from the Don Pedro Reservoir in the Sierra foothills through rural, agricultural, and urban land, including the city of Modesto. The Tuolumne River was 303(d)-listed for diazinon in 1998 based on data from the early 1990s and 303(d)-listed for chlorpyrifos in 2010 based on data from 2000-2006. There are limited subsequent data available from the City of Modesto's storm water program that contain no exceedances, but these data are for sites in Modesto that are upstream of much of the agricultural area discharging to the Tuolumne, and were not collected to represent the loading from agriculture based on timing or location of samples. The available data indicate that the chlorpyrifos and diazinon concentrations are exceeding water quality standards. Therefore specific pollution control requirements must be established for the Tuolumne River.

1.5.3.18. Westley Wasteway

Westley Wasteway drains storm water and agricultural return flows on the west side of the San Joaquin Valley in Stanislaus County into the San Joaquin River. Westley Wasteway is also a dewatering channel for the Delta-Mendota Canal. Westley Wasteway was 303(d)-listed for chlorpyrifos in 2010 based on data from 2004 through 2006. Westley Wasteway was the subject of a focused management plan by the Westside San Joaquin River Watershed Coalition in 2010 and 2011. Subsequent to the data used in the 303(d) listing, about five samples per year were collected from 2007 through 2011. In this more recent data, there were exceedances in 2008, 2010 and 2011. These available data indicate that chlorpyrifos concentrations are exceeding water quality standards. Therefore specific pollution control requirements must be established for Westley Wasteway.

1.5.4. Water Bodies for Which Specific Pollution Control Requirements Must be Established

Based on the evaluation of each 303(d)-listed water body in this section, it was determined that the Amendment should require specific pollution control actions to address the diazinon and/or chlorpyrifos impairments in the following water bodies.

Bear Creek (San Joaquin and Calaveras Counties)
Bear River (43), Lower (below Camp Far West Reservoir)
Berenda Creek (Madera County)
Berenda Slough (Madera County)
Colusa Basin Drain (29)
Coon Creek, Lower (Sutter County)

Deadman Creek (Merced County)
Del Puerto Creek
Dry Creek (tributary to Tuolumne River at Modesto, E Stanislaus County)
Duck Creek (San Joaquin County)
French Camp Slough
Gilsizer Slough
Ingram Creek
Jack Slough
Live Oak Slough
Lone Tree Creek
Main Drainage Canal (Butte County)
Merced River, Lower (McSwain Reservoir to San Joaquin River) (81)
Mormon Slough (from Stockton Diverting Canal to Bellota Weir)
Morrison Slough (Sutter County)
Orestimba Creek
Pixley Slough (San Joaquin County)
Salt Slough
Spring Creek (Colusa County)
Stanislaus River, Lower (Goodwin Dam to San Joaquin River) (90)
Tuolumne River, Lower (Don Pedro Dam to San Joaquin River) (86)
Ulatis Creek (Solano County)
Wadsworth Canal
Westley Wasteway (Stanislaus County)
Winters Canal (Yolo County)
Yankee Slough (Placer and Sutter Counties)

1.6 Recent Developments Affecting Diazinon and Chlorpyrifos Use

Pesticide uses are regulated by the USEPA Office of Pesticide Programs, DPR and the California Agricultural Commissioners. The phase-out of non-agricultural uses of diazinon and chlorpyrifos preceded a significant reduction of these pesticides in surface waters in urban areas, and there has been a reduction in concentrations from some agricultural areas as well. Several other relevant recent developments regarding the impacts of pesticides in surface water have resulted in, or will likely result in, additional restrictions and conditions on the use of diazinon and chlorpyrifos, as well as other pesticides. These restrictions and conditions on pesticide use are, or will be, implemented through the regulation of pesticide uses. These restrictions and conditions on pesticide use have caused, or in the future should cause, reductions in the amounts of diazinon and chlorpyrifos in surface waters. The Central Valley Water Board will continue to coordinate with DPR, USEPA and the County Agricultural Commissioners on appropriate pesticide registration and use requirements for the protection of water quality.

1.6.1. California Supplemental Diazinon Label

The manufacturer of diazinon developed a supplemental label that EPA approved, which took effect in 2005. This label placed the following additional requirements on the use of diazinon as a dormant spray in the Sacramento and San Joaquin Valleys below 1000 feet elevation.

- Dormant applications on orchard crops are restricted to ground application equipment only.
- Do not apply within 100 feet upslope of "sensitive aquatic sites" such as any irrigation ditch, drainage canal or body of water that may drain into a river or tributary unless a suitable method is used to contain or divert runoff waters. Waters that are contained or diverted must be held for a minimum of 72 hours before release into a sensitive aquatic site.
- Maintain a vegetative buffer strip a minimum of 10 feet wide from the edge of a field that is adjacent to and within 100 feet of sensitive aquatic sites.
- Do not apply this product to orchards when soil moisture is at field capacity, and/or when a storm event likely to produce runoff from the treated orchard is forecasted by NOAA/NWS (National Oceanic and Atmospheric Administration/National Weather Service) to occur within 48 hours following application.
- Make dormant applications only when insect scouting information or the recommendation of a Pest Control Advisor indicate treatment is required. (See UC IPM Guidelines for San Jose scale in stone fruits and almonds and aphids in stone fruits. Use the prune dormant spur sampling program to determine need for a dormant treatment in that crop).
- Apply only when wind speed is 3 – 10 mph at the application site as measured by an anemometer outside of the orchard on the side nearest and upwind from a sensitive site.
- When sensitive aquatic sites are downwind from orchards, spray the first three rows nearest the sensitive aquatic sites only when the wind is blowing away from the sites. The row at the edge of the field next to sensitive aquatic sites must be sprayed with the outside nozzles turned off. Spray must not be directed higher than the tree canopy and spray must be directed away from sensitive aquatic sites.
- The Stewardship Bulletin "Orchard Practices for Protecting Surface Water" must be available to handlers and equipment operators at the application site during all application activities.

1.6.2. DPR Dormant Season Insecticide Spray Regulations

DPR adopted regulations for dormant season insecticide sprays in orchards in 2007 (DPR, 2007). These regulations apply to diazinon and chlorpyrifos as well as other insecticides used on orchards during the dormant season. The regulations adopt restrictions for dormant insecticide sprays unless 1) only dormant oils and/or biological control agents such as *Bacillus sp.* or spinosad are applied; 2) they are applied to a hydrologically isolated site; or 3) runoff is held for 72 hours before it is released. For the remaining dormant season insecticide applications, certain restrictions apply.

The restrictions limit ground and aerial applications of dormant insecticides to areas 100 feet from any surface water body, unless the water body resides exclusively on private property. They specify wind speeds in which dormant insecticides may be applied (3-10 miles per hour) and allow aerial application only if soil conditions do not allow field entry or approaching bloom conditions require aerial applications. The restrictions prohibit all dormant insecticide applications when soil is saturated with water or runoff is likely to occur when it rains, and a storm event is to occur within 48 hours following application. Dormant applications may be made only when insect scouting information (or a Pest Control Advisor) indicates pest populations have reached damaging levels.

1.6.3. DPR Reevaluation of Diazinon and Chlorpyrifos

DPR has placed both diazinon and chlorpyrifos products into a special review status called reevaluation. Manufacturers are being required to conduct studies to document the factors that result in these pesticides contaminating waterways, and to develop mitigation strategies that will reduce or eliminate these residues in surface water. If the adverse effects of diazinon or chlorpyrifos cannot be mitigated, DPR can cancel or suspend their registration. The reevaluation for diazinon and chlorpyrifos were initiated in 2003 and 2004, respectively. DPR may take action to mitigate water quality impacts of diazinon and chlorpyrifos during this reevaluation, as DPR did in developing regulations for dormant sprays in 2007 and for urban applications of pyrethroid pesticides in 2012 (CDPR, 2012).

1.6.4. Lawsuits Against US EPA Regarding Pesticides and Endangered Species

In response to lawsuits in recent years, courts have ruled that USEPA, in registering certain pesticides, failed to meet Endangered Species Act (ESA) requirements to consult with the US Fish and Wildlife Service (FWS) and/or National Marine Fisheries Service (NMFS) regarding potential impacts of certain pesticides to endangered species. These court decisions have resulted in new restrictions on use of certain pesticides, including diazinon and chlorpyrifos.

In response to these rulings, USEPA has been required to make “effects determinations” for the potential effects of each pesticide on each endangered species involved. The effects determinations state whether ESA consultation will be necessary. If ESA consultation is determined to be necessary in an effects determination, then

USEPA initiates consultation with either FWS or NMFS. FWS or NMFS then issues a biological opinion, stating potential effects and prescribing measures for mitigating or preventing these effects. In response to the biological opinions, USEPA then modifies the pesticide labels to add measures to protect endangered species. These rulings have also resulted in injunctions on pesticide uses on or near endangered species habitat in the interim between the issuance of the ruling and the development of any needed label changes.

Once the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) label changes are finalized by USEPA, compliance with the new labels will be enforced through DPR and the agricultural commissioners through their usual regulatory programs. Until the label changes are complete, it is unclear how the court's injunctions will be enforced. Outside of implementing the new labels, none of the aforementioned regulators are currently enforcing the requirements of these court decisions.

1.6.4.1. Washington Toxics Coalition Salmon Lawsuit

The Washington Toxics Coalition et al., filed citizen lawsuits against USEPA for failure to consult with NOAA Fisheries regarding potential adverse impacts of pesticides on endangered salmonids in Washington, Oregon, and California. In January 2004, the U.S. District Court for the Western District of Washington issued orders requiring the establishment of pesticide buffer zones in areas adjacent to water bodies determined to be "salmon supporting waters" in portions of these states. These orders required that pesticides not be applied within 20 yards of surface water bodies for ground applications, and within 100 yards for aerial applications. These orders were upheld on appeal by the 9th Circuit Court in June 2005. (*Washington Toxics Coalition v. Environmental Protection Agency* 413 F.3d 1024.) Diazinon and chlorpyrifos are included in the list of pesticides subject to the buffer requirement. USEPA made an effects determination that diazinon, chlorpyrifos, and malathion (another organophosphate pesticide) may affect the listed salmonid species, and initiated consultations with NMFS Fisheries on these pesticides. NMFS issued a biological opinion on these pesticides in 2009. USEPA is now proceeding with implementing the biological opinion through the development of FIFRA label changes to incorporate use restrictions and conditions protective of endangered salmon species. These label changes are expected to include use buffers and timing restrictions to prevent drift and runoff into salmon habitat. These label changes are likely to be similar to the label changes for diazinon discussed above, which appear to have been effective at reducing diazinon in Central Valley surface waters.

1.6.4.2. Red-Legged Frog

The Center for Biological Diversity sued USEPA over lack of ESA consultation on impacts of pesticides, including diazinon and chlorpyrifos, to the California red-legged frog. The court issued a ruling requiring USEPA to make effects determinations, resulting in ESA consultation when required, and potential label changes. An injunction was also put in place restricting use prior to the completion of any needed ESA consultation. The court's injunction puts in place buffer areas around certain habitats of the California red-legged frog, and disallows use of certain pesticides, including diazinon and chlorpyrifos within those habitats and buffer zones. Some of these habitat areas are in a small fraction of the area under consideration for this Proposed Amendment.

1.6.4.3. Lawsuit and Injunction Involving 74 Pesticides and 11 Threatened or Endangered Species in the San Francisco Bay Area

In 2007, the Center for Biological Diversity filed a lawsuit challenging the failure of USEPA to consult with FWS pursuant to the ESA regarding the effects of USEPA-registered pesticides on eleven species within the counties in the San Francisco Bay area, which includes part of the Sacramento-San Joaquin Delta. Diazinon and chlorpyrifos were among the 74 pesticides involved in the lawsuit. The eleven species include aquatic organisms such as delta smelt. As a result of that lawsuit USEPA has agreed to consult with FWS regarding these potential impacts, which could result in additional pesticide use restrictions of these pesticides. Until a consultation process has been completed, an injunction is in place against use of the subject pesticides in occupied or designated critical habitat for the eleven species. Portions of two of these counties, Solano and Contra Costa, are within the area under consideration for this proposed Basin Plan Amendment.

1.6.5. USEPA Office of Pesticide Programs Registration Review

Registration review by the USEPA is required under the federal Food Quality Protection Act to ensure that new information regarding pesticide risk assessment is evaluated and that pesticides meet the statutory standard of no unreasonable adverse effects to human health or the environment. Registration review of diazinon began in 2008 and is scheduled for a final decision in 2014. Registration review of chlorpyrifos began in 2008 and is scheduled for a final decision in 2015. It is possible that USEPA could further restrict the uses of diazinon or chlorpyrifos or impose additional conditions on their uses in response to concerns about potential human health or environmental impacts of their currently registered uses.

One issue being addressed in the chlorpyrifos registration review, which was not considered in previous chlorpyrifos registration decisions, is that chlorpyrifos can transform to chlorpyrifos-oxon during the chlorination step of drinking water treatment. Chlorpyrifos-oxon is more toxic than the parent compound and is therefore the focus of the drinking water assessment being under taken as part of the chlorpyrifos registration review (USEPA 2011b).

1.7 Need for an Amendment to the Basin Plan

The Porter-Cologne Water Quality Control Act requires that the Central Valley Water Board establish water quality objectives that will ensure the reasonable protection of beneficial uses and the prevention of nuisance. (Wat. Code, § 13241.) The Water Code also requires that the Board establish programs of implementation that describe the actions that are needed to achieve the water quality objectives. (Wat. Code, § 13242.) In addition, the federal Clean Water Act, along with federal regulations adopted thereunder, require the Board to adopt water quality criteria that are protective of the water bodies' beneficial uses. Those criteria should be numerical values based on either guidelines developed by USEPA (which may be modified to reflect site-specific conditions) or on other scientifically-defensible methods, or, where numerical criteria cannot be established, on biomonitoring methods. (40 C.F.R. §131.11(b).) The Proposed Amendment will establish a water quality objective (i.e., a water quality criterion) for diazinon and chlorpyrifos based on CDFG-developed Aquatic Life Criteria. The establishment of these water quality objectives, along with a complimentary program of implementation that will rely on existing regulatory programs to enforce those objectives, will ensure that diazinon and chlorpyrifos will not cause impairments of any beneficial uses in all surface waters within the Project Area.

The Proposed Amendment will also fulfill obligations imposed by Section 303(d) of the federal Clean Water Act, which requires the establishment of total maximum daily loads (TMDLs) for impaired surface waters, unless other pollution control requirements obviate the need for such TMDLs. As mentioned above, the implementation provisions in the Proposed Amendment specify that the Board will address diazinon and chlorpyrifos impairments using existing regulatory programs that will impose restrictions on diazinon and chlorpyrifos discharges. The regulatory program requirements that are outlined in the implementation provisions of the Proposed Amendment are considered "other pollution control requirements … required by State authority" within the meaning of the federal regulations. (40 C.F.R. §130.7(b)(1)(iii).)

The numeric water quality objectives proposed in the Proposed Amendment are also consistent with numeric water quality objectives adopted by the Board in prior Basin Plan amendments to address diazinon and chlorpyrifos water quality impairments in the Sacramento, Feather, and San Joaquin Rivers and in the Sacramento-San Joaquin

Delta. Establishing the proposed numeric objective throughout the Project Area will provide a clear regulatory benchmark that will ensure that requirements imposed by the Board will fully protect the beneficial uses of surface waters within the Project Area.

2. Water Bodies Where the Proposed Numeric Objectives Would be Established

There are thousands of water bodies within the Project Area, but only a small portion of these water bodies are currently 303(d)-listed for diazinon and/or chlorpyrifos. Although many water bodies are not listed, this may be due to the fact that monitoring data for diazinon and chlorpyrifos are only available for a small fraction of the water bodies in the Project Area; due to the widespread use of these pesticides, many water bodies that are not currently monitored and/or 303(d)-listed likely receive diazinon and chlorpyrifos discharges. In addition, the overall goal of the Central Valley Pesticide Basin Plan Amendment project is to have a comprehensive program for pesticide discharges.

With this in mind, this section evaluates different ways in which the Board could apply the proposed numeric water quality objectives for diazinon and chlorpyrifos. These alternatives vary by the water bodies where the proposed numeric water quality objective would apply. The alternatives considered include:

1) Applying the proposed numeric water quality objective to all water bodies in the Project Area;
2) Applying the proposed numeric water quality objective to only the 303(d)-listed water bodies in the Project Area;
3) Applying the proposed numeric water quality objective to all water bodies in the Project Area with “WARM” or “COLD” aquatic life beneficial uses; and
4) Applying the proposed numeric water quality objective to a specific list of water bodies that excludes the smallest water bodies and constructed conveyances.

2.1. Alternative 1: All Water Bodies in the Project Area

Most of the water quality objectives for surface waters in the Basin Plan apply to all surface waters in the Sacramento and San Joaquin River basins. Under this alternative, the Board would establish the proposed numeric water quality objectives for diazinon and chlorpyrifos for all surface waters that qualify as “waters of the state” within the Project Area. This would be the most simple, straightforward approach. However, this approach would apply the proposed water quality objectives in minor constructed conveyances and drains where compliance with the objectives would be difficult and expensive (particularly because these waterbodies can be closer to sources and have less dilution). By requiring attainment in the smallest tributaries, including those directly downstream from all sources, this alternative would require the greatest reductions in discharges. Therefore, this alternative would require the most extensive use of the most effective management practices, such as ceasing irrigation return flow discharges and switching to different products. Due to the reductions required, a longer timeframe for attaining the objectives might also be needed for this alternative relative to the other alternatives.

2.2. Alternative 2: Only 303(d)-Listed Water Bodies That Are Required to Have TMDLs or Other Regulatory Requirements Established

Under alternative 2, the Board would establish water quality objectives for diazinon and chlorpyrifos in only the 303(d)-listed water bodies shown in Table 1-7. Under this alternative, the Board would only be addressing currently catalogued water quality impairments. Narrative objectives would continue to be applied in other water bodies, but no formal numeric standard or implementation provisions would be established for water bodies that are not listed in Table 1-7. This alternative would provide less certainty for these unlisted water bodies (as the Board would need to interpret the narrative limit each time it wished to assess the water quality status of the waterbody), and the Board would be required to address future diazinon and/or chlorpyrifos impairments through separate Basin Planning actions, which would be a time- and resource-intensive process.

2.3. Alternative 3: All Water Bodies with Aquatic Life Beneficial Uses

Some water quality objectives in the Basin Plan apply specifically to water bodies that have certain beneficial uses assigned, such as municipal and domestic drinking water (MUN), warm freshwater habitat (WARM), and cold freshwater habitat (COLD). The beneficial uses that are most sensitive to diazinon and chlorpyrifos are the aquatic life beneficial uses WARM and COLD, which apply to almost all surface water bodies named in the Basin Plan, along with their tributary streams (as discussed in Section 3). Under this alternative, the Board would establish numeric diazinon and chlorpyrifos water quality objectives for all surface waters within the Project Area that have the WARM or COLD aquatic life beneficial uses assigned. Since almost all water bodies named in the Basin Plan have the WARM and/or COLD beneficial uses designated and almost all streams in the Project Area are tributary to one or more of these water bodies, under this alternative, the Board would establish numeric diazinon and chlorpyrifos objectives in almost all natural water bodies within the Project Area.

Under this alternative, the Board would establish numeric diazinon and chlorpyrifos water quality objectives and implementation plans to rectify water quality impairments for water bodies that are currently on the 303(d) list due to diazinon or chlorpyrifos impairments. As discussed in Section 3, these include 5 constructed water bodies and 1 natural water body where the Basin Plan has not designated an aquatic life beneficial use, but where the evidence in the Board's files indicates that such uses currently exist. Water quality objectives are proposed for these water bodies as well.

The only exception would be the water bodies that are currently on the 303(d) list (discussed in sections 1.5) where recent water quality data show that they are now meeting water quality objectives. For those water bodies which are meeting criteria, de-listing is proposed, and the Board would not establish implementation plans or specifically name them in the diazinon and chlorpyrifos water quality objectives. This alternative would still be straightforward, but would leave more flexibility for smaller constructed water bodies, because the WARM or COLD beneficial uses may not apply to some tributaries that are considered "constructed." If the WARM or COLD beneficial uses do not apply to a water body, then the numeric diazinon and chlorpyrifos water quality objectives would not apply, either.

This alternative would be somewhat less expensive for dischargers compared to alternative 1, because dischargers would not have to meet the numeric objectives in some of the smallest water bodies and constructed drains and conveyances (where the objectives could be the most difficult to attain), although reductions would be required in those small water bodies in order attain the objectives downstream. Narrative objectives could be applied in the water bodies where numeric objectives are not established, providing more flexibility than alternative 1.

2.4. Alternative 4: An Inclusive List of Water Bodies

Under this alternative, the Board would establish water quality objectives and implementation provisions for a list of water bodies that would include all of the water bodies that are currently on the 303(d) list due to diazinon and chlorpyrifos impairments, along with a set of the water bodies that the Board estimates could experience diazinon and chlorpyrifos impairments in the future. A Board staff report created to support the development of this Amendment entitled *A Compilation of Selected Water Bodies and Aquatic Indicators for the Central Valley Pesticide Basin Plan Amendment Project* (Davis and Lee, 2010) documents the compilation of this inclusive list of water bodies.

These water bodies were within the Project Area, and are readily identifiable from the following sources:

- the Sacramento and San Joaquin Rivers Basin Plan,
- the 2010 303(d) List Update and Integrated Report (SWRCB, 2010)
- Reach File 3 (An electronic Geographic Information Systems (GIS) file created by USEPA based on USGS 1:100,000 scale maps),

- the National Hydrography Dataset (NHD) which contains USGS files based on 1:1000,000 scale maps and 1:24,000 scale maps, and
- Water bodies identified in a limited literature search.

Named water bodies from those sources were included in a list of approximately 1,300 water bodies. These named water bodies made up about 20% of the mapped water bodies in the Reach File 3 and National Hydrography Dataset. When compiling this list, Board staff made an effort to exclude minor constructed conveyances by excluding small scale (1:24,000 scale) water features that had names such as "drain" or "ditch," which would ordinarily indicate that they are minor constructed conveyances. Board staff also made revisions to the list of water bodies in Davis and Lee (2010) based on stakeholder comments (see Davis and Lee, 2010, Appendix A, Responses to Comments). An extensive description of the data sources and compilation of the water bodies can be found in Davis and Lee (2010). Under this alternative, the Board would establish numeric water quality objectives and implementation provisions to address diazinon and chlorpyrifos in all of the approximately 1,300 water bodies listed by Davis and Lee (2010).

Under this alternative, as with alternatives 1 and 3, covering most water bodies would provide a clear metric for determining whether or not a water body was in compliance with water quality standards, and would enable the Central Valley Water Board to more readily respond to detections of diazinon and chlorpyrifos.

As with alternative 3, this alternative would be somewhat less expensive for dischargers, compared to alternative 1, because dischargers would not have to meet numeric objectives in some of the smallest water bodies and constructed drains and conveyances (where the objectives could be the most difficult to attain), although reductions would be required in those small water bodies in order attain the objectives downstream. Narrative objectives could be applied in the water bodies where numeric objectives are not established, but there would be more flexibility than alternative 1.

Several of the approximately 1,300 water bodies that would have objectives under this alternative are water bodies that are, to varying degrees, "constructed" and therefore may not have beneficial uses designated by the tributary statement in the Basin Plan. Establishing diazinon and chlorpyrifos objectives for a list of water bodies that includes numerous constructed water bodies could limit the flexibility of the Central Valley Water Board to determine the appropriate level of protection for these constructed water bodies, and could have implications for the beneficial uses of these water bodies. Therefore this alternative may be less compatible than alternative 3 with the current effort to establish beneficial uses and protection levels in agriculturally-dominated constructed water bodies in the Central Valley (CRWQCB-CVR, 2012b).

2.5. Proposed Water Bodies for Diazinon and Chlorpyrifos Objectives

Board staff is proposing Alternative 3 as the proposed alternative. This alternative would establish clear numeric water quality objectives for water bodies throughout the Sacramento and San Joaquin River Basins, and would include hundreds of water bodies that could potentially be placed on the 303(d) list due to diazinon and chlorpyrifos impairments in the future. Establishing numeric water quality objectives for multiple water bodies, both 303(d)-listed and not, will provide a clear numeric goal for control of discharges of these pesticides, thus helping to prevent water quality impairments, and making it more likely that any future impairments can be promptly addressed. This alternative would be consistent with the overall goals of the Pesticide Basin Plan Amendment project to provide a clear regulatory framework for the protection of water quality from pesticides in surface water, and would allow the Central Valley Water Board to address potential future listings more efficiently. This alternative would leave the Board flexibility in terms of appropriate beneficial use designations and water quality objectives in constructed water bodies such as drains and canals where compliance could be most difficult and expensive. Therefore, more prompt compliance and less switching to alternative products could be expected under this alternative than under alternative 1.

The Central Valley Water Board has initiated a process to evaluate beneficial use designations for agriculturally-dominated water bodies (CRWQCB-CVR, 2012b), and this alternative would allow that process to continue. Should that process determine that the WARM and COLD beneficial uses are not associated with these water bodies, the numeric objectives in the Proposed Amendment would not apply to them. While the Board would retain some flexibility for constructed water bodies, attaining numeric water quality objectives in the water bodies proposed under this alternative would require reductions in the smaller tributaries and sources throughout the Project Area that have elevated concentrations. The water bodies for which water quality objectives would be established under the Proposed Amendment are shown in the Proposed Amendment in Appendix C. These include a) all water bodies downstream of the major dams with WARM or COLD freshwater habitat beneficial uses and b) thirty one specifically named water bodies with WARM or COLD beneficial uses which are 303(d)-listed for diazinon and/or chlorpyrifos. For brevity and clarity, these water bodies are referred to as “Sacramento and San Joaquin Valley water bodies” or “Valley water bodies” in the remainder of this report.

3. Beneficial Uses

The Water Code requires that the Board consider the “past, present, and probable future beneficial uses of water” when establishing water quality objectives. The Basin Plan defines 21 beneficial uses and designates one or more of these beneficial uses for specific water bodies in the Sacramento and San Joaquin River Basins. The Basin Plan also states that “the beneficial uses of any specifically identified water body generally apply to its tributary streams” and that “[for] unidentified water bodies, the beneficial uses will be evaluated on a case-by-case basis.”

The Board evaluated existing designated beneficial uses in conjunction with the development and adoption of TMDLs and Basin Plan Amendments that addressed diazinon and chlorpyrifos in the Sacramento and Feather Rivers (Hann, et al., 2007), the Sacramento-San Joaquin Delta Waterways (McClure, et al., 2006), and the Lower San Joaquin River (Beaulaurier, et al., 2005). The Board determined that it was not necessary to make modifications to these existing uses in order to establish pesticide discharge programs in these water bodies. As discussed in Section 4 and the staff reports referenced above, freshwater habitat uses, including the warm freshwater (WARM) and/or cold freshwater (COLD) habitat beneficial uses, are the beneficial uses most sensitive to diazinon and chlorpyrifos. Therefore, diazinon and chlorpyrifos water quality objectives that would protect freshwater habitat would be protective of all other beneficial uses as well.

The WARM and COLD beneficial uses are defined as follows:

> **Warm Freshwater Habitat (WARM)** – Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
>
> **Cold Freshwater Habitat (COLD)** – Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Some of the water bodies in the Project Area have specific beneficial uses designated in the Basin Plan. However, most of the water bodies in the Project Area are not named in the Basin Plan, but are assigned beneficial uses via the Basin Plan’s tributary statement described above. Nearly all natural water bodies in the Project Area are tributary to water bodies with WARM and/or COLD beneficial uses.

While the Basin Plan's tributary statement establishes beneficial uses for streams that are not specifically named in the Basin Plan, the Basin Plan does not establish beneficial use designations for unnamed constructed canals and drains.

For the following water bodies, the Basin Plan has not designated an aquatic life beneficial use, because uses are not designated in the Basin Plan via the tributary statement for water bodies other than streams. Nonetheless, evidence in the Board's files indicates that WARM and/or COLD beneficial uses currently exist. The proposed numeric water quality objective would therefore apply in the following water bodies:

Main Drainage Canal,
Mormon Slough,
Wadsworth Canal,
Westley Wasteway, and
Winters Canal

Additionally, Berenda Creek also may not have beneficial uses designated in the Basin Plan because it is unclear whether it can be considered a tributary of the San Joaquin River.

The evidence in the Board's files that indicates that WARM and/or COLD beneficial uses currently exist in the aforementioned water bodies can be found in a staff report created to support the development of this Amendment, entitled *A Compilation of Selected Water Bodies and Aquatic Indicators for the Central Valley Pesticide Basin Plan Amendment Project* (Davis and Lee, 2010). This report analyzed available data and information and concluded that aquatic life consistent with the definitions of the WARM and COLD beneficial uses occurs within all of the nearly 1300 water bodies listed in that report, including all of the Sacramento and San Joaquin Valley water bodies under consideration for this Amendment. Therefore, Board staff has concluded that WARM and/or COLD freshwater habitat beneficial uses are existing uses for all the water bodies which would be assigned numeric water quality objectives in the Proposed Amendment, including the five constructed water bodies listed above and Berenda Creek.

3.1 Alternative Beneficial Uses Considered

Board staff considered an alternative that would modify beneficial use designations and an alternative that would create new categories of beneficial uses in the Project Area. Board staff also considered not proposing any changes to existing beneficial use designations in the Project Area. An alternative beneficial use option would be appropriate if a new or modified beneficial use designation were necessary to establish diazinon and chlorpyrifos water quality objectives and a diazinon and chlorpyrifos regulatory program in the proposed Basin Plan Amendment. The three alternative beneficial use options are discussed below.

3.1.1 No Changes in Beneficial Uses

This alternative would make no changes to the existing beneficial use designations within the Project Area. Board staff have examined WARM and/or COLD freshwater habitat beneficial uses, and all available information indicates that these uses already exist, and are appropriate for streams within the Project Area that are not named in the Basin Plan. Water quality objectives proposed for constructed water bodies would be protective of what aquatic life beneficial uses exist in these water bodies, but the determination of the designated beneficial uses would not be done as part of the Proposed Amendment. No changes would be proposed for other beneficial use categories. Other beneficial use categories are not relevant to the Proposed Amendment, since the proposed numeric objectives would be protective of the most sensitive beneficial uses.

3.1.2 Modification of Beneficial Uses Affected by Diazinon or Chlorpyrifos

This alternative would create a sub-category of the WARM and COLD beneficial uses to account for factors that could make attainment of these uses infeasible. Board staff considered factors such as: 1) natural pollutant concentrations prevent attainment of the use; 2) flow conditions prevent attainment of the use; 3) human caused pollution prevents attainment of the use and remediation would cause more damage than to leave in place; 4) hydrologic modification prevents attainment of the use; 5) natural features of the water body preclude attainment of the aquatic life protection uses; and 6) controls more stringent than those required by sections 301(b) and 306 of the Clean Water Act would result in substantial and widespread economic and social impact. (See 40 C.F.R. § 131.10(g).)

None of the factors listed above are expected to make attainment of designated uses infeasible with respect to diazinon or chlorpyrifos. Diazinon and chlorpyrifos are not natural pollutants (Factor 1). Flow conditions in the Project Area water bodies would not prevent attainment of the use (Factor 2). It is not expected that environmental damage would result from reducing diazinon and chlorpyrifos discharges (Factor 3). Although there is hydromodification within the Project Area water bodies, discharges of diazinon and chlorpyrifos are not impacted by those modifications (Factor 4). The natural features of the Project Area water bodies do not prevent attainment of the uses (Factor 5). The costs of complying with the Proposed Amendment are estimated in Section 9 of this Staff Report. These costs are modest relative to the size of the Project Area, and would not result in substantial and widespread detrimental economic and social impacts (Factor 6).

3.1.3 Additional Beneficial Uses for the Project-Area Water Bodies

Additional beneficial uses defined in the Basin Plan that may apply to some or all of the Project Area water bodies include: Commercial and Sport Fishing (COMM); Preservation of Biological Habitats of Special Significance (BIOL); Rare, Threatened, or Endangered Species (RARE); Shellfish Harvesting (SHELL); and Estuarine Habitat (EST). However, none of these beneficial uses have been demonstrated to be more sensitive to diazinon or chlorpyrifos than WARM and COLD. Any potential effects of diazinon or chlorpyrifos on salmon or other threatened or endangered fish species would be prevented by ensuring the aquatic life beneficial uses are protected through compliance with the proposed Basin Plan Amendment.

3.2 Recommended Alternative for Beneficial Uses

Board staff does not recommend any changes to the beneficial use designations. Existing information indicates that the warm and/or cold freshwater habitat (WARM and/or COLD) beneficial uses are the most sensitive to diazinon and chlorpyrifos. Existing information also confirms the existence of the WARM and/or COLD beneficial uses in all the water bodies for which water quality objectives are proposed.,. Therefore, modifications to beneficial use designations are not necessary to support the Proposed Amendment.

Board staff also note that the Proposed Amendment would not preclude the Board from developing subcategories for the WARM and/or COLD beneficial uses (such as “LIMITED WARM” or “LIMITED COLD” beneficial use subcategories) at a later date. During the development of such subcategories, the Board could evaluate whether the proposed numeric objective should also apply to those beneficial use subcategories. However, since diazinon and chlorpyrifos impact aquatic life at a very basic level (aquatic invertebrates), all of the available information indicates that the proposed objectives should apply wherever aquatic life exists, which would include even “limited” subcategories.

4. Water Quality Objectives for Diazinon and Chlorpyrifos

This section examines and evaluates alternatives for establishing numeric water quality objectives for diazinon and chlorpyrifos in the Sacramento and San Joaquin Valley water bodies, and describes the basis for the recommended alternative.

Section 303(c) of the federal Clean Water Act requires states to adopt water quality standards to protect public health and enhance water quality. Water quality standards consist of the beneficial uses of a water body, water quality criteria designed to protect those uses, and anti-degradation policies to maintain and protect water quality. Individual states are responsible for reviewing, establishing, and revising water quality standards, and these water quality standards are then submitted to the USEPA for approval. In California, the State Water Resources Control Board (State Water Board) and the Regional Water Quality Control Boards are responsible for developing water quality standards. Upon adoption by the Central Valley Water Board, the State Water Board, and the State Office of Administrative Law, and approval by USEPA, water quality criteria are included in the appropriate Water Quality Control Plan (Basin Plan) as water quality objectives.

Water quality objectives adopted by the Central Valley Water Board must provide reasonable protection of the beneficial uses designated for the applicable water bodies, and must be consistent with state and federal regulations. Invertebrates are specifically mentioned in the definition of freshwater habitat beneficial uses contained in the Basin Plan (page II-2.00): “Uses of water that support warm (cold) water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.” Any methodology used to derive water quality objectives must protect the beneficial uses (40 C.F.R. §131.11(a).), which for this use specifically includes invertebrates.

Water quality objectives can be either numeric or narrative. The Basin Plan currently contains the following narrative water quality objectives for pesticides:

> - No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses.
>
> - Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses.

> - Pesticide concentrations shall not exceed those allowable by applicable anti-degradation policies.
>
> - Pesticide concentrations shall not exceed the lowest levels technically and economically achievable.

The Basin Plan also contains a narrative water quality objective for toxicity, which specifies:

> All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests of appropriate duration or other methods as specified by the Central Valley Water Board.
>
> The Regional Water Board will also consider all material and relevant information submitted by the discharger and other interested parties and numerical criteria and guidelines for toxic substances developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, the U.S. Food and Drug Administration, the National Academy of Sciences, the U.S. Environmental Protection Agency, and other appropriate organizations to evaluate compliance with this objective…

This narrative objective applies to toxicity caused by pesticides.

The Implementation chapter of the Basin Plan includes the following policies for evaluating pesticides relative to narrative water quality objectives:

> For most pesticides, numerical water quality objectives have not been adopted. USEPA criteria and other guidance are also extremely limited. Since this situation is not likely to change in the near future, the Board will use the best available technical information to evaluate compliance with the narrative objectives. Where valid testing has developed 96 hour LC_{50} values for aquatic organisms (the concentration that kills one half of the test organisms in 96 hours), the Board will consider one tenth of this value for the most sensitive species tested as the upper limit (daily maximum) for the protection of aquatic life. Other available technical information on the pesticide (such as Lowest Observed Effect Concentrations and No Observed Effect Levels), the water bodies and the organisms involved will be evaluated to determine if lower concentrations are required to meet the narrative objectives.

The Basin Plan also includes a policy for considering the additive toxicity of pesticides:

> In conducting a review of pesticide monitoring data, the Board will consider the cumulative impact if more than one pesticide is present in the water body. This will be done by initially assuming that the toxicities of pesticides are additive. This will be evaluated separately for each beneficial use, using the following formula:
>
> $$\frac{C_1}{O_1} + \frac{C_2}{O_2} + \cdots + \frac{C_i}{O_i} = S$$
>
> Where:
>
> C = The concentration of each pesticide.
>
> O = The water quality objective or criterion for the specific beneficial use for each pesticide present, based on the best available information. Note that the numbers must be acceptable to the Board and performance goals are not to be used in this equation.
>
> S = The sum. A sum exceeding one (1.0) indicates that the beneficial use may be impacted.

The Basin Plan also includes a more general policy for considering the additive toxicity of pollutants that is consistent with the pesticide-specific policy (see pages IV-17.00 & IV-18.00 of the Basin Plan).

In addition to the Basin Plan's narrative water quality objectives for pesticides and toxicity and associated policies for implementing those objectives, State Water Board Resolution 68-16, the Statement of Policy with Respect to Maintaining High Quality of Waters in California (*State Anti-Degradation Policy*) requires the maintenance of existing water quality, unless a change in water quality would provide maximum benefit to the people of the state and will not adversely affect beneficial uses.

The Basin Plan currently includes specific numeric water quality objectives for diazinon and chlorpyrifos in portions of the Sacramento, Feather, and San Joaquin Rivers, and the Sacramento-San Joaquin Delta. These objectives include the following maximum concentrations and averaging periods for diazinon:

- 0.16 µg/L; 1-hour average, not to be exceeded more than once every three years on average.
- 0.10 µg/L; 4-day average, not to be exceeded more than once every three years on average.

In addition, these objectives include the following maximum concentrations and averaging periods for chlorpyrifos:

- 0.025 µg/L; 1-hour average, not to be exceeded more than once every three years on average.
- 0.015 µg/L; 4-day average, not to be exceeded more than once every three years on average.

4.1 Alternatives Considered for Deriving Water Quality Objectives

The alternative water quality standards methodologies discussed in this section include the USEPA method for deriving numeric water quality criteria and the recently completed University of California, Davis (UC Davis) method for deriving pesticide water quality criteria (Tenbrook et al., 2009). The Probabilistic Ecological Risk Assessment (PERA) approach conducted by Novartis (1997) is not evaluated in this Staff Report. The evaluation for the Sacramento and Feather Rivers (Karkoski et al., 2003) found that the PERA methodology applied by Novartis is inconsistent with the Clean Water Act and would allow toxic conditions to exist. Since the Central Valley Water Board is not required to evaluate alternatives that are clearly contrary to state and federal clean water laws, the PERA method as applied by Novartis is not reviewed. Two additional methodologies from Canada and Australia were considered in the Delta staff report (McClure et al., 2006). However, both methods were determined infeasible due to the lack of developed diazinon guidelines and other technical issues. As a result, these methods will not be considered in this report.

Tables 4-1 and 4-2 present diazinon and chlorpyrifos water quality criteria used in the United States, Canada, and Australia and New Zealand. Criteria for other beneficial uses are not available. The available criteria indicate that the freshwater habitat beneficial uses are the most sensitive to diazinon and chlorpyrifos.

Table 4-1 Water Quality Criteria for Diazinon.

Aquatic Life Criteria for Surface Water	**ng/L**
Recalculated CDFG Aquatic Life Criterion for freshwater – 4 day average concentration	100
Recalculated CDFG Aquatic Life Criterion for freshwater – 1 hour maximum concentration	160
USEPA Aquatic Life Criterion for freshwater – 4 day average concentration	170
USEPA Aquatic Life Criterion for freshwater – 1 hour maximum concentration	170
UC Davis Aquatic Life Criterion for freshwater – 4 day average concentration	70
UC Davis Aquatic Life Criterion for freshwater – 1 hour maximum concentration	200
1/10th Most sensitive species mean average value (*Ceriodaphnia dubia*)[4] (Basin Plan)	44
Human Health Criteria for Drinking Water	
USEPA Drinking Water Health Advisory	1,000
California Department of Public Health Notification Level	1,200
Canadian Environmental Quality Guidelines	20,000

Table 4-2 Water Quality Criteria for Chlorpyrifos.

Aquatic Life Criteria for Surface Water	**ng/L**
Recalculated CDFG Aquatic Life Criterion for freshwater – 4 day average concentration	15
Recalculated CDFG Aquatic Life Criterion for freshwater – 1 hour maximum concentration	25
EPA Aquatic Life Criterion for freshwater – 4 day average concentration	41
EPA Aquatic Life Criterion for freshwater – 1 hour maximum concentration	83
UC Davis Aquatic Life Criterion for freshwater – 4 day average concentration	10
UC Davis Aquatic Life Criterion for freshwater – 1 hour maximum concentration	10
1/10th most sensitive species mean average value (*Ceriodaphnia dubia*)[5] (Basin Plan)	6
Human Health Criteria for Drinking Water	
USEPA Drinking Water Health Advisory (USEPA 2011)	2,000
Canadian Environmental Quality Guidelines	90,000
Agriculture-Livestock	
Canadian Environmental Quality Guidelines	24,000

Sources: Canadian Council of Ministers of the Environment, 2002; California Department of Public Health, 2010; USEPA, 2011c; USEPA, 2006; USEPA, 1986; Finlayson, 2004a; Finlayson, 2004b; Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000; Palumbo et al., 2010; Tenbrook et al., 2009.

The alternatives considered for deriving water quality objectives for diazinon and chlorpyrifos are:

- No change in water quality objectives
- No detectable levels of diazinon or chlorpyrifos
- USEPA Water Quality Criteria methodology
- UC Davis Water Quality Criteria methodology

[4] The species mean average value for *Ceriodaphnia dubia* is 440 ng/L for acceptable diazinon acute toxicity tests (Siepmann and Finlayson, 2000). *C. dubia* is the most sensitive species when the reported results for *Gammarus fasciatus* are not considered (as discussed in Section 4.1.3).

[5] The species mean average value for *Ceriodaphnia dubia* is 60 ng/L for acceptable chlorpyrifos acute toxicity tests (Siepmann and Finlayson, 2000). For chlorpyrifos, *C. dubia* was the most sensitive freshwater species tested.

After each methodology is described, Board staff provide a preliminary evaluation. The evaluation is based on the scientific merits of the method, along with policy and data considerations. If no significant issues are associated with the methodology after the preliminary evaluation, a more detailed evaluation is performed relative to Porter-Cologne considerations and other applicable laws and policies in Section 4.2.

4.1.1 No Change in Water Quality Objectives

The Basin Plan contains narrative water quality objectives regarding pesticides and toxicity, and the Central Valley Water Board uses available guidelines and criteria to interpret existing narrative water quality objectives. The Central Valley Water Board has been using the recalculated California Department of Fish and Game (CDFG) criteria for diazinon and chlorpyrifos (Finlayson, 2004b) to interpret compliance with its narrative toxicity and pesticide water quality objectives.

The Basin Plan states that the Central Valley Water Board will use the best available technical information to evaluate compliance with narrative objectives pertaining to pesticides, and will consider 1/10th of the 96-hour LC_{50} of the most sensitive organism as the daily maximum for protection of aquatic life. Other available information, such as the lowest observed effect concentrations and no observed effect levels, are to be evaluated to determine whether lower concentrations are required to interpret narrative objectives. However, since diazinon and chlorpyrifos criteria have been calculated, these criteria would likely continue to be used as the best available information to interpret narrative objectives.

For the "no change" alternative, the existing water quality objectives for chlorpyrifos and diazinon would remain unchanged for the Sacramento, Feather, and San Joaquin Rivers, and the Sacramento-San Joaquin Delta Waterways. These same values, which are the Central Valley Water Board's recalculation of the CDFG chlorpyrifos and diazinon criteria[6], would likely continue to be used to interpret compliance with narrative objectives in the remainder of the Sacramento and San Joaquin Valley water bodies. When additive toxicity is considered in determining compliance, the recalculated CDFG criteria for diazinon and chlorpyrifos would be used.

[6] The Regional Water Board used the suggested significant figures for criteria calculations found in the USEPA guidelines (1985), which resulted in slightly higher acute and chronic chlorpyrifos criteria.

4.1.2 Numeric Water Quality Objectives Based on no Diazinon or Chlorpyrifos

The Central Valley Water Board could adopt water quality objectives that would maintain “natural” water quality conditions. Water quality objectives based on these conditions would mean no detected concentrations of diazinon or chlorpyrifos. State and federal anti-degradation policies allow for the presence of diazinon and chlorpyrifos if the presence of those pollutants were consistent with maximum benefit to the people of the State, would not unreasonably affect present and anticipated beneficial uses, and would not result in water quality less than that prescribed in existing policies (see *State Anti-Degradation Policy* and 40 C.F.R. § 131.12).

To pursue this alternative, the Central Valley Water Board could make a determination that the presence of any diazinon or chlorpyrifos in surface waters is not to the maximum benefit of the people of the State, which would serve as the basis for a no diazinon or chlorpyrifos objective. Alternatively, the Central Valley Water Board could determine that the presence of some diazinon or chlorpyrifos is consistent with the maximum benefit to the people of the State, but the level that is consistent with the maximum benefit is less than the highest level that would still be protective of beneficial uses.

The no diazinon or chlorpyrifos alternative will be further considered, since anti-degradation policies suggest that the Central Valley Water Board could determine that the presence of any diazinon or chlorpyrifos in any Sacramento or San Joaquin Valley water body is not to the maximum benefit of the people of the State.

4.1.3 Numeric Water Quality Objectives Based on the USEPA Method for Deriving Numeric Water Quality Criteria

Most states and the USEPA use the USEPA methodology (USEPA, 1985) to establish aquatic life water quality criteria and standards. The USEPA methodology for deriving numeric water quality criteria (WQC) for aquatic organisms provides a method to review available toxicity data for a water quality constituent and derive two values: the criterion maximum concentration (CMC), an acute criterion, and the criterion continuous concentration (CCC), a chronic criterion. According to the guidelines, restricting concentrations to levels at or below these criteria should provide aquatic organisms with a “reasonable level” of protection and prevent “unacceptable” impacts.

The USEPA WQC are intended to protect aquatic organisms and their uses, with the knowledge that aquatic ecosystems can tolerate some stress and occasional adverse effects. The criteria are met if the one-hour average concentration of the constituent does not exceed the acute criterion (CMC) and the four-day average concentration does not exceed the chronic criterion (CCC) more than once every three years, on average, at a given location.

The USEPA method also suggests that data that may not have been used in the standard criteria derivation method should be used "…if the data were obtained with an important species, the test concentrations were measured, and the endpoint was biologically important." In cases in which such data are lower than the calculated criterion, the lower value should be applied as the criterion (USEPA, 1985).

4.1.3.1 USEPA Final Criteria for Diazinon and Chlorpyrifos

For diazinon, USEPA published final aquatic life ambient water quality criteria (USEPA, 2005). These criteria were derived using the USEPA methodology described above. Acceptable freshwater acute toxicity data for 13 invertebrate, ten fish, and one amphibian species were used in calculating the USEPA criteria. The acute freshwater criterion was calculated to be 170 ng/L. Chronic toxicity values for two species were used in calculating the USEPA chronic criterion. The chronic freshwater criterion was also calculated to be 170 ng/L, which is equivalent to the acute criterion.

The USEPA published national water quality criteria for chlorpyrifos in 1986 (USEPA, 1986). Acceptable freshwater acute toxicity data were available for seven fish and eleven invertebrate species, while acceptable saltwater acute toxicity data were available for ten fish and five invertebrate species. Acceptable chronic toxicity data were available for one freshwater and seven saltwater species. The calculated freshwater acute criterion was 83 ng/L and the chronic criterion was 41 ng/L.

4.1.3.2 CDFG Criteria for Diazinon and Chlorpyrifos

In 2000 CDFG published freshwater WQC for diazinon (Siepmann and Finlayson, 2000), using the USEPA methodology described above (USEPA, 1985). Forty acceptable acute toxicity values were available to calculate a freshwater criterion for diazinon. Acceptable acute toxicity tests were available for nine invertebrate and nine fish species. Five acute to chronic ratios for four species were available to calculate a chronic criterion for diazinon. CDFG calculated an acute criterion for diazinon of 80 ng/L and a chronic criterion of 50 ng/L. Insufficient data were available to calculate acute or chronic saltwater WQC for diazinon.

The CDFG diazinon criteria in Siepmann and Finlayson (2000) were calculated using questionable *Gammarus fasciatus* toxicity test results, as described in previous Basin Plan amendments (McClure et al., 2006; Hann et al., 2007). In 2004, CDFG recalculated the diazinon criteria to exclude the questionable toxicity test values for

Gammarus fasciatus, but also noted that the recalculation assumes no new information has been collected that would affect the criteria (Finlayson, 2004a). CDFG believed that it was impossible to discern the correct toxicity test results for the questionable *Gammarus fasciatus* study (Finlayson 2004a). The data set that CDFG used in recalculating the diazinon criteria also did not include the toxicity values for *Gammarus pseudolimnaeus* test that USEPA used in their criteria. CDFG found the *Gammarus pseudolimnaeus* study used by USEPA unacceptable for use in calculating water quality criteria because it did not meet American Society for Testing and Materials (ASTM) standards for acute toxicity tests (Finlayson, 2004b). The recalculated CDFG diazinon criteria are an acute criterion of 160 ng/L and a chronic criterion of 100 ng/L. Central Valley Water Board staff confirmed these recalculated values in previous Basin Plan amendment staff reports (Beaulaurier et al., 2005; McClure et al., 2006; Hann et al., 2007).

Forty-three acceptable acute toxicity values were available to calculate freshwater criteria for chlorpyrifos. Acceptable acute toxicity tests were available for 13 invertebrate and seven fish species. Eight acute to chronic ratios for seven species (both freshwater and saltwater) were available to calculate a chronic criterion for chlorpyrifos. The CDFG calculated an acute freshwater criterion for chlorpyrifos of 20 ng/L and a chronic freshwater criterion of 14 ng/L. The calculations that are part of the USEPA methodology (USEPA, 1985) can include interim calculations before the final criterion is calculated. The methodology states that interim calculations should be rounded to four significant figures and the final criterion should be rounded to two significant figures. When the freshwater chlorpyrifos criteria are rounded to two significant figures using the data set that the CDFG found acceptable, the acute criterion is 25 ng/L, rather than 20 ng/L, and the chronic criterion is 15 ng/L, rather than 14 ng/L. Central Valley Water Board staff confirmed these criteria calculations in previous Basin Plan Amendments (McClure et al., 2006; Hann et al., 2007).

4.1.3.3 Comparison of Diazinon and Chlorpyrifos Criteria Derived Using the USEPA Methodology

For the freshwater diazinon criteria, the use of different data sets resulted in a small (6%) difference between the recalculated CDFG acute criterion (160 ng/L) and the USEPA acute criterion (170 ng/L). The USEPA methodology uses only toxicity data from the four most sensitive genera directly in the criteria derivation. If the toxicity values for the four lowest genera are not changed, adding data for additional genera makes the criteria higher by lowering the percentile rankings of the four lowest genera. The four lowest toxicity values used by USEPA and CDFG were very similar, but the associated percentile ranks were different because USEPA's data set included additional, less sensitive genera. The inclusion of data for a greater number of genera in the USEPA data set resulted in USEPA's acute criterion being slightly higher than CDFG's recalculated acute criterion.

The difference between the recalculated CDFG and USEPA chronic freshwater diazinon criteria (100 vs. 170 ng/L, respectively) is due to the use of different acute to chronic ratios (ACRs). An ACR of 2 was used by USEPA and an ACR of 3 was used by CDFG. The ACR calculated by CDFG appears to be more appropriate, since they included three sensitive species in their calculation of the ACR (versus two by USEPA) and CDFG calculated ACRs based on toxicity test results from the same studies or at least the same laboratory. Because the CDFG criteria calculations used a more appropriate ACR and did not use the results from the two questionable *Gammarus* studies discussed above, the recalculated CDFG criteria presented by Finlayson (2004a) and confirmed by Central Valley Water Board staff calculations, are used to represent the application of the USEPA methodology for deriving freshwater diazinon criteria.

For chlorpyrifos, the criteria derived by CDFG (Siepmann and Finlayson, 2000), and recalculated by Central Valley Water Board staff to correct the number of significant figures are more appropriate than the criteria derived by USEPA (1986). The CDFG data set included toxicity studies for a greater number of sensitive organisms and included more recent toxicity study results.

4.1.4 Numeric Water Quality Objectives Derived Using the UC Davis Methodology

The Central Valley Water Board contracted with UC Davis to develop a new methodology to establish water quality criteria for the protection of aquatic life based on findings from a review of current methodologies (Tenbrook et al., 2006). The methodology developed by UC Davis incorporates procedures that could improve criteria generation. The goal of the UC Davis method is to extrapolate from available pesticide toxicity data for a limited number of species to a concentration that should not produce detrimental physiological effects in aquatic life (Tenbrook et al., 2009).

The UC Davis method provides an approach to review available toxicity data for a water quality constituent and to derive two values, an acute criterion and a chronic criterion. A main improvement incorporated into the UC Davis methodology was the ability to handle a variety of data sets, including data sets that did not meet the eight taxa requirements of the USEPA guidelines (USEPA, 1985). Toxicity data for the taxa required by the USEPA methodology are seldom available for pesticides, thus it is often not possible to generate criteria with the USEPA methodology using existing data. Incorporated into the UC Davis method is the use of a species sensitivity distribution (SSD) to derive acute or chronic criteria, which is similar to the SSD used in the USEPA method. The SSD method applied by UC Davis requires a minimum of five taxa to derive acute or chronic criteria:

a. The family Salmonidae;
b. A warm water fish;
c. A planktonic crustacean, of which one must be in the family Daphniidae in the genus *Ceriodaphnia, Daphnia,* or *Simocephalus*;
d. A benthic crustacean;
e. An insect (aquatic exposure).

The UC Davis method can be used to derive acute and chronic criteria when the SSD requirements are not met. For acute criteria, the method uses an assessment factor with a minimum of one datum from the family Daphniidae in the genus *Ceriodaphnia, Daphnia,* or *Simocephalus*. The method outlines data requirements if more than one datum is available for acute criterion derivation (Tenbrook et al., 2009).

When fewer than five toxicity values are available for derivation of chronic criterion, the UC Davis method uses an acute-to-chronic ratio (ACR). The ACR is calculated by dividing an acute LC/EC50 value by a chronic value (e.g., MATC) derived from the same test, or from tests conducted by the same laboratory under identical conditions. When an ACR cannot be calculated, the UC Davis method uses a default ACR of 12.4 to be used in chronic criteria derivation.

Criteria developed using the UC Davis method aim to protect all species in the aquatic ecosystem. The criteria are met if the one-hour average concentration of the constituent does not exceed the acute criterion and the four-day average concentration does not exceed the chronic criterion more than once every three years, on average.

In addition, the UC Davis method outlines procedures to evaluate derived criteria to ensure that they are set at levels that will protect against adverse effects to: 1) sensitive species, 2) species in the ecosystem, and 3) threatened or endangered species (Tenbrook et al., 2009). In cases when such data show toxicity can occur at a lower concentration than the acute or chronic criteria, then the criteria may be adjusted downward to ensure protection.

4.1.4.1 UC Davis Final Criteria for Diazinon and Chlorpyrifos

Using the UC Davis methodology described above, the acceptable acute data set for diazinon contained 13 species mean acute values, which were used to calculate an acute criterion of 200 ng/L (Palumbo et al., 2010). There were five acceptable species mean chronic values used to calculate a chronic criterion of 70 ng/L.

UC Davis published the aquatic life water quality criteria for chlorpyrifos in the finalized methodology (Tenbrook et al., 2009). The UC Davis acceptable acute data set contained 17 species mean acute values that were used to calculate an acute criterion of 10 ng/L. The chronic criterion was calculated to be 10 ng/L using three acceptable species mean chronic values.

4.1.5 Summary of Potential Water Quality Objectives Derived by Alternate Methods

The alternative potential water quality objectives are summarized in Table 4-3. The four alternatives for diazinon and chlorpyrifos are evaluated below with respect to Porter-Cologne requirements and other applicable laws and policies. Water quality objectives for diazinon and chlorpyrifos do not necessarily have to be selected from the same alternative.

The “No change” alternative would not establish water quality objectives for diazinon or chlorpyrifos in the Sacramento and San Joaquin Valley water bodies, but would likely result in the use of the criteria developed from the CDFG data set to interpret the narrative objectives.

The “No diazinon or chlorpyrifos” alternative would establish no detectable concentrations of either pesticide as water quality objectives.

The “CDFG/USEPA method” alternative would establish water quality objectives for diazinon and chlorpyrifos based upon criteria calculated using the CDFG data set and the USEPA methodology.

The “UC Davis method” alternative would establish water quality objectives for diazinon and chlorpyrifos based upon criteria calculated using the UC Davis data set and methodology.

Table 4-3 Summary of Potential Freshwater Water Quality Objectives Derived by Alternative Methods.

	Diazinon		Chlorpyrifos	
Alternative	Acute (ng/L)	Chronic (ng/L)	Acute (ng/L)	Chronic (ng/L)
1. No Change[1]	160[2]	100[2]	25[3]	15[3]
2. No diazinon or chlorpyrifos	0 or non-detect	0 or non-detect	0 or non-detect	0 or non-detect
3. CDFG/USEPA Method	160[2]	100[2]	25[3]	15[3]
4. UC Davis Method	200[4]	70[4]	10[4]	10[4]

1) These criteria are currently used by the Central Valley Water Board to interpret narrative objectives.
2) Central Valley Water Board staff calculations based on the CDFG data set, using the USEPA method. The acute criterion is a one-hour average and the chronic criterion is a four-day average–neither to be exceeded more than once every three years on the average.
3) CDFG (Siepmann and Finlayson, 2000) acute criterion recalculated by Central Valley Water Board staff to two significant figures per the USEPA methodology (1985).
4) UC Davis derived criteria using the UC Davis data set and method (Tenbrook et al., 2009; Palumbo et al., 2010).

4.1.6 Additive Toxicity

Diazinon and chlorpyrifos have the same mechanism of toxic action, and have been shown to exhibit additive toxicity to aquatic invertebrates when they co-occur (Bailey et al. 1997; Siepmann and Finlayson, 2000). Studies of mixtures of compounds acting through the same mechanism suggest there is no concentration below which a compound will no longer contribute to the overall toxicity of the mixture (Deener et al., 1988). Therefore, the total potential toxicity of co-occurring diazinon and chlorpyrifos needs to be assessed, even when one or both of their individual concentrations would otherwise be below thresholds of concern. Existing Central Valley Water Board water quality objectives require that additive toxicity effects are considered when evaluating compliance with the applicable narrative objectives.

The Basin Plan (in Chapter IV, “Pesticide Discharges from Nonpoint Sources”) provides an additivity formula that applies to diazinon and chlorpyrifos when they co-occur in the

Sacramento, Feather, and San Joaquin Rivers, and the Sacramento-San Joaquin Delta. This additivity formula is established as the loading capacity for diazinon and chlorpyrifos in these water bodies.

$$\frac{C_D}{WQO_D} + \frac{C_C}{WQO_C} \leq 1.0$$

Where

C_D = Diazinon concentration in the receiving water.
C_C = Chlorpyrifos concentration in the receiving water.
WQO_D = Acute or chronic diazinon water quality objective or criterion.
WQO_C = Acute or chronic chlorpyrifos water quality objective or criterion.

Another method that can be used to evaluate the additive toxicity of similar toxicants is the Toxic Equivalents (TEQ) method suggested by Felsot (2005). As discussed in the Delta TMDL staff report (McClure et al, 2006), the TEQ method as suggested by Felsot (2005) is mathematically the same as the Basin Plan formulas for additive toxic effects of pesticides.

4.1.7 Comparison of Water Quality Data to Alternative Objectives

Tables 4-4, 4-5, 4-6 and 4-7 compare recent (2006-2011) concentration data for the Sacramento and San Joaquin Valley water bodies (from the data sources used in Section 1) to the alternate water quality objectives in the three different watersheds. These tables also describe the average and maximum level of reduction that would be required during exceedances to meet the alternative objectives. For the "no diazinon" and "no chlorpyrifos" method, any detection of diazinon or chlorpyrifos would be counted as an exceedance, and all concentrations would need to be reduced 100%.

For chlorpyrifos, the use of alternative acute objectives made a substantial difference in the number of exceedances, with about twice as many samples exceeding 10 ng/L as exceeded 25 ng/L (Table 4-4). The use of the alternative chronic objectives also made a significant difference in exceedance rates (Table 4-5). The average chlorpyrifos reduction needed during exceedances was about 50%, but the maximum reduction needed was over 99%.

For diazinon the exceedance rates were generally low, and the alternative criteria concentrations were less different. Therefore, the alternative criteria did not make as much of a difference in exceedance frequencies as were observed for chlorpyrifos. However, there were some minor differences in exceedance rates (Tables 4-6 and 4-7).

For diazinon, the average diazinon reduction needed during exceedances was about 50%, and the maximum reduction needed was 97%.

Table 4-4 Comparison of Recent Data (2006 – 2011) to Alternate Chlorpyrifos Acute (1-hour) Water Quality Objectives

Watershed	Number of Samples	Number (%) Detections	CDFG: Number (%) > 25 ng/L	Reduction Needed to Meet 25 ng/L During Exceedances		UC Davis: Number (%) > 10 ng/L	Reduction Needed to Meet 10 ng/L During Exceedances	
				Average	Maximum		Average	Maximum
Delta	935	135 (14%)	51 (5%)	48%	99%	95 (10%)	58%	99%
Sacramento River	840	36 (4%)	6 (1%)	31%	50%	15 (2%)	47%	80%
San Joaquin River	1444	307 (21%)	121 (8%)	57%	99%	198 (14%)	63%	99.7%

Table 4-5 Comparison of Recent Data (2005 – 2009) to Alternate Chlorpyrifos Chronic (4-day) Water Quality Objectives

Watershed	Number of 4-day Averages	Number (%) Detections	CDFG: Number (%) > 15 ng/L	Reduction Needed to Meet 15 ng/L During Exceedance		UC Davis: Number (%) > 10 ng/L	Reduction Needed to Meet 10 ng/L During Exceedances	
				Average	Maximum		Average	Maximum
Delta	780	132 (17%)	64 (8%)	59%	99%	91 (12%)	58%	99%
Sacramento River	725	36 (5%)	9 (1%)	45%	70%	13 (2%)	50%	80%
San Joaquin River	1348	293 (22%)	151 (11%)	63%	99.6%	191 (14%)	64%	99.7%

Table 4-6 Comparison of Recent Data (2005 – 2011) to Alternate Diazinon Acute Water Quality Objectives.

Watershed	Number of Samples	Number (%) Detections	CDFG: Number (%) > 160 ng/L	Reduction Needed to Meet 160 ng/L During Exceedances		UC Davis: Number (%) > 200 ng/L	Reduction Needed to Meet 200 ng/L During Exceedances	
				Average	Maximum		Average	Maximum
Delta	894	166 (19%)	5 (1%)	38%	64%	4 (0.4%)	28%	56%
Sacramento River	842	197 (23%)	17 (2%)	59%	96%	14 (2%)	63%	95%
San Joaquin River	1533	150 (10%)	4 (0.3%)	50%	88%	4 (0.3%)	37%	85%

Table 4-7 Comparison of Recent Data (2006 – 2011) to Alternate Diazinon Chronic Water Quality Objectives.

Watershed	Number of 4-day Averages	Number (%) Detections	CDFG: Number (%) > 100 ng/L	Reduction Needed to Meet 100 ng/L During Exceedance		UC Davis: Number (%) > 70 ng/L	Reduction Needed to Meet 70 ng/L During Exceedance	
				Average	Maximum		Average	Maximum
Delta	739	147(20%)	14 (2%)	28%	78%	18 (2%)	41%	84%
Sacramento River	726	135 (19%)	15 (2%)	61%	96%	22 (3%)	54%	97%
San Joaquin River	1438	148 (10%)	8 (1%)	43%	92%	9 (1%)	57%	95%

4.2 Evaluation of Alternate Methods for Deriving Water Quality Objectives

This section evaluates the alternate methods for deriving water quality objectives presented above, with respect to Porter-Cologne and other applicable state and federal laws and policies. Water Code section 13241 specifies the following considerations for establishing water quality objectives:

- Past, present, and probable future beneficial uses of water.
- Environmental characteristics of the hydrographic unit under consideration, including quality of water available to it.
- Water quality conditions reasonably achievable through coordinated control of all factors that affect water quality in the area.
- Economic considerations.
- The need for developing housing within the region.
- The need to develop and use recycled water.

Tables 4-8 and 4-9 present qualitative assessments of the alternate methods for their consistency with Porter-Cologne and other state and federal requirements. The rationale for the assessment of each method follows the tables.

Table 4-8 Assessment of Diazinon Alternatives for Consistency with Porter-Cologne and other State and Federal Requirements

Porter-Cologne Requirements	No Change	No Diazinon	CDFG/ USEPA	UC Davis
Beneficial Uses	+	+	+	+
Environmental Characteristics	0	0	0	0
Conditions Reasonably Achievable	+	-	+	+
Economic Considerations	+	-	+	+
Need for Housing	0	0	0	0
Need to Recycle Water	0	0	0	0
State and Federal Laws and Policies	**No Change**	**No Diazinon**	**CDFG/USEPA**	**UC Davis**
Anti-degradation	C	C	C	C
Clean Water Act	C	C	C	C
ESA	C	C	C	C

Scores indicate relative degree of protection; attainability; achievability; impact or consistency with policy, as applicable, with 0 indicating neutral:

Beneficial Uses: Not protective of beneficial uses: **-** Fully protective: +

Environmental Characteristics: Not attainable: - Fully attainable: +

Achievability: Difficult to achieve: - Readily achievable: +

Economic Considerations: Potentially significant impact: - Modest or no negative impact: +

Housing: Significant housing impact: - Little or no impact: +

Recycling Water: Significant impact on recycling water: - Little or no impact: +

C = Consistent

Table **4-9** Assessment of Chlorpyrifos Alternatives for Consistency with Porter-Cologne and other State and Federal Requirements

Porter-Cologne Requirements	**No Change**	**No Chlorpyrifos**	**CDFG/USEPA**	**UC Davis**
Beneficial Uses	+	+	+	+
Environmental Characteristics	0	0	0	0
Conditions Reasonably Achievable	+	-	+	+
Economic Considerations	+	-	+	+
Need for Housing	0	0	0	0
Need to Recycle Water	0	0	0	0
State and Federal Laws and Policies	**No Change**	**No Chlorpyrifos**	**CDFG/USEPA**	**UC Davis**
Antidegradation	C	C	C	C
Clean Water Act	C	C	C	C
ESA	C	C	C	C

Scores indicate relative degree of protection; attainability; achievability; impact or consistency with policy, as applicable, with 0 indicating neutral:

Beneficial Uses: Not protective of beneficial uses: **-** Fully protective: +

Environmental Characteristics: Not attainable: - Fully attainable: +

Achievability: Difficult to achieve: - Readily achievable: +

Economic Considerations: Potentially significant impact: - Modest or no negative impact: +

Housing: Significant housing impact: - Little or no impact: +

Recycling Water: Significant impact on recycling water: - Little or no impact: +

C = Consistent

4.2.1 Protection of Beneficial Uses

This section evaluates each potential objective with the requirement to protect beneficial uses. Federal law requires that states adopt criteria that protect the beneficial uses and that the most sensitive use is protected. (40 C.F.R. § 131.11(a).) In addition, state law requires the reasonable protection of beneficial uses and that those beneficial uses of water be considered in establishing water quality objectives. (Wat. Code, § 13241 et seq.)

4.2.1.1 No Change in Water Quality Objectives

The Basin Plan's narrative water quality objectives for pesticides and toxicity provide direction in terms of protecting beneficial uses, i.e., toxicity is not allowed. However, the practical application of the narrative is problematic in that toxicity has to be demonstrated by actually testing surface water samples with living organisms, or by using available numeric criteria to determine whether beneficial uses are impacted. In addition, a narrative objective cannot be used directly for quantitative applications that require numeric criteria.

The Board has used existing numeric criteria, such as the CDFG water quality criteria, to determine if beneficial uses are being protected in specific water bodies. The Board has also used CDFG criteria to determine if waters should be identified as not attaining standards as required by section 303(d) of the Clean Water Act. Criteria calculations applying the USEPA methodology to the CDFG data sets were considered the most appropriate. The data sets were evaluated by a California state agency charged with protecting fish and wildlife (CDFG), and the USEPA methodology is used specifically to derive numeric criteria that should protect aquatic life beneficial uses.

The recalculated CDFG criteria for chlorpyrifos and diazinon are at a level that should be protective of freshwater habitat uses. Other beneficial uses are less sensitive to chlorpyrifos and diazinon than the freshwater habitat uses. With no change in the water quality objectives, the recalculated CDFG criteria for chlorpyrifos and diazinon would be used.

4.2.1.2 Numeric Water Quality Objectives Based on No Diazinon or No Chlorpyrifos

Water quality objectives based on no diazinon or no chlorpyrifos would be highly protective of beneficial uses, since there would be no potential risk to beneficial uses from these chemicals.

4.2.1.3 Numeric Water Quality Objectives Based on the USEPA Method

The USEPA criteria method, as applied by CDFG (and recalculated by the Central Valley Water Board), uses acute and chronic toxicity data for a wide range of species. The criteria are designed to be protective of the most sensitive aquatic organisms and the acute and chronic criteria are designed to avoid detrimental physiologic responses. The method has been used by the USEPA for over twenty-five years to establish water quality criteria, and has been used by the CDFG since the late 1980's to assess hazards to aquatic organisms in the Sacramento-San Joaquin Rivers and Delta Waterways. Available information indicates that the CDFG diazinon criteria and the recalculated CDFG chlorpyrifos criteria should be protective of all freshwater habitat uses in the Sacramento and San Joaquin Valley water bodies.

4.2.1.4 Numeric Water Quality Objectives Based on the UC Davis Method

Similar to the USEPA criteria method, the UC Davis method uses acute and chronic toxicity data for a wide range of species. The criteria derived using the UC Davis method are expressed in the same averaging period (hourly and 4-day) and allowable exceedance frequency, and the magnitudes are similar to those of the criteria derived using the USEPA method. The UC Davis criteria for diazinon and chlorpyrifos are generally lower than the criteria generated using the USEPA methodology. The UC Davis acute and chronic chlorpyrifos criteria are 20% and 60% lower than the recalculated CDFG criteria, respectively. The UC Davis acute diazinon criterion is 25% higher than the recalculated CDFG criterion. The UC Davis chronic diazinon criterion is 20% lower than the recalculated CDFG criterion. Therefore the UC Davis criteria should be protective of all freshwater habitat uses in the Sacramento and San Joaquin Valley water bodies, and somewhat more protective than the recalculated CDFG criteria.

4.2.2 Environmental Characteristics and Quality of Water Available

Diazinon and chlorpyrifos enter Sacramento and San Joaquin Valley water bodies primarily from applications to a variety of crops in the Central Valley and, to a lesser degree, from applications in urban areas. None of the alternate methods of deriving water quality objectives are dependent on any natural environmental characteristic. Diazinon and chlorpyrifos are not natural pollutants, so background levels of these pesticides would not be expected in absence of their use. All of the potential criteria are, therefore, equally consistent with the environmental characteristics of the watershed.

4.2.3 Water Quality Conditions Reasonably Achievable

Diazinon and chlorpyrifos concentrations detected in the Sacramento and San Joaquin Valley water bodies are the result of current-year applications of these pesticides. Unlike DDT or certain other chlorinated pesticides, diazinon and chlorpyrifos break down relatively rapidly in the aqueous environment, and are not sequestered in sediments to an appreciable extent. Unlike some naturally occurring compounds such as selenium, there are no natural sources of diazinon or chlorpyrifos, and there are no natural or "background" concentrations. If these pesticides were prevented from entering surface waters, then concentrations of diazinon and chlorpyrifos in the Central Valley water bodies would decline rapidly. Tables 4-4 – 4-7 compare recent data to the alternate water quality objectives evaluated in this section.

Practices for reducing diazinon and chlorpyrifos discharges, and their costs, are discussed in Section 5 and Section 9 of this report. Given the suite of options available to dischargers, as well as the recent declines in use and concentrations in Sacramento and San Joaquin Valley water bodies, the numeric criteria developed using the USEPA methodology appear to be reasonably achievable. Greater reductions would be required If the UC Davis numeric criteria were adopted, but these could also likely be considered reasonably achievable. Achieving the greater reductions required by the UC Davis numeric criteria would require more extensive implementation of the most effective management practices. Far greater changes would likely be needed to meet the no detectable levels of diazinon or chlorpyrifos alternative (e.g. additional controls to completely prevent diazinon and chlorpyrifos runoff and drift).

4.2.4 Economic Considerations

It is likely that some changes in agricultural practices will be necessary to achieve the proposed diazinon and chlorpyrifos objectives. These practices and their potential costs are discussed in greater detail in Section 5 and Section 9 of this report. For those growers that must change their current management practices to meet the new water quality objectives, providing mitigation for or preventing diazinon or chlorpyrifos runoff could increase total production cost by approximately 1-9%, as discussed in Section 9, in order to meet the numeric criteria derived using the USEPA methodology. Similar costs would likely be incurred even if the Board made no changes to the water quality objectives, because growers would still need to meet the applicable *narrative* objectives. The criteria being considered for the new numeric objectives are currently used to interpret the narrative objectives. Achieving the UC Davis criteria would be somewhat more expensive, as the extensive implementation of more expensive management practices would likely be needed to achieve greater reductions in discharges.

For the "no diazinon" or "no chlorpyrifos" alternative, all growers would either need to use a different pesticide product or implement measures to completely prevent surface water runoff and drift. Using an alternative to diazinon or chlorpyrifos would not necessarily lead to a significant increase in cost to the grower, since the cost of the actual pesticides is not a significant part of overall production costs (see Section 9), but in some cases it could increase potential pest damage by limiting pest control options available to address insecticide resistance in pests.

Attaining the water quality criteria derived using the USEPA methodology or UC Davis methodology are not expected to have significant costs for municipal dischargers. Likely costs to municipal dischargers would be monitoring and, if necessary, inclusion of diazinon and chlorpyrifos in general pesticide public education efforts (see Section 9). Attaining the "no diazinon" and/or "no chlorpyrifos" criteria could, however, have significant costs if treatment of wastewater or storm water was required to attain these objectives.

4.2.5 The Need to Develop Housing

The discharge of diazinon and chlorpyrifos is not necessary for the development of new housing or to maintain existing housing supply or values. Therefore, none of the alternate methods for establishing water quality objectives for diazinon or chlorpyrifos in the Sacramento and San Joaquin Valley water bodies is expected to affect housing.

4.2.6 The Need to Develop and Use Recycled Water

Diazinon or chlorpyrifos is not known to be a limiting factor for the development or use of recycled water. Therefore, none of the alternate methods for establishing water quality objectives in Sacramento and San Joaquin Valley water bodies is expected to affect the development or use of recycled water.

4.2.7 Consistency of Alternate Methods with State and Federal Laws and Policies

4.2.7.1 Clean Water Act

The Clean Water Act requires that numerical criteria be based on "…(i) 304(a) Guidance; or (ii) 304(a) Guidance modified to reflect site-specific conditions; or (iii) other scientifically defensible methods" (40 C.F.R. § 131.11(b) et seq.)

Making no change in the current narrative water quality objectives would be consistent with the Clean Water Act. The Central Valley Water Board would need to interpret the existing narrative objectives to adopt water quality objectives. Numeric water quality objectives based on the no diazinon or chlorpyrifos alternative would be consistent with the Clean Water Act, since states may adopt water quality standards that are more stringent than those necessary to protect beneficial uses. Criteria based on the USEPA methodology would be consistent with the Clean Water Act, since the methodology is part of the 304(a) Guidance. Criteria based on the UC Davis methodology would be consistent with the Clean Water Act, since the methodology builds on the USEPA methodology and has protection goals consistent with the Basin Plan and Clean Water Act.

4.2.7.2 Endangered Species Act

There are a number of aquatic species within the Sacramento and San Joaquin Valley water bodies that are listed as threatened, endangered, or species of concern under the Endangered Species Act. These include the Delta smelt, Sacramento splittail, green sturgeon, steelhead trout, and multiple runs of Chinook salmon. Water quality objectives must protect the aquatic life in the Sacramento and San Joaquin Valley water bodies, particularly threatened and endangered species and the food web on which they depend. Indirect effects of diazinon and chlorpyrifos on endangered fishes could occur if populations of sensitive arthropods were reduced at critical periods when they are needed as food by juvenile fish. Water quality objectives based on the no diazinon and no chlorpyrifos alternative would provide the greatest protection. Diazinon and chlorpyrifos water quality objectives derived by both the USEPA and UC Davis methodologies would still be protective, although the methodologies are based on data from tested species, and these species are surrogates for resident or endangered species.

A study conducted on Chinook salmon indicated that diazinon significantly inhibited olfactory-mediated avoidance response to predators at concentrations as low as 1,000 ng/L. An effect, although not statistically significant, was also found at 100 ng/L. The authors conclude that this inhibition could have negative consequences for survival and reproduction (Scholz et al., 2000). Since these effects were observed after short-term (2-hour) exposures, longer-term exposures to diazinon may have a more pronounced effect. Felsot (2005) suggested that the Scholz et al. (2000) study could not be used as the basis for deriving criteria due to the large differences in concentrations tested, poor quantitative separation of observed responses, and ambiguity about the ecological relevance of the observed responses. Central Valley Water Board staff agrees that the results of the Scholz study cannot be used directly for diazinon criteria derivation, although the study does raise concerns regarding sublethal effects of diazinon on endangered salmonids.

4.2.8 Recommended Water Quality Objectives

The recalculated CDFG criteria using the USEPA methodology (Finlayson, 2004a) are the recommended water quality objectives for diazinon. The recommended diazinon water quality objectives are 160 ng/L as a 1-hour average (acute) maximum concentration and 100 ng/L as a 4-day average (chronic) maximum concentration, not to be exceeded more than once in three years. The CDFG criteria are driven by toxicity studies for aquatic invertebrates and would be appropriate to use when assessing the additive toxicity of diazinon and chlorpyrifos. The Scholz et al. (2000) study indicated that effects on salmon behavior from short-term exposure to diazinon begin to occur at concentrations somewhere between 100 ng/L and 1000 ng/L, however, additional study is needed in order to determine a concentration that would be appropriate to apply as a water quality criterion.

The recalculated CDFG criteria for chlorpyrifos are the recommended water quality objectives. The recommended chlorpyrifos water quality objectives are 25 ng/L as a 1-hour average (acute) maximum concentration and 15 ng/L as a 4-day average (chronic) maximum concentration, not to be exceeded more than once in three years. The CDFG criteria are driven by toxicity studies for aquatic invertebrates and would be appropriate to use when assessing the additive toxicity of diazinon and chlorpyrifos.

If the proposed criteria are adopted as water quality objectives and new information suggests the numeric objectives are not protective enough, the Central Valley Water Board could still apply the narrative objectives to ensure protection of beneficial uses while it goes through the process of amending the numeric objectives. Currently, a number of alternative management practices are available to reduce discharges of diazinon and chlorpyrifos. In addition, available data indicate that the proposed water quality objectives are often attained.

The “No Diazinon” and “No Chlorpyrifos” alternatives are not recommended at this time. It may not be feasible to completely prevent off-site movement of diazinon and chlorpyrifos given current allowed uses, seasons of use, and application methods.

The “No Change” alternative is not recommended. There is sufficient information available to establish numerical objectives for diazinon and chlorpyrifos, which will provide a clear goal for dischargers and for the Board’s regulatory programs.

The UC Davis criteria are not recommended. Although the UC Davis criteria would also be protective, the use of the CDFG criteria would be adequately protective of beneficial uses, more readily achievable than the UC Davis criteria, and would be consistent with previous, recently adopted water quality objectives in the Basin Plan. Furthermore, achieving the CDFG criteria throughout the smaller tributary Sacramento and San

Joaquin Valley water bodies would likely result in levels well below either the UC Davis or CDFG criteria in the main-stem rivers and the Sacramento-San Joaquin Delta.

5. Program of Implementation

Porter-Cologne requires the Board to identify and define a program of implementation for achieving water quality objectives "…that shall include, but not be limited to:

a) A description of the nature of actions that are necessary to achieve the objectives, including recommendations for appropriate action by any entity, public or private.
b) A time schedule for actions to be taken.
c) A description of the surveillance to be undertaken to determine compliance with objectives." (Wat. Code, § 13242.)

This section evaluates options for how the Board can ensure attainment of the proposed water quality objectives for diazinon and chlorpyrifos. Available practices and technology for controlling diazinon and chlorpyrifos discharges are summarized. Previously adopted implementation provisions addressing diazinon and chlorpyrifos discharges are reviewed. Options for ensuring compliance with the proposed water quality objectives are evaluated for the potential sources of these pesticides. Options for establishing a time schedule for specific actions to ensure compliance with the water quality objectives are evaluated.

Porter-Cologne provides four basic tools for the regulation of discharges of waste (including runoff) into surface waters:

1. Not allowing discharge of waste in certain areas or under certain conditions (i.e. a prohibition under Wat. Code, §13243).
2. Issuing Waste Discharge Requirements (WDRs) (Wat. Code, § 13263). (Sometimes issued as combined WDRs and NPDES permits when NPDES permits are required under the Federal Clean Water Act)
3. Conditionally waiving WDRs (Wat. Code, § 13269).
4. Issuing cleanup and abatement orders (Wat. Code, § 13304).

Cleanup and abatement orders are generally applied to localized pollution problems and not to watershed-wide issues addressed in the Basin Plan, and are not proposed for the control of diazinon or chlorpyrifos discharges.

The predominant source of diazinon and chlorpyrifos is irrigated agricultural operations where diazinon and chlorpyrifos are applied. While the non-agricultural uses are relatively minor compared to the agricultural uses, discharges of chlorpyrifos or diazinon in wastewater and/or storm water could have an impact on attaining the proposed objectives, particularly in smaller water bodies with less dilution availability. Under the proposed implementation framework, the Board would use existing regulatory controls, along with a prohibition as a regulatory backstop, to implement a control program to attain the water quality objectives for diazinon and chlorpyrifos. Consistent with the framework established for diazinon and chlorpyrifos discharges to the Sacramento, Feather and San Joaquin Rivers and the Sacramento-San Joaquin Delta, the Proposed Amendment would not specify in the Basin Plan the mechanism to be used for each discharger or discharger category, but would allow the Board flexibility in this regard.

Under the Proposed Amendment, waivers, WDRs, and NPDES permits for discharges of diazinon or chlorpyrifos would be required to contain requirements to achieve compliance with the water quality objectives. For unregulated sources whose discharges could cause exceedances of the water quality objectives, a prohibition would ensure that the objectives are met within the required time frame. This general framework is already being successfully implemented through the ILRP and the NPDES program to control diazinon and chlorpyrifos discharges.

5.1 Available Practices and Technology

There are many agricultural management practices effective in reducing offsite movement of diazinon and chlorpyrifos into surface water. Information on trends in pesticide use is available through the DPR's PUR database, but detailed information on the extent of implementation of runoff mitigation practices is not currently available (ICF, 2010). Available information indicates that many of these practices are already used by a significant portion of the growers in the Central Valley (ICF, 2010). The major types of management practices available for reducing diazinon and chlorpyrifos agricultural discharges are:

Pest management practices
Pesticide application practices
Vegetation management practices
Water management practices.

As discussed in previous reports, viable pest control alternatives to diazinon and chlorpyrifos are available (Beaulaurier et al., 2005; Reyes and Menconi, 2002). These reports assessed strategies that should be viable for both pest management and water quality protection (including mitigating potential effects of replacement products).

When pesticides that pose significant risks to water quality, such as diazinon or chlorpyrifos, are used, a broad range of practices for controlling runoff are available to growers (Zhang et al., 2010). These practices include changes in application practices and adoption of vegetation management and water management practices that prevent or reduce runoff. Changes in application practices could include turning off outward facing airblast sprayer nozzles at the end of rows and on outside rows, improved sprayer technologies, more frequent calibration of sprayer equipment, use of aerial drift retardants, improved mixing and loading procedures, and other practices that would result in reduced application rates or mitigation of off-site pesticide movement.

Vegetation management practices could be used to increase infiltration and/or decrease runoff. Examples of these types of practices include planting cover crops, buffer strips, or allowing native vegetation to grow where they would reduce runoff rates. In addition to reducing runoff, vegetative cover would also reduce runoff of sediment and excess nutrients.

Water management practices include improvements in water infiltration and runoff control include increased irrigation efficiency and distribution uniformity, increased use of soil moisture monitoring tools, increased use of tailwater return systems, and vegetated drainage ditches.

The appropriate actions for individual growers will vary depending on the crops grown, field conditions, and pest pressures. The Board will not require implementation of specific practices or technologies at this time, but may review proposed actions based upon the likelihood that the growers' collective actions will be protective of water quality in the Sacramento and San Joaquin Valley water bodies.

Non-agricultural discharges of diazinon and chlorpyrifos include storm water and wastewater discharges. Significant reductions in concentrations are not needed in these discharges. Additional treatment technologies will therefore likely not be needed for these discharges to meet the current and proposed objectives and existing TMDL allocations. For areas where some reductions may still be needed, there are a number of activities that municipal dischargers can implement to achieve any further reductions needed. These activities include education and outreach efforts to encourage and facilitate proper disposal of remaining stored diazinon and chlorpyrifos, and encouraging the use of integrated pest management and reduced use of insecticides that pose significant risks to water quality.

5.2 Review of Existing Diazinon and Chlorpyrifos Control Programs and TMDLs

The Basin Plan currently has three control programs that address diazinon and chlorpyrifos in the Sacramento and Feather Rivers, the San Joaquin River, and the Sacramento-San Joaquin Delta and include TMDLs. These control programs all have similar requirements, which are also similar to the control program contained in the proposed Basin Plan Amendment. The Basin Plan also states that the Board intends to review existing diazinon and chlorpyrifos allocations and implementation provisions in the control program. This section contains a review of existing control programs' allocations and implementation provisions and progress in attaining them.

5.2.1 Sacramento and Feather Rivers Control Program

The Board adopted a control program and TMDL for diazinon in the Sacramento and Feather Rivers in 2003. The control program was reviewed and modified to include chlorpyrifos in 2007. This control program/TMDL contains implementation requirements similar to those in the proposed Basin Plan Amendment. TMDL load allocations are applied at the point that a tributary enters the Sacramento and Feather Rivers, and waste load allocations for NPDES dischargers are applicable at the point of discharge to surface waters.

The Sacramento Valley Water Quality Coalition represents agricultural dischargers in the entire area discharging to the lower Sacramento and Feather Rivers. The Sacramento Valley Water Quality Coalition has taken responsibility for implementing the water quality control program and the related monitoring requirements. Beginning in 2006, the Sacramento Valley Water Quality Coalition submitted reports documenting water quality in the Sacramento and Feather Rivers. The Sacramento and Feather Rivers have been meeting water quality objectives for diazinon for several years. Tributaries also appear to be largely exhibiting compliance with load allocations, with the exception of Colusa Basin Drain. For these reasons, the Sacramento Valley Coalition in recent years has foregone monitoring in the Sacramento and Feather Rivers and instead has focused on tributary data, which generally show compliance with allocations, indicating compliance in the Sacramento and Feather Rivers as well.

Recent storm water and wastewater data show that the waste load allocations and numeric targets for diazinon and chlorpyrifos are largely being met in the Sacramento and Feather rivers. Currently, the implementation program appears to provide adequate protection for the Sacramento and Feather Rivers and appears to be attainable for dischargers with the continued implementation of management practices, particularly for reducing chlorpyrifos runoff. Changes to the TMDL allocations and implementation provisions for the Sacramento and Feather Rivers are not part of the Proposed Amendment.

The control program in the Proposed Amendment would mesh well with the control program in place for the Sacramento and Feather Rivers. Under the current control program for the Sacramento and Feather Rivers, tributaries must meet the loading capacity as they enter the Sacramento River. The Proposed Amendment would result in the requirement for all water bodies with a WARM/COLD beneficial use to meet the objectives. Therefore, under the Proposed Amendment, tributary streams that ultimately discharge into the Sacramento or Feather Rivers would be required to meet the water quality objectives for these pesticides at any point along their length and not just at its confluence with the Sacramento or Feather Rivers. Tributaries to the Sacramento and Feather Rivers to which the proposed water quality objectives would not apply would still need to meet the allocations at their point of discharge to the Sacramento or Feather Rivers. The allocations for point source discharges would not change under the Proposed Amendment.

5.2.2 Delta Control Program

The Central Valley Water Board adopted a control program and TMDL for diazinon and chlorpyrifos in the Delta in 2006. This control program/TMDL contains allocations and implementation provisions similar to those in the control program/TMDL for the Sacramento and Feather Rivers. Load allocations (LAs) are evaluated at the point a tributary enters a Delta Waterway and wasteload allocations (WLAs) are applicable at the point of discharge to surface waters. Water bodies that cross the Legal Delta boundary are only defined as “Delta Waterways” in the Basin Plan at the point where they enter the Legal Delta (as defined in the Water Code). The load allocations for discharges upstream of the Legal Delta are evaluated at the point where the waterway enters the Legal Delta (essentially treating the reaches of these water bodies upstream of the Legal Delta as tributaries).

Two Coalition groups represent agricultural dischargers within the project area for the Delta diazinon and chlorpyrifos control program/TMDL, which includes lands draining to the Delta below major reservoirs but not the areas (covered by other control programs/TMDLs) that drain to the Sacramento or San Joaquin Rivers upstream of the Legal Delta. The Sacramento Valley Coalition represents agricultural dischargers in areas which discharge into the northern and northwestern Delta. The San Joaquin County and Delta Coalition represent agricultural dischargers within the remainder of the project area for the Delta control program. These Coalition groups include compliance assessment data for the Delta control program/TMDL in their TMDL or other management plan reports to the Central Valley Water Board.

Recent data indicate that the water quality objectives for chlorpyrifos are not consistently being met in some smaller Delta Waterways, such as French Camp Slough and Ulatis Creek. Diazinon water quality objectives are rarely exceeded in a few smaller water bodies, but are consistently attained in the other smaller water bodies such as Marsh Creek, and are consistently met in the main-stem Sacramento River in the Delta. Observed exceedances of water quality objectives in the Delta are likely due to discharges within the area discharging Delta, since the Sacramento and San Joaquin Rivers are below water quality objectives where they flow into the Delta.

The extent of implementation of practices is not yet known, although the Coalitions have provided information on a number of implementation practices and will continue to gather and provide such information. While further reductions are needed to meet the load allocations for the Delta, the practices to attain these reductions are feasible and can be successfully implemented. Changes to the allocations and implementation provisions are not part of the Proposed Amendment.

These pesticides are still present in storm water and wastewater in areas draining to the Delta. Some of these pesticide concentrations may be due to atmospheric transport from agriculture as discussed in section 1.5. The available data indicate that wasteload allocations for storm water discharges and wastewater treatment plants are almost always met. One notable exception was that Sacramento Regional WWTP was not meeting its wasteload allocation due to chlorpyrifos. Chlorpyrifos effluent limits and a time schedule order for meeting those limits were adopted as part of the NPDES permit update for Sacramento Regional WWTP. The data from Sacramento Regional WWTP with the chlorpyrifos exceedances was from 2007; subsequent data have not shown exceedances of the chlorpyrifos allocations. Implementing the adopted diazinon and chlorpyrifos TMDL allocations in NPDES permits is discussed further in section 5.2.4.

The control program in the Proposed Amendment would mesh well with the control program in place for the Delta. Under the current control program for the Delta, tributaries must meet the loading capacity as they enter Delta Waterways. Under the Proposed Amendment water quality objectives equivalent to the existing Delta TMDL load allocations would have to be met throughout any of the tributaries of the Sacramento and San Joaquin Valley water bodies with the WARM/COLD beneficial uses. Therefore, the effective difference for the Proposed Amendment would be that the compliance point for agricultural discharges would be extended upstream for these water bodies. Dischargers to tributaries meeting the proposed water quality objectives would also be in compliance with the load allocations for the Delta control program and TMDL. Minor tributaries for which objectives are not proposed would still have to meet the allocations at their point of discharge to the Delta Waterways, based on the allocations in the existing Delta control program/TMDL. The allocations for point source discharges would not change under the Proposed Amendment.

5.2.3 San Joaquin River Control Program

The Central Valley Water Board adopted a control program and TMDL for diazinon and chlorpyrifos in the San Joaquin River (SJR) in 2005. This control program/TMDL contains implementation provisions similar to those in the proposed Basin Plan Amendment, for the Sacramento and Feather Rivers, and Delta. The SJR TMDL wasteload allocations (WLAs) are the same as those for the Sacramento and Feather River and the Delta. The available data indicate that the WLAs are being attained in domestic wastewater discharges and almost always being attained in municipal storm water.

The load allocations (LAs) for the San Joaquin River diazinon and chlorpyrifos TMDL are given to five subareas along the lower San Joaquin River. The discharge from each of these subareas must be below the concentration-based LA, which is equal to the loading capacity of the SJR. Compliance with the load allocations is determined by measuring the concentrations of diazinon and chlorpyrifos in the San Joaquin River upstream and downstream of the discharges from each subarea. At a minimum this monitoring must be done at six compliance points that are named in the Basin Plan.

The control program required compliance with the load and wasteload allocations by December 2011. Two agricultural Coalition groups, the East San Joaquin Valley and Westside San Joaquin Valley Water Quality Coalitions, represent agricultural dischargers to the lower SJR. These coalitions have taken the responsibility for implementing the water quality control program, TMDL, and monitoring required in the Basin Plan. These coalitions submitted their first TMDL compliance report in 2010 which included quarterly monitoring in 2010 in the SJR, but did not include a dormant season event. The data from the Coalitions' 2010 water year monitoring show that the chlorpyrifos water quality objective and loading capacity for the SJR were not met in the SJR near Patterson. This means that the loading capacity and allocations were not met in at least one subarea (the combined Tuolumne River, Northeast Bank, and Westside Creek subarea). The monitoring report submitted by the coalitions for the 2011 water year included quarterly monitoring and a dormant season monitoring event, and indicated that the water quality objectives were being met in the San Joaquin River by the December 2010 compliance date (CRWQCB-CVR, 2012c). San Joaquin River monitoring for diazinon and chlorpyrifos in 2012 was required to be increased from quarterly to monthly during the period of high chlorpyrifos use, May through August (CRWQCB-CVR, 2012d). That monthly monitoring has been required to continue in 2013 and subsequent years, with the addition of a September sampling event due to SJR tributary exceedances observed in September in the San Joaquin Valley (CRWQCB-CVR, 2013b).

Determining compliance with specific load allocations for the SJR TMDL is not as straightforward as it is for the Sacramento and Feather Rivers TMDL or the Delta TMDL, as the allocations are allotted to subareas that discharge to the SJR through multiple tributaries. The required monitoring at main-stem SJR sites does not necessarily determine which tributaries are discharging concentrations of diazinon and chlorpyrifos into the SJR. Four of the five subareas are along both sides of the river, thus, parts of each subarea are represented by both Coalitions. These factors could make determining and following-up on exceedances of the load allocations more complex than in the Delta or Sacramento and Feather Rivers. However, this program has been successfully implemented by the coalitions and the data indicate that the objectives and allocations are being attained. In addition to attainment of the SJR TMDL allocations, most SJR tributaries would have water quality objectives for diazinon and chlorpyrifos under the proposed amendment. Meeting the water quality objectives in the SJR tributaries should result in the SJR TMDL load and the loading capacity and water quality objectives in the SJR being met. Monitoring at the six SJR compliance points will continue to be used to verify attainment of the loading capacity and water quality objectives in the SJR, and provide information indicating if any subareas are exceeding allocations. Therefore no changes to the SJR TMDL allocations are included in the Proposed Amendment. The wasteload allocations for point source discharges would also not change under the Proposed Amendment.

5.2.4 Review of Existing Basin Plan Wasteload Allocations for NPDES Discharges

The three existing Basin Plan control programs for diazinon and chlorpyrifos contain the same TMDL wasteload allocations (WLAs) for NPDES discharges. These WLAs are set equal to the additive toxicity formula using the diazinon and chlorpyrifos objectives. The NPDES-permitted discharges identified as sources in previous staff reports are municipal and domestic wastewater and municipal storm water discharges to the Sacramento, Feather, and Lower San Joaquin Rivers and their tributaries downstream of the major dams, as well as the Delta and its tributaries.

NPDES permits are updated every five years. The existing control programs state that the WLAs will be implemented through the adoption or modification of permits where necessary implementation programs are not already in place. There are 50 NPDES-permitted municipal or domestic wastewater dischargers to the Sacramento, Feather, or San Joaquin Rivers and/or the Delta. Most of their permits require monitoring for these two pesticides, and some permits contain effluent limits for one or both pesticides. The inconsistency of these provisions among permits is likely partly due to the decreasing relevance of these sources, since they are often not detected in effluent monitoring.

Given the minimal concentrations and infrequent detections seen in recent data for these two pesticides in wastewater effluent monitoring (as discussed in Section 1.5), and the fact that these are expected to continue to decline, these effluents largely appear to contribute negligible amounts of diazinon and chlorpyrifos concentrations to surface waters. Wastewater effluents are highly unlikely to have any significant contribution to exceedances of the water quality objectives or loading capacity for the established TMDLs, and are unlikely to contribute to exceedances of the existing or proposed water quality objectives.

Storm water and urban runoff discharges from large municipalities, with populations greater than 100,000 people are regulated under individual "Phase 1" municipal storm water NPDES permits issued by the Central Valley Water Board. Smaller municipalities are regulated under a statewide "Phase 2" storm water NPDES permit. In the Sacramento and San Joaquin River Basins, there are five populated areas regulated under Phase 1 NPDES storm water permits: Sacramento County, City of Stockton and County of San Joaquin, the Port of Stockton, Modesto, and East Contra Costa County[7]. All of the Phase 1 storm water permits have provisions addressing diazinon and chlorpyrifos discharges; monitoring is required and the WLAs are included as receiving water limits, and follow-up actions are required for exceedances.

Smaller urban areas are regulated under a statewide Phase 2 Small Municipal Separate Storm Sewer (MS4) permit, which is under the approval of the State Water Resources Control Board and is implemented by the Central Valley Water Board. There are 50 municipal entities within the Project Area that are regulated under the Phase 2 MS4 permit. The Phase 2 permit includes the requirements of the diazinon and chlorpyrifos TMDLs for monitoring and management plans for meeting allocations for all 50 municipal entities. Storm water runoff from industrial areas is regulated by a statewide industrial storm water permit. The industrial storm water permit currently does not contain provisions implementing the diazinon and chlorpyrifos TMDLs. The Proposed Amendment includes monitoring requirements for storm water discharges from all sites where diazinon or chlorpyrifos are applied. Therefore, if these pesticides continue to be used on any industrial sites, monitoring will be required. If this monitoring indicates discharges cause or contribute to water quality exceedances, they will be subject to controls under the storm water program.

Monitoring data from three of the Phase 1 storm water permits (Sacramento County, the City of Stockton and County of San Joaquin, and Modesto) were included in the data set summarized in the Section 1. Some of the methods used did not have low enough detection limits to determine if the objectives and allocation were being met, but most of

[7] Part of Contra Costa County is in Region 5 and part is in Region 2. The part in Region 2 is regulated under Region 2's Storm water Program.

the data was usable. Recent monitoring data for storm water and urban stream have indicated that the objectives and allocation in storm water discharges are almost always met.

Because these pesticides rarely exceed the objectives and allocations in wastewater effluent and municipal storm water, and continue to decline, monitoring and reporting for these two pesticides for NPDES discharges may not be necessary in the future. Other replacement pesticide products, however, remain a concern for storm water and wastewater, and the current implementation provisions in the Basin Plan require activities to address those replacement products. As these replacement pesticides remain a concern, no changes are proposed to the requirements for addressing potential replacement products. The costs for maintaining some monitoring for diazinon and chlorpyrifos and monitoring and reporting activities to assess risks for potential replacement products are included in Section 9.

5.2.5 Prohibition Provisions

The Basin Plan currently contains conditional prohibitions for discharges of diazinon or chlorpyrifos to the Sacramento, Feather, and San Joaquin Rivers and Delta Waterways. These prohibitions provide a backstop to ensure that a regulatory mechanism exists for all dischargers of diazinon or chlorpyrifos. To be in effect, the prohibitions require a number of conditions are met, including a documented exceedance of water quality objectives (specific to the season), in a defined geographic area, and product or discharger causing the exceedance. The conditional nature of the existing Basin Plan prohibitions makes it somewhat unclear as to when they apply. Additionally, the data and information required to determine when prohibition conditions are met are often not available.

Because unregulated discharges could potentially cause or contribute to exceedances of the proposed water quality objectives, a new prohibition is included in the Proposed Amendment. Board staff considered the following alternatives for imposing the new prohibition: 1) add a prohibition similar to existing Basin Plan prohibitions for diazinon and chlorpyrifos, 2) add a prohibition on all unregulated discharges of diazinon and chlorpyrifos, 3) add a prohibition on unregulated discharges of diazinon and chlorpyrifos causing or contributing to an exceedance of water quality objectives, and 4) add a prohibition on unregulated diazinon and chlorpyrifos discharges with concentrations above the water quality objectives.

Alternative 1. Prohibition Similar to Existing Basin Plan Prohibitions

Under this alternative, the Board would establish a prohibition of discharge similar to existing Basin Plan prohibitions. An exceedance of water quality objectives would have to be documented from the previous year in the same season and geographic area before the prohibition would be in effect. The data to implement a similar prohibition is less likely to be available in many cases, especially for many smaller water bodies covered in the Proposed Amendment.

Alternative 2. Prohibition of All Unregulated Diazinon or Chlorpyrifos Discharges

Under this alternative, the Board would prohibit all unregulated diazinon or chlorpyrifos discharges. This alternative would be the most straightforward to implement, as any discharge of these pesticides would be in violation of the prohibition. Under this alternative, enforcement of the prohibition could occur in situations where the discharge poses a negligible threat to water quality.

Alternative 3. Prohibition of Unregulated Discharges Causing or Contributing to an Exceedance of Water Quality Objectives

Under this alternative, the Board would prohibit unregulated discharges of diazinon or chlorpyrifos if they were determined to be causing or contributing to an exceedance of water quality objectives. Implementing this prohibition would require documenting both a discharge and an exceedance of water quality objectives. This alternative would be slightly less straightforward to implement than alternative 2, but more straightforward than alternative 1. This alternative would limit enforcement to cases where water quality objectives exceedances were documented at the time the unregulated discharge was documented.

Alternative 4. Prohibition of unregulated discharges with concentrations above water quality objectives

Under this alternative, the Board would prohibit unregulated discharges of diazinon or chlorpyrifos at concentrations above the water quality objectives. Implementing this prohibition would be relatively straightforward, as it would only require sampling a discharge to determine compliance. The prohibition would only apply to unregulated discharges that have concentrations of diazinon and chlorpyrifos above the water quality objective concentrations, but would not require documentation of a water quality objective exceedance in the receiving water to determine a violation of the prohibition.

Recommended prohibition

Alternative 4 is recommended. Since this alternative is straightforward to implement and is focused only on potentially significant unregulated sources, this alternative would provide the most effective protection of water quality from unregulated discharges. By providing the most effective control for unregulated discharges, this alternative would also help nonpoint source dischargers already participating in regulatory programs achieve the water quality objectives. The Proposed Amendment contains the recommended prohibition for discharges that are not regulated under a waiver of waste discharge requirements or individual or general waste discharge requirements that are implementing the chlorpyrifos and diazinon control program. Any otherwise unregulated sources, such as agricultural dischargers not participating in the ILRP, could be controlled through the prohibition.

5.3 Implementation Provisions

5.3.1 Implementation Provisions for Agricultural Dischargers

The Nonpoint Source Policy requires nonpoint source dischargers to describe the management practices that will be implemented to attain water quality objectives. If the Amendment is adopted, the Central Valley Water Board would require the submission of a management plan by a Coalition or by individual dischargers if an exceedance of the water quality objectives occurs. Management plans would be required from the agricultural dischargers of chlorpyrifos regulated through the ILRP or through the Dairy Program. By identifying the actions that the discharger will take to reduce diazinon and chlorpyrifos discharges, the Central Valley Water Board and the dischargers will be able to determine which practices are most effective at reducing pesticide runoff. The Central Valley Water Board will also be able to determine whether adequate effort is being made to reduce diazinon and chlorpyrifos discharges.

Specifically, each Management Plan would be required to describe the following:

1. The causes of the non-attainment of objectives.
2. The actions that the discharger(s) will take to reduce diazinon and chlorpyrifos discharges and meet the diazinon and chlorpyrifos water quality as soon as possible but no later than the compliance dates established in the Basin Plan
3. A schedule for the implementation of those actions.
4. A monitoring plan to track effectiveness of pollution controls.
5. A commitment to revise pollution controls, as necessary.

To the extent that they are have not already been developed and submitted to the Central Valley Water Board, under the Proposed Amendment, submittal of management plans would be required for the 303(d)-listed water bodies within a specified time frame. For water bodies that are subsequently found in non-attainment of the proposed objectives, the management plan shall be submitted within a specified time frame from the date the executive officer determines that the water body is in non-attainment of the objective(s). In addition if a water body is found in non-attainment and is being used by the discharger to represent water quality conditions in multiple water bodies, than the management plan would have to address diazinon and/or chlorpyrifos impairment in all of the represented water bodies.

As included in previous Basin Plan Amendments, the Proposed Amendment states that management plans could include actions already required by state and federal pesticide regulations. Therefore, if compliance with new or existing regulations, such as DPR's dormant spray regulations, would result in compliance, additional practices would not be required. Revisions to management plans would be required when existing management plans are insufficient to obtain objectives.

5.3.2 Implementation Provisions for Municipal Storm Water

Municipal separate storm sewer system (MS4) permits require the discharger to develop and implement a Storm Water Management Plan (SWMP) to reduce pollutants to the maximum extent practicable. The SWMP specifies specific best management practices that will be used to address potential pesticide sources. If the proposed objectives are not being attained, any MS4s that are causing or contributing to a water quality exceedance will be required to update their SWMPs or submit a management plan describing how chlorpyrifos and diazinon discharges will be reduced. The SWMP or a separate management plan would be required to contain the five elements described above for agricultural discharges, and actions would be required within the same timeline as required for agricultural discharges, and could refer to implementation of existing pesticide use regulations, as described above for nonpoint source agricultural discharges.

5.3.3 Implementation Provisions for Industrial Storm Water

One of the remaining non-agricultural uses of chlorpyrifos occurs on industrial areas. Therefore, under the Proposed Amendment, industrial storm water NPDES permits for facilities where chlorpyrifos is applied would be subject to the same implementation and monitoring requirements as the other storm water discharges.

5.3.4 Implementation Provisions for Golf Courses

A remaining registered non-agricultural use of chlorpyrifos is applications to golf course turf. Currently discharges from golf courses within areas regulated by MS4 permits are regulated as part of the storm water permit, so any chlorpyrifos discharge would be regulated under those permits. Discharges from golf courses outside of areas covered by storm water permits are currently not regulated. As long as they remain unregulated, their discharge would be subject to the proposed prohibition. If these golf courses become regulated under NPDES permits under the storm water program, the discharges would be subject to the same implementation and monitoring requirements as the other storm water discharges. Therefore, the proposed amendment contains no implementation provisions specific to golf courses, but still provides regulatory coverage for this potential source.

5.3.5 Implementation Provisions for Roadside Medians

A remaining registered non-agricultural use of chlorpyrifos is applications to roadside medians. Discharges from roadside medians managed by the California Department of Transportation (Caltrans) are regulated under Caltrans' statewide storm water permit. Caltrans does not use diazinon or chlorpyrifos. Discharges from roadside medians outside of areas covered by municipal or Caltrans storm water permits are currently not regulated. As long as they remain unregulated, their discharge would be subject to the proposed prohibition. If discharges from these areas become regulated under NPDES permits under the storm water program, these discharges would be subject to the implementation and monitoring requirements as the other storm water discharges. Therefore the proposed amendment contains no implementation provisions specific to roadside medians, but still provides regulatory coverage for this potential source.

5.3.6 Implementation Provisions for Municipal and Domestic Wastewater

Municipal and domestic wastewater dischargers are regulated by the NPDES Wastewater Program. Under this program, the Board issues NPDES permits and monitors compliance with permit requirements. Included in each NPDES permit are specific monitoring requirements of effluent and receiving water. These permits are updated on a five year cycle, and each permit renewal includes monitoring to determine what constituents need numeric effluent limits or regular monitoring due to their potential to cause or contribute to exceedances of water quality objectives. If monitoring for a domestic wastewater discharger in the Project Area indicates that these pesticides are still present in the discharge, then the Board will include numeric effluent limitations in that facility's permit if reasonable potential analysis shows effluent limits are necessary to ensure that water quality objectives are attained.

5.3.7 Provisions for Water Bodies That Are Not Monitored

Due to the large number of water bodies receiving agricultural, storm water, and other discharges in the Central Valley, representative monitoring is used by the ILRP and storm water programs. Representative monitoring is also recommended to assess compliance with the proposed water quality objectives in the proposed Basin Plan Amendment (see Section 6). Individual nonpoint source discharges of diazinon and chlorpyrifos would not be monitored under the proposed monitoring requirements, nor would all of the Sacramento and San Joaquin water bodies receiving discharges of diazinon and chlorpyrifos. Therefore, implementation provisions must also have a means to ensure the water quality objectives would be attained in water bodies that are not monitored. Therefore, the proposed Basin Plan Amendment would specify that if a water body not attaining the diazinon or chlorpyrifos objectives is being used to represent water quality conditions in multiple water bodies, management plans shall be developed to address diazinon and/or chlorpyrifos in all of those represented water bodies.

5.4 Time Schedule for Actions to be Taken

Porter-Cologne requires the Central Valley Water Board to include a time schedule for actions to be taken as part of the program of implementation. Board staff have considered alternatives for the time schedule for expected attainment of the proposed diazinon and chlorpyrifos water quality objectives, and have identified proposed alternatives. Timelines are also identified for Regional Water Board issuance or revision of WDRs or waivers of WDRs to address diazinon and chlorpyrifos runoff, and for submittal and implementation of monitoring plans and management plans to ensure attainment of the proposed water quality objectives within the time schedule. A timeline for the frequency for updates to the Central Valley Water Board and for review of the water quality objectives and implementation provisions is also identified.

5.4.1 Time Schedule for Compliance

This section evaluates the alternative time schedules for compliance with water quality objectives. The primary considerations in the Board staff's evaluation were the feasibility of complying in the specified time frame, minimizing the time period in which potential beneficial use impacts could occur, and cost. In considering the compliance schedule, it is important to consider the history of the issue and the amount of time (nearly 20 years) that these pesticides have been a focus of water quality improvement efforts in the Central Valley.

Three potential time frames for compliance were evaluated: short term (1-2 years), medium term (5 years), and long term (10 years).

The time schedule will focus on compliance with the proposed water quality objectives. There are existing practices, such as those discussed in Section 5.1 that could be implemented in a short time-frame (i.e. within the next two years) to produce the required changes. Since the agricultural management practices generally do not require large capital investments, a long time-frame should not be needed.

Factors that may make compliance more difficult and require more time to achieve compliance include: (1) increased diazinon or chlorpyrifos use, (2) unfavorable weather conditions, and (3) difficulty in reducing peak concentrations. Diazinon and chlorpyrifos use may increase if pests develop resistance to alternatives being used. Diazinon and chlorpyrifos use may also increase if commodity prices increase and growers are more willing to increase production costs to ensure yields are maximized. If heavy rainfall were to occur soon after application, receiving water concentrations may increase, even if total yearly use does not. Careful management of the timing of pesticide application (i.e., no applications immediately prior to storm or irrigation events) may be required to make significant reductions in peak concentrations.

5.4.1.1 Short-Term (2 – year, ~2016) Time Schedule for Compliance

Compliance with the proposed objectives is feasible in the short-term. A short-term time schedule would likely provide the greatest benefit to the environment, since exposure of aquatic life to diazinon and chlorpyrifos would be quickly reduced. A short-term time schedule may not give some growers sufficient time to implement improved agricultural management practices if weather conditions or pest pressure conditions prove unfavorable to reducing diazinon and chlorpyrifos runoff. In addition, compliance with objectives in the short-term would be difficult without making significant changes in pesticide use and management practices. Growers who continue to use diazinon and chlorpyrifos may require a few seasons to fully implement practices that will reduce chlorpyrifos and diazinon runoff, such as establishing buffer strips, implementing improved application techniques, or implementing improved irrigation practices.

A short-term compliance schedule may be problematic for NPDES dischargers. Pollution control requirements will have to be included when permits are renewed, and the NPDES permits are renewed on a five-year cycle. A short-term compliance schedule could require re-opening permits outside of the regular cycle, which could be a significant diversion of Board resources from current programs.

In the event that dischargers would need additional time to comply with water quality objectives, a short-term compliance schedule would not allow time for the Regional

Board to revisit the compliance schedule in the Basin Plan before compliance would be required.

5.4.1.2 Medium-Term (5 year ~ 2019) Time Schedule for Compliance

Compliance with the proposed objectives is feasible to obtain in the medium term. A medium-term time schedule would accommodate any additional time that might be needed to respond to changing pest pressures or economic conditions. Growers would likely be able to implement an effective system to reduce pesticide runoff by 2017. Establishing buffer strips, improved application techniques, or improved water management could be feasibly accomplished within three years. If growers had an effective overall system of management practices for minimizing pesticide runoff, then any necessary changes in use of pest control products would not be as likely to result in significant discharge of pesticides to surface water.

A medium-term compliance schedule could be feasible for NPDES dischargers. To the extent that provisions addressing diazinon and chlorpyrifos are not included in permits, based on previously adopted TMDLs or interpretation of narrative objectives, they could be added to any permits by the compliance date, or shortly thereafter, since permits are renewed every five years. By 2017, the phase-out of sales of chlorpyrifos and diazinon for almost all non-agricultural uses will have been in effect for 17 and 13 years, respectively. Therefore, their presence due to any remaining non-agricultural uses is expected to be negligible by that time and any permit limits for storm water and wastewater necessary to ensure the discharge does not cause or contribute to exceedances of the proposed objectives should be easily attainable. A medium-term compliance schedule also would allow for Central Valley Water Board to review the water quality objectives and program of implementation before the compliance date and extend it, if necessary.

A medium-term compliance schedule would potentially result in the exposure of some aquatic life to elevated diazinon and chlorpyrifos concentrations for a longer period of time. If growers and NPDES dischargers implement practices to reduce overall pesticide runoff, the exposure of aquatic life to all potentially toxic pesticides should be reduced. Under this alternative, the compliance date set in the Basin Plan would be a firm date, but and dischargers would still be required to attain the water quality objectives as soon as possible. Therefore under the medium-term compliance schedule, attainment of the proposed water quality objectives could be required before this compliance date in the Basin Plan as appropriate in waivers and WDRs. The medium term compliance schedule would provide the Board and dischargers more flexibility to prioritize work on the greatest threats to water quality compared to the short term compliance time schedule.

5.4.1.3 Long-Term (10-year, ~2024) Time Schedule for Compliance

Compliance with the proposed objectives is feasible to obtain in the long-term. A long-term compliance time schedule would have similar benefits to a medium-term time schedule. A long-term time schedule for tributaries requiring significant reductions in peak concentrations would make compliance within the time schedule more likely. A longer compliance schedule would provide dischargers with greater flexibility to adopt those management practices that are most cost effective at minimizing pesticide runoff.

A long-term compliance schedule also would allow for Central Valley Water Board to review the water quality objectives and program of implementation before the compliance date, and extend it, if necessary. A long-term compliance schedule would potentially result in the exposure of aquatic life to elevated diazinon and chlorpyrifos concentrations for a longer period of time than the short term or medium-term compliance schedules. As with the medium term compliance date, under this alternative, the compliance date set in the Basin Plan would be a firm date, but and dischargers would still be required to attain the water quality objectives as soon as possible. Therefore under the long-term compliance schedule, attainment of the proposed water quality objectives could be required before the compliance date specified the Basin Plan as appropriate in waivers and WDRs. The long-term compliance schedule would provide the Board and dischargers more flexibility to prioritize work on the greatest threats to water quality compared to the short-term and medium-term compliance time schedules.

5.4.1.4 Recommendation for Time Schedule for Compliance

A long-term (ten year) time schedule, requiring compliance with the proposed diazinon and chlorpyrifos water quality objectives as soon as possible, but no later than ten years from the date of EPA approval of the Amendment, is recommended. A period of approximately ten years from Central Valley Water Board adoption of the Basin Plan Amendment should provide sufficient time to attain the objectives and should be sufficient to get a comprehensive system for control of pesticide runoff into place. Although attainment of the objectives is likely feasible in the short-term, focusing exclusively on diazinon and chlorpyrifos could result in use of alternative pesticides that may also impact surface water. A ten-year compliance schedule would also allow flexibility to adjust the program of implementation and time schedule, if necessary. A ten-year compliance time schedule provides sufficient time to implement a comprehensive program focused on an overall reduction in pesticide runoff through implementation of appropriate management practices. A compliance time schedule greater than ten years is not recommended, since there is no clear environmental or economic benefit to extending compliance beyond ten years.

A ten-year compliance time schedule would be consistent with the State Water Board's Policy for Compliance Schedules in NPDES Permits (SWRCB, 2008) which allows up to ten years for NPDES permittees to comply with new water quality objectives or new numeric interpretations of narrative water quality objectives. A ten-year maximum compliance time-schedule would also be consistent with the WDRs adopted for irrigated agricultural dischargers in the Central Valley Region, which require compliance with water quality objectives as soon as possible, but no longer than ten years from their adoption, in 2013 and 2014. The WDRs would require compliance about a year before the backstop ten-year compliance date set in the Basin Plan.

Because the State Board's compliance schedule policy, and other laws and policies effectively decide the compliance date, the proposed amendment would defer to existing laws and policies where they establish a compliance date, but still needs to contain a compliance date for discharges which do not have compliance dates set by existing laws or policies.

5.4.2 Time Schedule for Modification of Permits and Waivers

The Basin Plan Amendment would become fully effective upon the date of USEPA approval, which is expected to occur in late 2014 or early 2015. Permits and waivers regulating dischargers of diazinon and chlorpyrifos would in some cases need to be modified to require compliance with the Basin Plan Amendment. It is likely that many of the actions required by the Basin Plan Amendment would already be included in the waivers and WDRs for agricultural dischargers as a result of existing standards and implementation programs. Any additional changes to WDRs or waivers could be adopted by the Board within five years of the adoption by USEPA of this Basin Plan Amendment, since NPDES permits are updated on a five-year cycle.

5.4.3 Time Schedule for Submission Addressing Any Future Impairments

Follow-up actions are proposed for when water bodies are subsequently found to be in non-attainment of the proposed water quality objectives for diazinon and chlorpyrifos. The Proposed Amendment contains requirements for prompt follow-up through management plans and implementation of practices when water bodies are found to be in exceedance of the proposed water quality objectives. Under the proposed amendment, the Board would require management plans within one year of the measurement of a water quality objective exceedance.

6. Surveillance and Monitoring

Porter-Cologne requires that Basin Plan Amendments describe the type of surveillance and monitoring that will be required to determine compliance with water quality objectives. In general, responsibility for monitoring and surveillance will fall to three main groups: the Central Valley Water Board; the entity or entities and individuals directly overseeing the implementation program (i.e., Coalition groups representing agricultural dischargers and/or individual agricultural dischargers, NPDES dischargers); and those entities responsible for adopting new management practices. Monitoring requirements vary depending on whether the discharge is associated with an agricultural or urban area (NPDES discharges).

Three main alternatives for surveillance and monitoring were considered:

1) No change in existing surveillance and monitoring requirements. Do not include a general or specific monitoring and surveillance program for the Sacramento and San Joaquin Valley water bodies, beyond existing requirements for the Sacramento and Feather Rivers, San Joaquin River and, the Delta.
2) Provide only general requirements on the monitoring and surveillance.
3) Identify specific monitoring requirements, including methods, sites, and constituents.

Under the no-change alternative (Alternative 1), no additional information would be provided in the monitoring and surveillance chapter for the new water bodies. The existing general information on monitoring and surveillance in the Basin Plan would apply as would the existing surveillance and monitoring programs for diazinon and chlorpyrifos the Sacramento and Feather Rivers, the San Joaquin River, and the Delta would still be in place. Required monitoring is already being conducted by Irrigated Lands Regulatory Program (ILRP) Coalition Groups and NPDES permittees to demonstrate compliance with these requirements. In addition, ILRP Coalition Groups' general monitoring program includes sampling for diazinon and chlorpyrifos in a number of Valley water bodies.

There is significant project area overlap between the existing TMDLs and the proposed water quality objectives. The establishment of these objectives will ensure that these pesticides are included in standard reasonable potential analysis for point source discharges. Under Alternative 1, there would still be monitoring requirements for NPDES permittees, since most permittees are already required to monitor to show compliance with the wasteload allocation (from the Sacramento/Feather, San Joaquin and/or Delta TMDLs). .

For the agricultural sources, under Alternative 1 it may be unclear as to what information should be collected to ensure that the Regional Water Board can determine progress in implementing this Amendment.

Under Alternative 2, the Basin Plan Amendment would provide general requirements for the monitoring and surveillance to be conducted, but would allow flexibility in terms of the specific monitoring requirements. The general requirements would be structured to provide enough data to allow accurate and meaningful evaluation of compliance with the Basin Plan Amendment. These requirements would also ensure that all programs are utilizing methods with sufficiently low detection limits to detect exceedances of water quality objectives.

Under Alternative 3, the Basin Plan Amendment would explicitly identify specific requirements for monitoring and surveillance, including specific sites to be monitored, the frequency of monitoring, and constituents to be monitored. This alternative would provide the greatest certainty as to expectations of the monitoring effort, but would provide the least flexibility for dischargers.

Alternative 2 is recommended. This will provide consistent requirements for the additional water bodies receiving water quality objectives similar to existing monitoring requirements for the Sacramento and Feather Rivers, San Joaquin River, and Delta. Specific expectations for the information to be collected can be required through monitoring and reporting programs established through waivers of waste discharge requirements and/or waste discharge requirements to ensure that the necessary information is collected and submitted to the Central Valley Water Board to determine progress in implementing the Basin Plan requirements and attaining water quality standards. The specific methods and number of monitoring sites required to meet those expectations should remain flexible to take advantage of the efforts of different groups and agencies conducting monitoring and evaluating management practices, and to allow resources to be adjusted relative to the magnitude of the water quality threat without requiring an amendment to the Basin Plan. The general monitoring and surveillance needs are described below. A detailed description of potential monitoring scenarios is included in Section 9.

Under the Proposed Amendment, the surveillance and monitoring program should be designed to collect the information necessary to meet the following six monitoring goals in agricultural discharges in the Sacramento River, San Joaquin River, and Delta watersheds (downstream of major dams):

1. Determine compliance with established water quality objectives for diazinon and chlorpyrifos. ,

2. Determine the degree of implementation of management practices to reduce off-site movement of diazinon and chlorpyrifos,
3. Determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon and chlorpyrifos,
4. Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts,
5. Determine whether the discharges of pesticides cause or contribute to a toxicity impairment due to additive or synergistic effects of multiple pollutants, and

The monitoring and surveillance program for applicable NPDES point sources is designed to meet the following requirements:

1. Determine whether the discharge causes or contributes to an exceedance of water quality objectives for diazinon and chlorpyrifos.
2. Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts.
3. Determine whether the discharge causes or contributes to a toxicity impairment due to additive or synergistic effects of multiple pollutants.

Specific laboratory methods for analysis are not included in the proposed Basin Plan Amendment because methods frequently change or improve. Additionally, the monitoring and laboratory requirements are often specified by the regulatory programs (NPDES and ILRP) which implement the requirements of the Proposed Amendment. For monitoring conducted to determine compliance with the water quality objectives, it is inherent that adequately low reporting limits (below the water quality objectives) are needed. Currently, diazinon and chlorpyrifos can be analyzed using USEPA Method 8141A, USEPA Method 625M, or an equivalent GC/MS method to reporting limits below the proposed objectives. A review of recent monitoring data from the background sections showed reporting limits for diazinon and chlorpyrifos of 0.020µg/L and 0.010µg/L, respectively, are often attained with these methods.

6.1 Surveillance and Monitoring for Agricultural Dischargers

Agricultural Coalitions are currently implementing monitoring plans that are expected to be generally consistent with the following recommendations, though expansion of the number of monitoring sites and total samples collected may be necessary. If individual agricultural dischargers choose to implement their own monitoring, the monitoring and analytical requirements would need to be consistent with the monitoring goals stated above. The descriptions below assume a collective monitoring effort would continue to be implemented by the agricultural dischargers. For agricultural discharges, the types of activities required to meet the monitoring goals are described in more detail below.

1: Determine compliance with established water quality objectives for diazinon and chlorpyrifos

To determine compliance with water quality objectives, monitoring will need to occur at a number of sites in each of the three watersheds. Under the Proposed Amendment, most of the Sacramento and San Joaquin water bodies would have water quality objectives. Monitoring to determine compliance with water quality objectives could occur in a number of representative sites. As an example, a number of representative sites including main rivers, smaller sloughs, and upland drainages could be sampled in the three watersheds. Monitoring locations should be representative of the tributaries and the major rivers in the various subareas.

The frequency of monitoring should be based on the primary processes leading to diazinon and chlorpyrifos runoff. During the dormant season, storm water runoff could account for most of the diazinon and chlorpyrifos found in the water bodies in the three watersheds. Monitoring should, therefore, take place concurrent with, and for a few to several days after, storms of sufficient magnitude in the region. Storm water runoff during March should also be monitored, since this is a period of chlorpyrifos application on some crops, such as alfalfa. During the irrigation season, interval sampling should be implemented to monitor diazinon and chlorpyrifos transported into the water bodies via irrigation runoff and possibly aerial drift. Since irrigation and pesticide use will take place at different times, monitoring can take place at a frequency that depends on pesticide use patterns and frequency of irrigation.

2: Determine the degree of implementation of management practices to reduce off-site movement of diazinon and chlorpyrifos.

Information must be collected from growers on the types of practices they are implementing and how those practices are being applied, while aiming to minimize the paperwork burden on growers, use existing reporting systems, and create a repository for the data that will allow for ease of data entry and analysis. Data should be collected in the four broad areas: pesticide application, mixing, and loading practices; pest management practices; water management practices; and cultural practices. Experts in each of those broad fields should be consulted in designing the survey or reporting requirements to ensure relevant data is collected. A focused effort should be made to receive complete reporting from growers whose lands drain to the monitoring sites. This should allow the Central Valley Water Board to relate the implementation of specific diazinon and chlorpyrifos runoff mitigation approaches to changes in diazinon and chlorpyrifos loading.

3: Determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon and chlorpyrifos.

To assess the effectiveness of specific management practices or strategies, evaluations of management practices will need to be conducted. The evaluations should quantify the amount of load reduction or reduction in off-site migration of diazinon and chlorpyrifos (in the case of practices to reduce aerial drift) that could be expected with implementation of a new management practice or strategy.

4: Determine whether alternatives to diazinon or chlorpyrifos are being discharged at concentrations which have the potential to cause or contribute to exceedances of applicable water quality objectives .

Replacement of diazinon and chlorpyrifos with other organophosphate insecticides, carbamate insecticides, or pyrethroids pesticides may result in water column or sediment toxicity. First, an evaluation of pesticide use patterns would need to be performed in order to determine whether any alternative pesticides could pose a threat to water quality. Monitoring of the water column and sediment would need to include analyses for these insecticides to ensure that aquatic toxicity does not continue, or does not simply move from a water column pesticide problem to a sediment pesticide problem.

When pesticide use patterns indicate that monitoring is necessary, the monitoring locations should generally be the same as those used to monitor diazinon and chlorpyrifos and the monitoring could be done concurrently. Monitoring could be done at a representative number of water bodies within the Sacramento River, San Joaquin River, and Delta watersheds if monitoring programs are carefully designed so that the stations monitored were representative of the water quality conditions likely to occur in the three watersheds. Sediment monitoring should be done at sites where sediments are likely to be deposited. Sediment sampling could be performed concurrently with surface water monitoring, but may not need to be performed as frequently (e.g. monthly during the dormant season rather than daily during storm event sampling).

5: Determine whether the discharge causes or contributes to a toxicity impairment due to additive or synergistic effects of multiple pollutants

The toxicity and pesticide water quality objectives that apply to diazinon and chlorpyrifos include provisions for considering additive and synergistic effects. The Basin Plan

Amendment is based on the current understanding of the additive effects of diazinon and chlorpyrifos and similarly-acting pesticides. Diazinon and chlorpyrifos may also have additive, synergistic, or antagonistic effects in combination with other pollutants. To determine if such effects are occurring, monitoring for toxicity and monitoring for pollutants suspected of acting in an additive or synergistic manner with diazinon and chlorpyrifos will be required. When toxicity is detected, toxicity identification evaluations should be required to determine the compounds likely contributing to the toxicity. Such monitoring can be conducted in conjunction with monitoring for diazinon and chlorpyrifos.

Monitoring could be done at a representative number of water bodies within the Sacramento River, San Joaquin River, and Delta watersheds if monitoring programs are carefully designed so that the stations monitored were representative of the water quality conditions likely to occur in the watersheds. Toxicity monitoring should be done at sites and times of year when toxicity would be most likely to occur. Water bodies receiving orchard runoff should be monitored for toxicity following winter storms. During the irrigation season, water bodies receiving irrigation runoff should be monitored for toxicity. For example, in the Delta this should include back sloughs and small upland drainages. The stations monitored should include stations at which toxicity was detected in previous studies, including Kuivila and Foe, 1995; Deanovic et al., 1996; and Deanovic et al, 1998.

6.2. Surveillance and Monitoring for Point Sources

Because non-agricultural uses of diazinon and chlorpyrifos have largely been phased out, surveillance and monitoring requirements for point sources includes only three of the seven requirements for agricultural discharges. Point source, for the purposes of this Basin Plan Amendment, means urban storm water (Phase I and II) and wastewater discharges. This point source subsection provides new Basin Plan text regarding monitoring and surveillance requirements for these NPDES discharges. Since pesticide uses in urban areas are likely similar, collective programs for conducting representative monitoring and assessing potential replacement products and additive toxicity impacts could be implemented by storm water and wastewater dischargers to meet these requirement.

<u>1: Determine whether the discharge causes or contributes to an exceedance of water quality objectives for diazinon and chlorpyrifos.</u>

To determine if their discharge is likely to cause or contribute to exceedances of the diazinon or chlorpyrifos objectives. NPDES urban storm water and wastewater dischargers will need to conduct effluent monitoring. Urban storm water should be monitored at locations within the permitted area sufficient to characterize pesticide occurrence within MS4s. For NPDES discharges it may be appropriate to conduct representative monitoring, as an alternative to monitoring of all discharges. Representative monitoring would be less expensive, but would provide less certainty that the objectives were being met. If representative monitoring is used, monitoring programs would need to be carefully designed so that the samples collected would be representative of the water quality conditions likely to result from the group of discharges. The frequency and timing of monitoring wastewater and storm water should be based on the primary processes leading to diazinon and chlorpyrifos within the collection system area and/or MS4.

The ban of the sale, with use allowed of existing stock, of diazinon and chlorpyrifos for most residential and commercial uses should significantly reduce or eliminate detections of these two pesticides. On a case-by-case basis, it may be determined that monitoring already being conducted is adequately to determine compliance with the requirements in the Proposed Amendment.

2: Determine whether alternatives to diazinon or chlorpyrifos are being discharged at concentrations which have the potential to cause or contribute to exceedances of applicable water quality objective.

Replacement of diazinon and chlorpyrifos with other organophosphate insecticides, such as pyrethroid pesticides may result in water column or sediment toxicity. Therefore, an evaluation of the potential impacts of potential replacement pesticides is included in the monitoring requirements. To meet this requirement, an evaluation of pesticide use patterns would be performed, or an existing evaluation found to be appropriate, in order to determine which alternative pesticides could pose a threat to water quality. Storm water and wastewater discharge monitoring of the water column and sediment would need to include analyses for these insecticides to ensure that aquatic toxicity does not continue, or does not simply move from a water column pesticide problem to a sediment pesticide problem.

The monitoring locations should generally be the same as those used to monitor diazinon and chlorpyrifos and the monitoring could be done concurrently. Sediment monitoring should be done at sites where sediments are likely to be deposited. Sediment sampling could be performed concurrently with surface water monitoring, but may not need to be performed as frequently.

3: Determine whether the discharge causes or contributes to a toxicity impairment due to additive or synergistic effects of multiple pollutants.

The toxicity and pesticide water quality objectives that apply to diazinon and chlorpyrifos include provisions for considering additive or synergistic effects. This Basin Plan Amendment is based on the current understanding of the additive effects of diazinon and chlorpyrifos and similarly-acting pesticides. Diazinon and chlorpyrifos may also have additive, synergistic, or antagonistic effects in combination with other pollutants. To determine if such effects are occurring, monitoring for toxicity and monitoring for pollutants suspected of acting in an additive or synergistic manner with diazinon and chlorpyrifos will be required. Such monitoring can be conducted in conjunction with monitoring for diazinon and chlorpyrifos.

7. Policies

Both the State Water Board and the Central Valley Water Board have a number of existing policies and Management Agency Agreements (MAAs) that are potentially applicable to the control of diazinon and chlorpyrifos in Sacramento and San Joaquin Valley water bodies. Proposed Basin Plan Amendments must be consistent with existing State laws and regulations including adopted State and Central Valley Water Board policies. Water Code section 13146 requires that, in carrying out activities that affect water quality, all state agencies, departments, boards, and offices comply with state policy for water quality control unless otherwise directed or authorized by statute, in which case they shall indicate to the State Water Board in writing their authority for not complying with such policy.

In addition to being consistent with existing laws and policies, the Basin Plan Amendment will need to include new policies specific to the control of diazinon and chlorpyrifos in the Sacramento and San Joaquin River Basins' water bodies. This section summarizes existing State and Central Valley Water Board policies and MAAs that are relevant to the Proposed Amendment and describes the needed policies specific to the control of diazinon and chlorpyrifos discharges. In the sections below, language from State and Central Valley Water Board policies or MAAs is shown in indented quotes.

7.1 Consistency with State Water Board Plans and Policies

The State Water Board is authorized to adopt state policy for water quality control (Wat. Code, §13140). State Water Board water quality control plans supersede any regional water quality control plans for the same waters to the extent of any conflict (Wat. Code, §13170). The following are the potentially relevant State Water Board plans and policies:

- State Water Board Resolution 68-16, the Statement of Policy with Respect to Maintaining High Quality of Waters in California (*State Anti-Degradation Policy*)
- State Water Board Resolution 74-43, the Water Quality Control Policy for the Enclosed Bays and Estuaries of California
- State Water Board Resolution 2004-002, the Bay Protection Toxic Hot Spots Cleanup Plan

- State Water Board Resolution 2004-0030, the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program
- State Water Board Resolution 2005-0050, the Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options
- State Water Board Resolution 2008-0025, the Policy for Compliance Schedules in National Pollutant Discharge Elimination System Permits

These policies and their relevance to the proposed water quality objectives and implementation plan are described in the following sections.

7.1.1 *State Anti-Degradation Policy*

The *State Anti-Degradation Policy*[8] includes the following statements:

> 1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies."
>
> "2. Any activity which produces or may produce a waste or increase volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

In addition, the Central Valley Water Board's Anti-degradation Implementation Policy states:

> …Implementation of this policy [*State Anti-Degradation Policy*] to prevent or minimize surface and ground water degradation is a high priority for the Board.…The prevention of degradation is, therefore, an important strategy to meet the policy's objectives (Basin Plan, pp. IV-15.01).

[8]The *State Anti-Degradation Policy* incorporates the federal anti-degradation standards for surface waters. (see 40 CFR § 131.12)

> The Central Valley Water Board will apply 68-16 in considering whether to allow a certain degree of degradation to occur or remain. In conducting this type of analysis, the Central Valley Water Board will evaluate the nature of any proposed discharge, existing discharge, or material change therein, that could affect the quality of waters within the region. Any discharge of waste to high quality waters must apply best practicable treatment or control not only to prevent a condition of pollution or nuisance from occurring, but also to maintain the highest water quality possible consistent with the maximum benefit to the people of the State. (Basin Plan, pp. IV-16.00).

The Proposed Amendment is consistent with federal and state anti-degradation policies. The new objectives are designed to provide protection to the most sensitive beneficial uses. Furthermore, the new water quality objectives clarify an existing narrative water quality objective, and the establishment of the numeric objective does not, in itself, cause any degradation in water quality. To the extent that permitted activities designed to ensure compliance with the Proposed Amendment will cause degradation of water quality, that activity's detrimental impact on water quality, if any, will be measured against the interest in allowing limited agricultural discharges of these pesticides. Overall, the Proposed Amendment is expected to result in an improvement in water quality in the Sacramento and San Joaquin Valley water bodies.

The *State Anti-Degradation Policy* also applies to potential degradation of groundwater or surface water due to the use and introduction of new chemicals. There are a number of practices available to growers that could lead to further reduction of diazinon and chlorpyrifos levels in surface water. Some of these practices could result in increased infiltration of water, changes in timing of application of diazinon and/or chlorpyrifos, or the increased use of other pesticides that have to potential to degrade ground or surface water. Discharges of these other pesticides would still be regulated by the Board under the Irrigated Lands Regulatory Program. The proposed monitoring requirements for agricultural dischargers include monitoring to assess potential impacts of alternatives to diazinon and chlorpyrifos. If these alternative pesticides are found to have potential to affect water quality, the Board will be aware of their potential through the required monitoring and assessments and will be required to address them to ensure compliance with the Federal Anti-degradation Policy, the *State Anti-Degradation Policy*, and the Central Valley Water Board's Anti-degradation Implementation Policy.

Furthermore, practices that result in increased infiltration of surface runoff are not expected to degrade groundwater, due to the relatively short half-life of diazinon and chlorpyrifos in soil. The proposed Basin Plan Amendment is, therefore, consistent with the Federal Anti-degradation Policy, the *State Anti-Degradation Policy*, and the Central Valley Water Board's Anti-degradation Implementation Policy.

7.1.2 State Water Board Resolution 74-43, the Water Quality Control Policy for the Enclosed Bays and Estuaries of California

This policy was adopted by the State Water Board in 1974 and provides water quality principles and guidelines for the prevention of water quality degradation in enclosed bays and estuaries to protect the beneficial uses of such waters. The Central Valley Water Board must enforce the policy and take actions consistent with its provisions. Sections of the policy relevant to this Basin Plan Amendment are discussed below.

> This policy does not apply to wastes from vessels or land runoff except as specifically indicated for siltation (Chapter III 4.) and combined sewer flows (Chapter III 7).

Many of the sources of diazinon and chlorpyrifos to the Sacramento and San Joaquin Valley water bodies are from direct runoff. This policy is not relevant to those sources that discharge to Sacramento and San Joaquin Valley water bodies via land runoff.

> There is a considerable body of scientific evidence and opinion which suggests the existence of biological degradation due to long-term exposure to toxicants which have been discharged to the San Francisco Bay-Delta system. Therefore, implementation of a program which controls toxic effects through a combination of source control for toxic materials, upgraded wastewater treatment, and improved dilution of wastewaters, shall proceed as rapidly as is practicable with the objective of providing full protection to the biota and the beneficial uses of Bay-Delta waters in a cost-effective manner.
>
> Nonpoint sources of pollution shall be controlled to the maximum practicable extent.

The proposed Basin Plan Amendment would require source controls for toxic materials (diazinon and chlorpyrifos) that currently discharge to the Sacramento and San Joaquin Valley water bodies, and provide requirements, such as management plans, for controlling nonpoint source pollution. Thus, the proposed Basin Plan Amendment would be consistent with implementing this policy.

7.1.3 State Water Board Resolution 2004-002, the Bay Protection Toxic Hot Spots Cleanup Plan

In 1989 the California Legislature established the Bay Protection and Toxic Cleanup Program (Bay Protection Program). The State and Central Valley Water Boards have adopted cleanup plans for diazinon and chlorpyrifos in the Delta (CRWQCB-CVR, 2003) as part of the Consolidated Toxic Hot Spots Cleanup Plan (Cleanup Plan) under the Bay Protection Program (CRWQCB-CVR Resolution R5-2003-0034, SWRCB Resolution 2004-0002). The Cleanup Plan identified the entire Delta as a toxic hot spot due to diazinon from dormant spray runoff. The Cleanup Plan also identified Morrison Creek in the City of Sacramento, Mosher Slough, Five Mile Slough, the Calaveras River, and Mormon Slough in the City of Stockton, as toxic hot spots due to diazinon and chlorpyrifos from urban runoff. In addition, the Cleanup Plan identified French Camp Slough, Duck Slough, Paradise Cut, and Ulatis Creek as toxic hot spots due to chlorpyrifos in irrigation return flows. The Cleanup Plan's requirements were met by the adoption of the TMDL for diazinon and chlorpyrifos in Sacramento County Urban water ways and the adoption into the Basin Plan of the water quality objectives and control program and for diazinon and chlorpyrifos in the Delta water ways. The Proposed Amendment would maintain the diazinon and chlorpyrifos water quality objectives for the Delta Waterways and, with minor adjustments, the control program to meet those objectives. The Proposed Amendment is therefore consistent with the Bay Protection Toxic Hot Spots Cleanup Plan.

7.1.4 State Water Board Resolution 2004-0030, the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Program (*Nonpoint Source Policy*)

The State Water Board adopted the *Nonpoint Source Policy* in May 2004. The Nonpoint Source Policy clarifies the applicability of Porter-Cologne to nonpoint sources by specifying that all nonpoint source (NPS) discharges must be regulated under waste discharge requirements, waivers of waste discharge requirements, a Basin Plan prohibition, or some combination of those regulatory tools. The Nonpoint Source Policy also describes the following key elements that must be included in a nonpoint source implementation program:

> KEY ELEMENT 1: An NPS control implementation program's ultimate purpose shall be explicitly stated. Implementation programs must, at a minimum, address NPS pollution in a manner that achieves and maintains water quality objectives and beneficial uses, including any applicable anti-degradation requirements.
>
> KEY ELEMENT 2: An NPS control implementation program shall include a description of the management practices and other program elements that are expected to be implemented to ensure attainment of the implementation program's stated purpose(s), the process to be used to select or develop management practices, and the process to be used to ensure and verify proper management practice implementation.
>
> KEY ELEMENT 3: Where a Regional Water Quality Control Board determines it is necessary to allow time to achieve water quality requirements, the NPS control implementation program shall include a specific time schedule, and corresponding quantifiable milestones, designed to measure progress toward reaching the specified requirements.
>
> KEY ELEMENT 4: An NPS control implementation program shall include sufficient feedback mechanisms so that the Regional Water Quality Control Board, dischargers, and the public can determine whether the program is achieving its stated purpose(s), or whether additional or different management practices or other actions are required.
>
> KEY ELEMENT 5: Each Regional Water Quality Control Board shall make clear, in advance, the potential consequences for failure to achieve an NPS control implementation program's stated purposes.

The proposed Basin Plan Amendment is consistent with the *Nonpoint Source Policy*. WDRs or waivers of WDRs can be effectively used to address nonpoint sources of diazinon and chlorpyrifos. The proposed Basin Plan Amendment includes requirements to: meet water quality objectives (Key Element 1); submit management plans and evaluate management practices (Key Element 2); comply with objectives within a specified time frame (Key Element 3); and conduct monitoring on the success of management practices (Key Element 4). The Basin Plan Amendment includes provisions for requiring modification to management plans in the event of failure to achieve objectives (Key Element 5).

7.1.5 State Water Board Resolution 2005-0050, the Water Quality Control Policy for Addressing Impaired Waters

The State Water Board adopted the Water Quality Control Policy for Addressing Impaired Waters to describe the requirements for how the State and Regional Water Boards must correct impairments to the waters of the State. This Basin Plan Amendment has been prepared in a manner consistent with this provision of the State Water Board's Water Quality Control Policy for Addressing Impaired Waters, as described below under each potentially relevant provision.

> A. If the water body is neither impaired nor threatened, the appropriate regulatory response is to delist the water body.

In the preparation of the Proposed Amendment, Board staff analyzed the water bodies that are 303(d) listed for diazinon or chlorpyrifos within the Project Area. For those listed water bodies that are currently meeting water quality standards for diazinon and chlorpyrifos, staff is recommending delisting those water bodies, as discussed in Section 1.5. Diazinon and chlorpyrifos are still found at levels exceeding the existing water quality standards in several water bodies in the Sacramento and San Joaquin River Basins; therefore, these remaining impairments still need to be corrected through a Central Valley Water Board action.

> B. If the failure to attain standards is due to the fact that the applicable standards are not appropriate to natural conditions, an appropriate regulatory response is to correct the standards.

The proposed objectives for diazinon and chlorpyrifos are appropriate based on the toxicity data evaluated using the USEPA methodology. Diazinon and chlorpyrifos are manmade chemicals. Therefore, the objectives for diazinon and chlorpyrifos are appropriate.

> C. The State Board and Regional Boards are responsible for the quality of all waters of the state, irrespective of the cause of the impairment. In addition, a TMDL must be calculated for impairments caused by certain EPA designated pollutants.

Pesticides fit under the definition of pollutants, and diazinon and chlorpyrifos are technically suitable for TMDL calculation. However, if other pollution control programs will address the impairments, then adoption of a TMDL is not required. The water quality objectives and implementation program for diazinon and chlorpyrifos provide the pollution control mechanism that will ensure the attainment of water quality standards in impaired water bodies without the adoption of TMDLs.

> D. Whether or not a TMDL calculation is required as described above, impaired waters will be corrected (and implementation plans crafted) using existing regulatory tools

The Proposed Amendment can be implemented by the Board through the ILRP and NPDES programs using existing regulatory tools, including prohibitions of discharge, waste discharge requirements and/or waivers of waste discharge requirements, to correct diazinon and chlorpyrifos impairments.

> D1. If the solution to an impairment will require multiple actions of the Regional Board that affect multiple persons, the solution must be implemented through a Basin Plan Amendment or other regulation.

Correcting the diazinon and chlorpyrifos impairments in the Sacramento and San Joaquin River Basins will likely require multiple actions of the Central Valley Water Board to gain compliance from all of the dischargers to these water bodies, therefore a Basin Plan Amendment or other regulation is necessary in this case.

> D2. If the solution to an impairment can be implemented with a single vote of the Regional Board, it may be implemented by that vote.

The solution to these impairments will likely require multiple votes of the Central Valley Water Board, therefore a regulation, such as a Basin Plan Amendment, is required.

> D3. If a solution to an impairment is being implemented by a regulatory action of another state, regional, local, or federal agency, and the Regional Board finds that the solution will actually correct the impairment, the Regional Board may certify that the regulatory action will correct the impairment and if applicable, implement the assumptions of the TMDL, in lieu of adopting a redundant program.

Recent and anticipated changes in pesticide use requirements by regulatory agencies such as DPR and USEPA are expected to reduce diazinon and chlorpyrifos discharges. But there is no guarantee that these actions will result in attainment of water quality objectives. Therefore, the adoption of a Basin Plan Amendment is appropriate.

> D4. If a solution to an impairment is being implemented by a non-regulatory action of another entity, and the Regional Board finds that the solution will actually correct the impairment, the Regional Board may certify that the non-regulatory action will correct the impairment and if applicable, implement the assumptions of the TMDL, in lieu of adopting a redundant program.

A solution to the impairment is not being implemented through a non-regulatory action by another entity, so this provision could not be applied.

7.1.6 State Water Board Resolution 2008-0025, the Policy for Compliance Schedules in National Pollutant Discharge Elimination System Permits

The Policy for Compliance Schedules in National Pollutant Discharge Elimination System Permits authorizes the Central Valley Water Board to include a compliance schedule in a permit for an existing discharger to implement a new, revised, or newly interpreted water quality objective or criterion in a water quality standard that results in a permit limitation more stringent than the limitation previously imposed. The proposed Basin Plan Amendment will establish new water quality objectives, which will be incorporated into NPDES permits with appropriate compliance schedules in accordance with this compliance schedule policy.

7.2 Consistency with Central Valley Water Board Policies

The following are the potentially relevant Central Valley Water Board policies:

- Urban Runoff Policy
- Controllable Factors Policy
- Water Quality Limited Segment Policy
- Anti-degradation Implementation Policy
- Pesticide Discharges from Nonpoint Sources
- Application of Water Quality Objectives Policy
- Watershed Policy
- Policy in Support of Regionalization, Reclamation, Recycling and Conservation for Wastewater Treatment Plants

7.2.1 Urban Runoff Policy

On page IV-14.00 of the Basin Plan, the Central Valley Water Board's Urban Runoff Policy states:

> a. Subregional municipal and industrial plans are required to assess the impact of urban runoff on receiving water quality and consider abatement measures if a problem exists.
>
> b. Effluent limitations for storm water runoff are to be included in NPDES permits where it results in water quality problems.

The proposed Basin Plan Amendment addresses constituents found in domestic wastewaters and urban runoff; therefore, this policy is applicable to the proposed Basin Plan Amendment. The Basin Plan Amendment includes requirements for monitoring diazinon and chlorpyrifos, new water quality objectives, and a program of implementation applicable to NPDES dischargers.

7.2.2 Controllable Factors Policy

> Controllable water quality factors are not allowed to cause further degradation of water quality in instances where other factors have already resulted in water quality objectives being exceeded. Controllable water quality factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of waters of the State, that are subject to the authority of the State Water Board or Central Valley Water Board, and that may be reasonably controlled.
>
> (Basin Plan, pp. IV-15.00)

This Policy is applicable to the proposed Basin Plan Amendment as agricultural, wastewater and urban sources occur. The proposed Basin Plan Amendment addresses a synthetic chemical (no natural sources) and includes requirements for nonpoint and point sources. A variety of methods to control the runoff of diazinon and chlorpyrifos are available. Implementation of these control measures is expected to result in attainment of the proposed water quality objectives within a reasonable period of time.

7.2.3 Water Quality Limited Segment Policy

Water quality management may require the identification and ranking of water bodies with regard to certain water quality parameters. Water Quality Limited

Segments (WQLs) are one example of expressing water quality problems by water bodies. WQLs are those sections of lakes, streams, rivers, or other fresh water bodies where water quality does not meet (or is not expected to meet) water quality standards even after the application of appropriate effluent limitations for point sources. (40 C.F.R. § 130 et seq.)

> Additional treatment beyond minimum federal requirements will be imposed on dischargers to Water Quality Limited Segments. Dischargers will be assigned or allocated a maximum allowable load of pollutant so that water quality objectives can be met in the segment. (Basin Plan, pp. IV-7.00)

The Proposed Amendment establishes maximum allowable concentrations of diazinon and chlorpyrifos for many water bodies within the Project Area that are currently included in the CWA section 303(d) list of Water Quality Limited Segments through the establishment of water quality objectives. The Proposed Amendment includes enforceable requirements for agricultural, storm water, and domestic wastewater dischargers to reduce diazinon and chlorpyrifos discharges and to ensure that beneficial uses are protected within the water quality limited segments. These enforceable requirements go beyond the minimum federal requirements because the Proposed Amendment imposes requirements not only on point-source dischargers regulated under the federal Clean Water Act's NPDES requirements, but also on non-point sources as well. The requirements applicable to point sources dischargers are consistent with the Board's numeric interpretation of existing narrative water quality objectives. Therefore, the proposed Basin Plan Amendment is consistent with the implementation of this policy.

7.2.4 Pesticide Discharges from Nonpoint Sources

The Central Valley Water Board's policy on Pesticide Discharges from Nonpoint Sources (Pesticide Policy) was adopted to implement the water quality objectives for pesticides. The Pesticide Policy includes a number of provisions that should be evaluated with respect to the Proposed Amendment.

> The control of pesticide discharges to surface waters from nonpoint sources will be achieved primarily by the development and implementation of management practices that minimize or eliminate the amount discharged. (Basin Plan, pp. IV-33.12)

The Proposed Amendment requires dischargers to impaired waters to submit management plans that describe the actions they will take and management practices they will implement to meet the applicable water quality objectives.

> The Board will use water quality monitoring results to evaluate the effectiveness of control efforts and to help prioritize control efforts. (Basin Plan, pp. IV-33.12)

The proposed Basin Amendment includes provisions that require monitoring and address the evaluation of water quality monitoring results to evaluate the effectiveness of control efforts.

> Central Valley Water Board monitoring will consist primarily of chemical analysis and biotoxicity testing of major water bodies receiving irrigation return flows. The focus will be on pesticides with use patterns and chemical characteristics that indicate a high probability of entering surface waters at levels that may impact beneficial uses. Board staff will advise other agencies that conduct water quality and aquatic biota monitoring of high priority chemicals, and will review monitoring data developed by these agencies. Review of the impacts of "inert" ingredients contained in pesticide formulations will be integrated into the Board's pesticide monitoring program. (Basin Plan, pp. IV-34.00)
>
> When a pesticide is detected more than once in surface waters, investigations will be conducted to identify sources. Priority for investigation will be determined through consideration of the following factors: toxicity of the compound, use patterns and the number of detections. These investigations may be limited to specific watersheds where the pesticide is heavily used or local practices result in unusually high discharges. Special studies will also be conducted to determine pesticide content of sediment and aquatic life when conditions warrant. Other agencies will be consulted regarding prioritization of monitoring projects, protocol, and interpretation of results.

These provisions focus on the general approach the Central Valley Water Board will use in determining whether a water quality problem related to pesticides exists. This procedure was generally followed in the investigation of water quality problems related to diazinon and chlorpyrifos. The Central Valley Water Board will need to continue following this procedure to determine if shifts in pesticides use patterns or use of alternatives to diazinon or chlorpyrifos require investigation or special studies. The Proposed Amendment includes provisions that address continued sampling and evaluation of pesticides. The Proposed Amendment has, therefore, been prepared in a manner consistent with this provision of the Pesticide Policy.

> The Board will conduct reviews of the management practices being followed to verify that they produce discharges that comply with water quality objectives. It is anticipated that practices associated with one or two pesticides can be reviewed each year. Since objective, control methods and other factors are subject to change, it is also anticipated that allowable management practices will change over time, and control practices for individual pesticides will have to be reevaluated periodically. (Basin Plan, pp. IV-34.00)

The proposed Basin Plan Amendment describes a role for the Central Valley Water Board in reviewing management practices and provides for periodic review of those practices. Dischargers of diazinon and chlorpyrifos will be responsible for providing that information to the Central Valley Water Board. The Basin Plan Amendment has, therefore, been prepared in a manner consistent with this provision of the Pesticide Policy.

> Public hearings will be held at least once every two years to review the progress of the pesticide control program. At these hearings, the Board will review monitoring results and identify pesticides of greatest concern, review changes or trends in pesticide use that may impact water quality, consider approval of proposed management practices for the control of pesticide discharges, set the schedule for reviewing management practices for specific pesticides; and consider enforcement action.
>
> After reviewing the testimony, the Board will place the pesticides into one of the following three classifications. When compliance with water quality objectives and performance goals is not obtained within the timeframes allowed, the Board will consider alternate control options, such as prohibition of discharge or issuance of waste discharge requirements.
>
> 1. Where the Board finds that pesticide discharges pose a significant threat to drinking water supplies or other beneficial uses, it will request DFA to act to prevent further impacts. If DFA does not proceed with such action(s) within six months of the Board's request, the Board will act within a reasonable time period to place restrictions on the discharges.
>
> 2. Where the Board finds that currently used discharge management practices are resulting in violations of water quality objectives, but the impacts of

> the discharge are not so severe as to require immediate changes, dischargers will be given three years, with a possibility of three one year time extensions depending on the circumstances involved, to develop and implement practices that will meet the objectives. During this period of time, dischargers may be required to take interim steps, such as meeting Board established performance goals to reduce impacts of the discharges. Monitoring will be required to show that the interim steps and proposed management practices are effective.
>
> 3. The Board may approve the management practices as adequate to meet water quality objectives. After the Board has approved specific management practices for the use and discharge of a pesticide, no other management practice may be used until it has been reviewed by the Board and found to be equivalent to or better than previously approved practices. Waste discharge requirements will be waived for irrigation return water per Resolution No. 82-036 if the Board determines that the management practices are adequate to meet water quality objectives and meet the conditions of the waiver policy. Enforcement action may be taken against those who do not follow management practices approved by the Board. (Basin Plan, pp. IV-34.00)

The Central Valley Water Board, through the Clean Water Act section 303(d) listing process, has reviewed available monitoring results for pesticides and has identified diazinon and chlorpyrifos as two of the pesticides of greatest concern, which is consistent with this provision of the Pesticide Policy.

As part of the review procedure identified in the Proposed Amendment, the Central Valley Water Board may consider enforcement action, which is consistent with this provision of the Pesticide Policy.

By adopting the Proposed Amendment, the Central Valley Water Board is effectively considering diazinon and chlorpyrifos to fall within classification three. Discharges of diazinon and chlorpyrifos will be regulated through implementation of either waste discharge requirements and/or an enforceable waiver of waste discharge requirements. This Basin Plan Amendment requires monitoring to demonstrate that proposed management practices are effective. The Proposed Amendment is, therefore, consistent with this provision of the Pesticide Policy.

> To ensure the best possible program, the Board will coordinate its pesticide control efforts with other agencies and organizations. Wherever possible, the burdens on pesticide dischargers will be reduced by working through the DFA or other appropriate regulatory processes. The Board may also designate another

> agency or organization as the responsible party for the development and/or implementation of management practices, but it will retain overall review and control authority. The Board will work with water agencies and others whose activities may influence pesticide levels to minimize concentrations in surface waters. (Basin Plan, pp. IV-35.00).

The Central Valley Water Board has been working with DPR since the 1990s to identify possible ways the two agencies can best coordinate to reduce diazinon and chlorpyrifos discharges and discharges of other pesticides of concern. Management practices for controlling diazinon have been added to the diazinon use label requirements (MANA, 2004), which are implemented by the County Agricultural Commissioners under DPR's supervision. Management practices for controlling diazinon and chlorpyrifos were incorporated in DPR's dormant spray regulations adopted in 2007. In addition, DPR has placed both diazinon and chlorpyrifos products under special review status called reevaluation, which may include the identification of management practices to control these pesticides.

The proposed Basin Plan Amendment would allow dischargers to use compliance with state and federal pesticide use regulations as part of their required management plans for pesticide reductions. The program of implementation established by the Proposed Amendment also retains the Central Valley Water Board's role in reviewing management practices and monitoring data, and determining what further control actions might be required. The Proposed Amendment has, therefore, been prepared in a manner consistent with this provision of the Pesticide Policy.

> Since the discharge of pesticides into surface waters will be allowed under certain conditions, the Board will take steps to ensure that this control program is conducted in compliance with the federal and state anti-degradation policies. This will primarily be done as pesticide discharges are evaluated on a case by case basis. (Basin Plan, pp. IV-36.00)

Anti-degradation policies have been explicitly considered in the development of the Proposed Amendment.

7.2.5 Application of Water Quality Objectives Policy

Excerpts from this policy are presented below. The full text can be found on page IV-16.00 of the Basin Plan.

Water quality objectives are defined as ‘the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water, or the prevention of nuisance within a specific area.’ Water quality objectives may be stated in either numerical or narrative form. Water quality objectives apply to all waters within a surface or ground water resource for which beneficial uses have been designated. The numerical and narrative water quality objectives define the least stringent standards that the Central Valley Water Board will apply to regional waters in order to protect beneficial uses. Where compliance with narrative objectives is required, the Central Valley Water Board will, on a case-by-case basis, adopt numerical limitations in orders which will implement the narrative objectives.

Where multiple toxic pollutants exist together in water, the potential for toxicological interactions exists. On a case-by-case basis, the Central Valley Water Board will evaluate data to determine whether there is a reasonable potential for interactive toxicity. Pollutants which are carcinogenic or which manifest their toxic effects on the same organ systems or through similar mechanisms will generally be considered to have potentially additive toxicity. The following formula will be used to assist the Central Valley Water Board in making determinations:

$$\sum_{i=1}^{n} \frac{[\text{Concentration of Toxic Substance}]_i}{[\text{Toxicologic Limit for Substance in Water}]_i} < 1.0 \quad \text{(Equation 6.1)}$$

The concentration of each toxic substance is divided by its toxicologic limit. The resulting ratios are added for substances having similar toxicologic effects. If such a sum of ratios is less than one, an additive toxicity problem is assumed not to exist. If the summation is equal to or greater than one, the combination of chemicals is assumed to present an unacceptable level of toxicologic risk.

This Basin Plan Amendment proposes the establishment of acute and chronic numeric objectives for diazinon and chlorpyrifos. Since diazinon and chlorpyrifos have the same toxicological effect, the program of implementation in the Proposed Amendment requires that the water quality objectives for diazinon and chlorpyrifos be considered additively using this equation from the section of the Basin Plan. Therefore, the proposed Basin Plan Amendment is consistent with the Policy for Application of Water Quality Objectives.

7.2.6 Watershed Policy

> The Central Valley Water Board supports implementing a watershed based approach to addressing water quality problems. The benefits to implementing a watershed based approach would include gaining participation of stakeholders and focusing efforts on the most important problems and those sources contributing most significantly to those problems. (Basin Plan, pp. IV-21.00)

The Central Valley Water Board conducted outreach to the stakeholders in the area covered by the Proposed Amendment as discussed in Chapter 12. This Report also focuses on identifying and addressing the uses of diazinon and chlorpyrifos that are likely contributing most significantly to their presence in Central Valley surface waters. Also, the Proposed Amendment recognizes that dischargers may work together in coalitions to implement a watershed-based approach. For these reasons, the proposed Basin Plan Amendment is consistent with the watershed policy.

7.3 Management Agency Agreement (MAA)with the California Department of Pesticide Regulation

The State Water Board and DPR have a MAA to ensure that pesticides registered for use in California are used in a manner that protects water quality and the beneficial uses of water, while recognizing the need for pest control (SWRCB and DPR, 1997). The State Water Board and Central Valley Water Board are responsible for protecting the beneficial uses of water in California, and for controlling all discharges of waste into waters of the state. DPR is the lead agency for pesticide regulation in California.

The MAA describes a four-stage process for DPR and the Water Boards to address potential water quality problems related to pesticides. Stage One is general outreach and education to prevent surface water contamination. Stage Two is a self-regulating response based on sponsors leading implementation efforts. Stage Three is a regulatory approach based on the authorities of DPR and the County Agricultural Commissioners. Stage Four is a regulatory approach based on Central Valley Water Board authorities.

Stages Two and Three include the development of numerical values (referred to as “Quantitative Response Limits”-QRLs) to assess success of mitigation efforts when no numerical water quality objectives are available. DPR is to develop QRLs after repeated valid detections of pesticides in surface water. The Stage

Four process under the MAA, regulation by the Central Valley Water Board, is to be considered when there is an actual or threatened violation of water quality standards; when the Regional or State Water Board finds that the stage two or three efforts are not protecting water quality; or when the Central Valley Water Board believes it is necessary to take action to protect water quality and meet its statutory obligations.

Stage One; general education to prevent surface water contamination was conducted in the Sacramento and San Joaquin River Basins by the Central Valley Water Board, DPR and others, starting in the early 1990s. Stage Two has not been put into effect for diazinon or chlorpyrifos in Sacramento and San Joaquin Valley water bodies. QRLs for diazinon or chlorpyrifos have not been developed and no sponsor has been identified. DPR began to implement Stage Three in February 2003 by placing diazinon into the reevaluation process, and later placed chlorpyrifos into reevaluation (DPR, 2003; DPR, 2004). In 2006, the DPR released dormant spray regulations. The regulations restrict ground and aerial applications of dormant season insecticides to areas 100 feet or more from any irrigation or drainage ditch, canal, or any other body of water in which the presence of dormant season insecticides could adversely impact any of the beneficial uses of the waters of the state. The regulations also specify wind speeds in which dormant insecticides may be applied. The regulations allow aerial application only if soil conditions do not allow field entry or approaching bloom conditions require aerial applications. The regulations prohibit all dormant insecticide applications when soil moisture is at field capacity and a storm event is forecast to occur within 48 hours following application, or when a storm event that is likely to produce runoff from the treated area is forecast to occur within 48 hours following application.

Since the diazinon and chlorpyrifos concentrations in the Sacramento and San Joaquin Valley water bodies have been found to exceed existing water quality objectives, the Central Valley Water Board is obligated by both federal and state law to develop a program to address the discharge of diazinon and chlorpyrifos, so the four-stage process applies. This Basin Plan Amendment allows DPR requirements to be taken into account as a component of management plans that are submitted by dischargers. DPR’s regulatory authorities can still be used in conjunction with this Basin Plan Amendment to address the control of diazinon and chlorpyrifos discharges.

8. Proposed Changes to Existing Basin Plan Provisions

The Proposed Amendment, which is included in Appendix C, includes changes to existing Basin Plan language. While this Staff Report presents the overall analysis supporting the Proposed Amendment, this section summarizes all the proposed changes to existing Basin Plan provisions.

8.1 Changes to Water Quality Objectives

The proposed Basin Plan Amendment would establish water quality objectives for diazinon and chlorpyrifos for water bodies throughout the Sacramento and San Joaquin River Basins, below the major dams, as shown in the Proposed Amendment in Table III-2A and discussed in Sections 2 and 4.

8.2 Changes to Chapter 1V, Implementation

8.2.1. Changes to the "Regional Water Board Prohibitions" Section.

The Proposed Amendment contains a new prohibition applicable to diazinon and chlorpyrifos discharges that are not regulated by a permit or waiver, as described in Section 5.

8.2.2. Changes to the "Pesticide Discharges from Nonpoint Sources" Section

Currently the three control programs for the control of diazinon and chlorpyrifos are included in the Implementation section under the heading of Pesticide Discharges from Nonpoint Sources. Including these provisions under this heading could give some users the impression that there are no requirements in these control programs for point sources. The wasteload allocations in these control programs are applicable to point sources, including municipal storm water and wastewater discharges. In addition to provisions for the control of diazinon and chlorpyrifos, this section contains a number of provisions that are applicable to how the Central Valley Water Board responds to pesticide discharges that are appropriate and applicable to the evaluation of pesticides, regardless of the regulatory classification of the source. Therefore, the Proposed Amendment would change the title of this section from “Pesticide Discharges from Nonpoint Sources” to simply “Pesticide Discharges.” This change will provide clarity to the applicability of the implementation requirements, regardless of the current classification of a particular source as a point source or nonpoint source, since these classifications can change.

The Proposed Amendment would add a new diazinon and chlorpyrifos control programs under “Pesticide Discharges from Nonpoint Sources”. The provisions of this new control program would include, provisions very similar to those currently included in the three current diazinon and chlorpyrifos control programs.

8.3 Changes to “Estimated Costs of Agricultural Water Quality Control Programs and Potential Sources of Financing” Section

The Proposed Amendment would add a cost estimate for the proposed control program. This cost estimate is discussed in Section 9.

8.4 Changes to Chapter 5, Surveillance and Monitoring

The Proposed Amendment would add a new surveillance and monitoring program as described in Section 6. The proposed monitoring provisions are similar to those already established for diazinon and chlorpyrifos but specify different requirements for agricultural discharges and storm water and wastewater discharges. The requirements for agricultural discharges in the Proposed Amendment are essentially the same requirements as previously established for the Sacramento, Feather, and San Joaquin Rivers and the Delta, but are extended to additional water bodies. A shorter set of monitoring goals is proposed for storm water and wastewater discharges.

9. Estimated Costs and Potential Sources of Funding

The Porter-Cologne Water Quality Control Act requires consideration of economics when water quality objectives are established. Additionally, it requires that "prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of financing, shall be indicated in any regional water quality control plan." In accordance with this requirement, the costs to meet the proposed water quality objectives and to implement the proposed program of implementation are estimated below, and the Proposed Amendment contains an estimate of the total costs for agriculture.

To meet regulatory and legal requirements and because it is not possible to disaggregate the estimated costs for compliance with the Proposed Amendment from other existing requirements that result in many of the same expenses, the costs of compliance with the proposed amendment was estimated without subtracting the already existing costs of compliance with existing requirements. Therefore in consideration of the estimated costs of the Proposed Amendment, it should be noted that without the proposed Basin Plan Amendment, the discharges of diazinon and chlorpyrifos would still need to be addressed under existing laws and regulations. These laws and regulations include the State's Nonpoint Source Policy and the existing Basin Plan water quality objectives for toxicity and pesticides discussed in Section 4 of this report, site-specific water quality objectives and control programs for diazinon and chlorpyrifos in the Sacramento, Feather and San Joaquin Rivers, and the Delta, and general implementation provisions for control of pesticide discharges from nonpoint sources.

All the Sacramento and San Joaquin Valley water bodies are upstream of one or more of the Sacramento River, the Feather River, the San Joaquin River, and the Delta. Therefore, some reductions in discharges of diazinon and chlorpyrifos have already been required. However, additional reductions are needed to meet the proposed numeric objectives, although these same reductions would likely be needed for compliance with narrative objectives under the ILRP, since the same criteria that were used for the proposed diazinon and chlorpyrifos water quality objectives are currently used by Central Valley Water Board programs when interpreting the narrative pesticide and toxicity objectives,.

Without the proposed Basin Plan Amendment, implementation of many of the practices that control diazinon and chlorpyrifos runoff would be required under pesticide use requirements and conditions including the existing and pending regulations discussed in Section 1, such as ILRP requirements. There is uncertainty regarding pending and recently adopted requirements and their costs and effectiveness; therefore, their costs could not be explicitly considered in the cost calculations provided in this report. Because of these existing requirements, these cost estimates should be considered high-end cost estimates.

9.1 Estimated Costs for Agricultural Management Practices

The following subsections present the estimated cost for reducing diazinon and chlorpyrifos discharges from agriculture.

9.1.1 Information sources

The cost of implementing agricultural management practices was estimated based on information considered in previous Central Valley Water Board staff reports as well as new sources of information about management practices costs and effectiveness, and the current implementation of agricultural management practices in agriculture in the Sacramento and San Joaquin River Basins. Previous Central Valley Water Board staff reports have examined the costs to agriculture of implementing management practices to reduce or eliminate agricultural discharges of diazinon and chlorpyrifos (Karkoski et al., 2003; Beaulaurier et al., 2005; McClure et al., 2006; Hann et al., 2007). These staff reports examined in detail the costs of management practices for irrigation season discharges from alfalfa and almonds and dormant season discharges from peaches, almonds, and apples. A base-case scenario for each crop was compared with alternative scenarios that reduced risk to water quality while still providing adequate pest control. Some of the alternative scenarios include the use of pesticides that present some risk to water quality, and therefore also include the use of cover crops to reduce runoff.

Since storm water runoff is considered to be the primary pesticide transport mechanism during the dormant season and irrigation runoff is the primary transport mechanism during the growing season, the suite of practices used to reduce pesticide runoff varied by season. It was assumed in those staff reports that dormant season practices would primarily be pesticide application practices, pest control practices (including use of less and/or alternative pesticides) and passive runoff control (e.g., buffer strips), since management of large volumes of storm water runoff may be impractical. For the growing season, it was assumed that practices to reduce pesticides in irrigation runoff would include pesticide application practices, pest management practices (including use of less and/or alternative pesticides), and irrigation water management practices. In support of the development of this and future pesticide Basin Plan Amendments, the Central Valley Water Board funded the researchers at the UC Davis to review current literature on costs and effectiveness of agricultural management practices to reduce pesticide discharges. The resulting study, *Agricultural Pesticide Best Management Practices Report* (Zhang et al., 2010) was used to inform the selection of management practices used to estimate costs.

Detailed information on the overall extent of implementation of agricultural management practices in the Central Valley is not currently available (ICF, 2010). The estimates of the overall implementation of agricultural management practices developed for the ILRP (ICF, 2010) were used to calculate overall costs incurred by agriculture as a result of this Amendment.

9.1.2 Practices Description, Costs, Effectiveness, and Applicability

As discussed in Section 5, a number of practices are available that can significantly reduce or eliminate agricultural discharges of diazinon and chlorpyrifos. Many of these practices are already being implemented by many of the agricultural dischargers in the Project Area. So for those growers, these practices are not *additional* costs. These practices include the use of alternatives to diazinon and chlorpyrifos for pest control (alternative pest management practices), and practices that reduce the potential for spills and off-site drift (pesticide application practices). These practices also include measures that reduce the amount of pesticide that is transported off-site via runoff, including water management practices and vegetation management practices. Water management practices include controlling surface irrigation (irrigation water management), using drip or micro sprinkler irrigation systems (pressurized irrigation systems), and capturing and re-using surface runoff (tailwater recovery system). Vegetation management practices include planting or allowing vegetation to grow on orchard floors (cover crop/conservation tillage) and planting or allowing growth of vegetation between fields and receiving waters (buffer strip / hedgerow).

While there are numerous practices and combinations of practices available to growers to reduce diazinon and chlorpyrifos discharges, the five practices listed in Table 9-1 provide a good representation of the range of options available to growers. These practices are effective in substantially reducing pesticide discharges and are likely to achieve the reductions necessary to attain the water quality objectives in the Proposed Amendment. One or more of these five practices are applicable to all crops on which diazinon and chlorpyrifos are used in the Central Valley. Costs are also relatively well characterized for these five practices. Therefore, these five practices were used to estimate the costs of implementing agricultural management practices to meet the water quality objectives in the Proposed Amendment.

Table 9-1 Agricultural Management Practices Used to Calculate Costs.

Practice Category	Management Practice
Pest management	Alternative pest management
Pesticide application	Pesticide application practices
Water management	Irrigation water management
Water management	Pressurized irrigation system
Water management	Tailwater Recovery System

Alternative pest management refers to strategies that can be used to control pests with reduced or no use of diazinon and chlorpyrifos. Pest control is achieved through the use of alternative pesticides, including those that pose less risk to water quality, practices such as orchard sanitation, maintaining habitat for beneficial insects, and integrated pest management (IPM) strategies to minimize the need for sprays of harmful insecticides. Alternative pest management scenarios examined in previous staff reports were used in this cost analysis (Karkoski et al., 2003, Beaulaurier et al., 2005). Pest management scenarios were developed using information from experts in pest management for the crops examined. These scenarios are expected to provide adequate levels of pest control so that no loss of yield is expected due to pest damage. The price of the pesticide is a small fraction of overall production costs. Therefore, the use of alternative pesticides generally did not represent a significant cost increase, unless the use of alternative pesticides made it more likely that multiple applications would be necessary to adequately control pests (Karkoski et al., 2003). In those cases, the costs of additional applications were included in the cost estimates for alternative pest control. The costs examined in this report, however, are for specific alternative pest management practices and not for the implementation of an entire IPM program for a certain crop.

Pesticide application practices involve actions to prevent spills and leakage during mixing, loading and application of pesticides, preparation for spill cleanup, and actions to properly target sprays and prevent spray drift such as proper sprayer calibration, turning off outward facing nozzles when spraying outside rows and not spraying right next to water bodies. Most of these practices are required by existing pesticide use regulations and laws; therefore, their costs are considered pre-existing and not a new cost resulting from the Proposed Amendment. Another effective pesticide application practice is the use of "smart sprayers" that use sensors to adjust sprayer nozzles to more precisely target sprays. In orchards, this results in approximately 15% - 40% less pesticide being applied, with reductions in concentrations in pesticide runoff estimated at 50% (Giles et al., 2011). While these sprayers have a high initial capital cost of approximately $15,000, the savings realized in the cost of pesticides and pesticide applications (due to less frequent need for fill-ups) can make the investment pay for itself within approximately two years (Giles et al., 2011).

Water management practices can involve management of both storm water and irrigation water by using vegetated buffers, grassed waterways, cover crops (which can also provide habitat for beneficial insects, reducing the need for sprays), reduced tillage, tailwater ponds and tailwater pump-back systems, and constructed wetlands. Water management can also involve reduced irrigation runoff through improvements in irrigation systems, such as installing pressurized irrigation systems, or the use of surge irrigation. The three water management practices used for this cost analysis are irrigation water management, pressurized irrigation systems, and tailwater recovery systems.

Irrigation water management is a group of actions taken before and during irrigation to reduce runoff while providing adequate water to crops. Irrigation water management includes pre-determining the optimal timing, amount, and design of irrigation events. In addition, actions should be implemented during irrigation to reduce runoff by adjusting size, duration, timing and flow rate to reduce runoff. The costs associated with irrigation water management are typically associated with the labor required to plan irrigation events and to monitor and adjust the irrigation as it is applied (Imperial Irrigation District (IID), 2007). While studies quantifying the effectiveness of this practice for diazinon and chlorpyrifos are not available, this practice is expected to result in significant reductions of transport of pesticides to surface water via tailwater discharges because irrigation water management can significantly reduce tailwater flows.

Pressurized irrigation systems include drip and sprinkler irrigation methods. Uniform distribution of irrigation water can be achieved through these methods without producing runoff. The primary costs associated with pressurized irrigation systems are the installation, use, and maintenance of the system. The use of pressurized irrigation systems can eliminate nearly 100% of the transport of diazinon and chlorpyrifos to surface water via irrigation tailwater discharges.

Tailwater recovery systems collect and reuse irrigation water runoff that would normally be discharged to surface waters. While tailwater recovery systems vary, the basic configuration consists of a pond or structure at the lower end of a field and a pump to elevate the water for distribution and re-use. Since they eliminate all surface runoff, tailwater recovery systems are expected to eliminate 100% of the transport of diazinon and chlorpyrifos to surface water via irrigation return flows.

Table 9-2 Agricultural Management Practice Costs

Management Practice	**Cost $/acre-yr. 2010 Dollars**[9]	**Reference**	**Notes**
Alternative pest management	$-17 to $219	Karkoski et al., 2003; Beaulaurier et al., 2005	Varies by crop (see Table 9-6)
Pesticide application practices	$ 0	USEPA, 2006; USEPA, 2002; Giles et al., 2011	Applicable to all acres treated.
Irrigation water management	$50-88	IID, 2007, ICF, 2010	Referred to as "Irrigation Scheduling and Event Management" in the IID source report
Pressurized irrigation system	$160	IID, 2007; ICF, 2010	
Tailwater Recovery System	$89	IID, 2007; ICF, 2010	

[9] (2) Costs were converted to 2010 dollars using the United States Department of Labor, Consumer Price Index Inflation Calculator (USDL, 2010).

9.1.3 Practices Applicable to Specific Crops

Practices from Table 9-1 were selected for all major crops to which diazinon or chlorpyrifos are applied. The practices selected were those that would be applicable to each crop and effective in reducing pesticide runoff from these crops, considering the timing of the diazinon and chlorpyrifos applications and potential pathways by which diazinon and chlorpyrifos enter surface waters (e.g. storm runoff, irrigation runoff, or spray drift). For each crop an expensive and a less expensive practice was applied to yield an estimated cost range. Practices selected for each crop are shown in Tables 9-5 and 9-6. Different practices were selected for dormant season applications and irrigation season applications. Since this Basin Plan Amendment would require meeting water quality objectives in smaller tributaries where less dilution available, the management practices selected were those likely to be more effective at reducing pesticide runoff. Pesticide application practices that would prevent discharges via spray drift, spills, etc. were considered applicable to all crops, but were considered a pre-existing cost due to current pesticide labels and other pesticide use laws and regulations. In most cases, costs of management practices were not crop-specific. For alternative pest control strategies, however, some crop-specific per acre costs were available and were used.

In this cost estimate, it was not assumed, as it had been in previous Basin Plan Amendment cost estimates for the Delta and Sacramento River (McClure et al., 2006, Hann et al., 2007), that compliance with DPR's dormant spray regulations and the revised diazinon label would provide enough control of dormant spray runoff from orchards to assure full compliance with the proposed water quality objectives. While the implementation of these regulations is believed to be significantly reducing diazinon and chlorpyrifos discharges, additional reductions could be needed in some of the smaller tributaries closer to the sources during the dormant season. For the orchard crops (almonds, plums and prunes, peaches, walnuts, and apples) examined in previous staff reports, alternative pest control strategies to dormant sprays of diazinon and chlorpyrifos are available and are effective in controlling pests and eliminating diazinon and chlorpyrifos discharges (Karkoski et al., 2003, Beaulaurier et al., 2005). The strategies examined either utilize products that pose low risk to water quality or involve practices to limit runoff of potentially high risk pesticides, such as pyrethroids. Implementation of alternative pest control strategies has a similar cost range for each of these deciduous fruit and nut crops (Karkoski et al., 2003, Beaulaurier et al., 2005). Therefore, the cost range for orchard crops was used to represent potential costs for other deciduous nut and fruit crops upon which diazinon and chlorpyrifos are used in the dormant season in the Sacramento and San Joaquin River Basins. Alternative pest management strategies are also likely useful in the irrigation season as well, but were not examined in detail in this analysis, as their costs are not as well documented as those for the dormant season. Nevertheless, if alternative pest management practices, such as the use of different pesticides, are shown to be economically viable for various commodities, they may also provide a less expensive alternative to the irrigation season practices used in this analysis.

The per-acre cost of implementation of practices did not include the potential cost savings from reduced water use or reduced soil loss, but did include potential fertilizer cost savings ranging from between $2 and $20/per acre for irrigation water management, pressurized irrigation system, and tailwater recovery systems (Hatchett, 2011). Additionally, many of these practices would help to reduce discharges of other pollutants of concern, such as sediment, herbicides, other pesticides, and nutrients, but this benefit was not quantified in the cost estimate.

Based on the information gathered and the subsequent analysis, it is evident that management practices are available that will result in the reduction or elimination of diazinon and chlorpyrifos in agricultural discharges from all crops to which they are applied. To get an idea of the relative magnitude of the costs of the practices examined, costs of these practices were compared to the University of California Cooperative Extension (UCCE) estimated costs of production for the five commodities with the most acreage treated with diazinon or chlorpyrifos during both the irrigation and dormant season, as shown in Tables 9-3 and 9-4. UCCE estimated cost of production for the various commodities ranged from about $1000 per acre per year for corn to over $14,000 per acre per year for cherries. The low-end cost estimates for dormant season practices for the crops ranged from a minor cost saving to no increase in the cost of production. The high-end cost estimates for dormant season practices for the various crops ranged from a minor cost savings to a 1% increase in the cost of production.

The estimated cost of irrigation season practices for the commodities examined ranged from 1% to 5% of the cost of production for the low cost estimates, and from 4% to 9% for the higher cost estimates. Since the cost of practices are likely a high-end estimate, actual percentages of production costs may be lower than estimated.

Table 9-3 Dormant Season Practices Costs Percent of Production Costs

Crop	Production cost $/ acre year	Management Practice Costs $/acre year		Management Practice Costs as % of Production Costs	
		low	high	low	high
Almonds	$3,811(Duncan et al., 2011)	$ -	$ 182	0%	5%
Plums	$4,930 (Niederholzer et al., 2008)	$ (-20)	$ 207	0%	4%
Peaches	$5,866 (Norton et al., 2011)	$ -	$ 163	0%	3%
Tomatoes	$2,283 (Miyao et al., 2007)	*	*	*	*
Cherries	$14,454(Grant et al., 2011)	$ (-20)	$ 207	0%	1%

* Applications to tomatoes during the dormant season are pre-emergent soil incorporations. These applications are not expected to produce contaminated runoff; therefore no costs are expected for applications to tomatoes during the dormant season.

Table 9-4 Irrigation Season Practices Costs Percent of Production Costs

Crop	Production Cost $/acre year	Management Practice Costs $/acre year		Management Practice Costs as % of Production Costs	
		low	high	low	high
Alfalfa	$1,362 (Mueller et al., 2008)	$ 50	$ 89	4%	7%
Almonds	$3,811 (Duncan et al., 2011)	$ 50	$ 160	1%	4%
Walnuts	$1,906 (Krueger et al., 2007)	$ 50	$ 160	3%	8%
Cotton	$1,087 (Huntmacher et al., 2003)	$ 50	$ 89	5%	8%
Corn	$977 (Brittan et al., 2008)	$ 50	$ 89	5%	9%

9.1.4 Calculation of Total Cost of Implementing Management Practices

Tables 9-5 and 9-6 summarize the calculation of the total cost of implementing agricultural management practices to achieve compliance with the proposed amendment. To calculate the total cost of implementing management practices, the costs per acre per year from above tables were multiplied by the number of acres to which practices would likely need to be applied. From the PUR database, the acres of each crop treated with diazinon or chlorpyrifos was determined for each year for 2004 through 2008. The average number of treated acres for each crop for 2004 through 2008 was then used to represent the treated acres for each crop.

Some of these treated acres are already under management practices. Since detailed land use information about management practices is not currently available, the estimates of the current level of agricultural management practice implementation from the Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program (ICF, 2010) were used to estimate the percentage of treated acres that are already under certain management practices. The treated acres from the PUR database were adjusted for the acres estimated to already be under certain management practices to determine the number of applicable treated acres for each crop and management practice. The applicable treated acres for each crop and management practice were then multiplied by the cost per acre for the least and most expensive management practices applied to each crop.

Separate calculations were done for the dormant season and the irrigation season, as different practices are applicable to controlling storm water runoff and irrigation runoff. The total of dormant season and irrigation season costs were then summed to estimate the total cost of implementing agricultural management practices. The crops explicitly included in these calculations constitute over 95% and 90% of the acres treated with diazinon or chlorpyrifos in the irrigation season and in the dormant season, respectively. For remaining crops, categorized as miscellaneous, the full range of management practice costs (the highest and lowest per acre costs) and highest and lowest percent of applicable acres were used to provide the high and low end estimates of cost. The resulting total estimated costs of implementing agricultural management practices in the dormant and irrigation season ranges from $5.0 to $21.6 million dollars per year, which is likely a high estimate.

Table 9-5 Irrigation Season Practices Total Cost Calculation

Crop	Acres Treated (1)	low cost management practice (2)	low cost $/acre-yr.	% of acres applicable (3)	low cost $/yr. (4)	high cost management practice (2)	high cost $/acre-yr.	% of acres applicable (3)	high cost $/yr. (4)
Alfalfa	88,773	irrigation water mgmt.	50	70%	3,107,052	tailwater recovery	89	90%	7,110,710
Almonds	67,617	irrigation water mgmt.	50	20%	676,169	pressurized irrigation	160	20%	2,163,741
Walnuts	63,436	irrigation water mgmt.	50	20%	634,361	pressurized irrigation	160	20%	2,029,954
Corn	19,649	irrigation water mgmt.	50	30%	294,732	tailwater recovery	89	90%	1,573,868
Cotton	7,924	irrigation water mgmt.	50	30%	118,867	tailwater recovery	89	90%	634,747
Grapes	6,405	irrigation water mgmt.	50	10%	32,027	pressurized irrigation	160	10%	102,487
Tomatoes	4,923	irrigation water mgmt.	50	50%	123,075	pressurized irrigation	160	50%	393,840
Plums (dried and fresh)	3,234	irrigation water mgmt.	50	20%	32,342	pressurized irrigation	160	20%	103,493
Sugarbeets	2,763	irrigation water mgmt.	50	30%	41,452	tailwater recovery	89	90%	221,354
Melons	2,639	irrigation water mgmt.	50	50%	65,973	pressurized irrigation	160	50%	211,115
Miscellaneous other crops (5)	*12,370*	irrigation water mgmt.	50	10%	61,851	various	160	90%	1,781,309
Total	***279,734***				***$5,187,900***				***$16,326,618***

Notes:
(1) 2005-2008 Average from PUR Database (CDPR 2010)
(2) pesticide application practices are also assumed to be applicable to all treated acres, but are considered to be pre-existing costs due to label requirements or otherwise negligible costs
(3) Based on information compiled in ICF, 2010, table 2-2
(4) cost = cost per acre * acres treated * % of acres applicable
(5) The lowest and highest per acre costs and percent of applicable acres was used to estimate the cost range for miscellaneous other crops.

Table 9-6 Dormant Season Practices Total Cost Calculation

Crop	Acres treated (2005-2008 avg.)	low cost management practice (1,2)	low cost $/acre-yr.	% of acres applicable	low cost $/yr. (3)	high cost management practice (1)	high cost $/acre-yr.	% of acres applicable	high cost $/yr. (3)
Almonds	11,659	alternative pest management	0	100%	0	alternative pest management	182	100%	2,121,976
Plums and Prunes	6,402	alternative pest management	*-20*	100%	*-128,043*	alternative pest management	207	100%	1,325,245
Peaches	6,393	alternative pest management	0	100%	0	alternative pest management	163	100%	1,042,005
Tomatoes	1,205	NA(4)	0	0%	0	NA(4)	0	0%	0
Cherries (5)	1,070	alternative pest management	*-20*	100%	*-21,393*	alternative pest management	207	100%	221,419
Apples	755	alternative pest management	*-17*	100%	*-12,840*	alternative pest management	178	10%	13,444
Misc. other crops (6)	2,742	alternative pest management	*-20*	100%	*-54,844*	alternative pest management	207	100%	567,639
Total	**30,226**				***- $217,120***				**$5,291,728**

Notes:
(1) Pesticide application practices are also assumed to be applicable to all treated acres, but are considered to be preexisting or negligible costs (2) Pest management scenarios are from Karkoski et al., 2003 and Beaulaurier et al., 2005. Costs were adjusted to 2010 dollars. (3) Cost = cost per acre * acres treated * % of acres applicable (4) Applications to tomatoes during the doormat season are pre-emergent soil incorporations. These applications are not expected to produce contaminated runoff; therefore no costs are expected for applications to tomatoes during the dormant season. (5) The cost range for scenarios for other stone fruit was applied to cherries. (6) The lowest and highest per acre costs was used to estimate the cost range for miscellaneous other crops.

9.2 Estimated Monitoring, Planning, and Evaluation Costs

9.2.1 Monitoring Planning and Evaluations Costs for Agriculture

For agricultural dischargers, monitoring and planning costs were estimated for three different approaches that growers could take: a watershed approach, an individual grower approach, and a hybrid approach. Coalition groups could implement the Basin Plan Amendment requirements for all growers (watershed approach), growers could work individually with the Central Valley Water Board (individual grower approach) to meet the Basin Plan Amendment requirements, or a watershed effort with monitoring of individual discharges (hybrid approach) could be implemented by individuals and the Coalitions. Approximately 2,400 growers reported approximately 8,000 applications of diazinon or chlorpyrifos in the Sacramento and San Joaquin River Basins, below the major dams watersheds in 2008 (DPR, 2010). For the purposes of this analysis, it is assumed that this number of growers would need to respond to this Basin Plan Amendment.

9.2.1.1. Watershed Approach

For a watershed approach, the estimated annual monitoring, planning, and evaluation cost is approximately $1.6 million per year for the approximately 2,400 growers who use diazinon or chlorpyrifos, or approximately $677 per grower. Watershed approach-based monitoring activities are likely to be combined with agricultural discharge monitoring, planning, and reporting and it is likely that the cost will be spread out over multiple agricultural dischargers throughout the Project Area. Therefore, these are likely high-end estimates.

The cost estimate for watershed monitoring assumes monitoring in 303(d)-listed water bodies. Many of these water bodies were originally selected for monitoring to be representative of discharges from important agricultural sources. Assuming these water bodies are still representative, monitoring these 303(d)-listed water bodies, with the right timing and frequency, should provide an indication of the concentrations of diazinon and chlorpyrifos throughout the Project Area. The monitoring sites and calculation of numbers of samples are shown in Table B-5 in Appendix B. Total costs estimates for watershed sampling are detailed in Table B-2 in Appendix B.

For the Delta Waterways, in addition to individually monitoring 303(d)-listed water bodies, representative monitoring in a subset of the 146 Delta Waterways is also assumed, as in the previous cost estimate for diazinon and chlorpyrifos monitoring (McClure et al., 2006). The cost estimates include sampling one representative Delta island drain in each of the six Delta subareas.

This monitoring estimate had a total of 68 sites in the Sacramento and San Joaquin Valleys selected for diazinon and chlorpyrifos monitoring in the dormant and/or irrigation seasons. The monitoring goals also require collection of information necessary to determine if the discharge contributed to an additive toxic effect and monitoring to determine if replacement products are impacting water quality. Therefore, analysis of occasional sediment and water samples for toxicity and replacement insecticides, such as other organophosphate, pyrethroids, and carbamate pesticides, is included at a subset of 20 of the 68 sites, and this is also included in the cost estimates. Although the additional monitoring for toxicity and potential replacement pesticides is only performed in a subset of the monitoring sites, cost estimates are similar to the diazinon and chlorpyrifos monitoring, since the cost per sample is much higher than only testing for diazinon and chlorpyrifos. Cost to monitor under the watershed approach is estimated at $1.1 million annually.

The monitoring costs are associated with determining compliance with water quality objectives, assessing potential impacts of replacement products and potential contributions of diazinon and chlorpyrifos to additive or synergistic toxicity. Additional costs for planning and evaluation by watershed groups include the development of annual monitoring and implementation plans, annual monitoring and implementation reports, and coordination of implementation activities. The calculation of the costs of these activities is shown in Table B-2 in Appendix B. The total cost for these activities is estimated at approximately $480,000 annually. The planning and evaluation costs are associated with ensuring management practices are implemented, determining the degree of implementation, and reporting on the effectiveness of the implementation efforts in meeting water quality goals.

9.2.1.2. Individual Grower Approach

The estimated per-grower costs for monitoring, planning, and evaluation using the individual grower approach are similar to those estimated in previous Central Valley Water Board reports (McClure et al., 2006; Beaulaurier et al., 2005[10]; Hann et al., 2007). If growers report directly to the Central Valley Water Board, the estimated monitoring, planning, and evaluation cost is approximately $2500 per grower for the approximately 2,400 growers in the Sacramento and San Joaquin River Basins, below the major dams, totaling approximately $6 million. These costs are detailed in Table B-3 in Appendix B and are explained in more detail below.

The cost incurred by each grower includes monitoring, planning, and reporting costs. To estimate monitoring costs for individual growers, it was assumed that samples would be collected from storm or irrigation runoff following half of the approximate 8,000 diazinon or chlorpyrifos applications that occur during a year. This is because not all fields or orchards will produce runoff following storms or irrigation events. Therefore approximately 4,000 samples per year would need to be collected for a total monitoring cost of approximately

[10] With cost corrections as described in Landau, 2006.

$2.3 million for monitoring alone. The monitoring costs are associated with determining compliance with water quality objectives. It is assumed that under a program where growers report directly to the Central Valley Water Board, data characterizing individual discharges would provide adequate information to meet all the monitoring goals, since growers using alternative pesticides would also likely be required to monitor their discharges, Having full characterization of discharges would allow for the determination of the potential to contribute to additive toxicity. Therefore, additional costs for analysis for other pesticides or toxicity monitoring were not included in the cost estimate for the individual grower approach.

In addition to monitoring, each grower would need to prepare a water quality monitoring plan and monitoring and evaluation reports. The cost to the grower for his/her time to prepare monitoring and implementation plans and reports is estimated to be approximately $1,560 annually, for a total annual cost of approximately $3.7 million for implementation planning, evaluation, and reporting. Sampling costs (estimated at $2.2 million) and monitoring and implementation plans and report costs (estimated at $3.7 million) total $6 million annually. It should be noted that this cost estimate could be substantially greater if these tasks were contracted out instead of conducted by the grower.

9.2.1.3. Hybrid Approach - Watershed Effort with Monitoring of Individual Discharges

A hybrid approach could be used where discharges of diazinon and chlorpyrifos are sampled by individual growers and a collective effort is used for preparing monitoring plans and reports. It is estimated that this approach would cost $2.8 million. This approach would be less expensive than the individual grower approach described above, since pooling resources would result in efficiencies and economies of scale, but more expensive than the watershed approach because more samples would be analyzed. (Under the watershed approach it was estimated that approximately 1,000 samples would need to be analyzed, while individual monitoring would require monitoring approximately 4000 samples.)

As in the individual grower approach, this estimate assumes approximately 4,000 diazinon and chlorpyrifos samples per year would need to be collected for a monitoring cost of approximately $2 million, including monitoring planning and reporting. Additionally, as in the watershed monitoring approach, occasional sediment and water toxicity analysis and analysis for replacement products is included in the cost estimate, as an additional $260,000 cost. This yields a total monitoring cost of approximately $2.3 million for monitoring individual discharges under a hybrid approach. These costs are detailed in Table B-4 in Appendix B.

As in the watershed approach, implementation planning, coordination, evaluation and reporting would be done on a coalition area basis, for a total cost of approximately $480,000. Therefore, the estimated annual monitoring, planning, and evaluation cost is approximately $2.8 million per year for the 2,400 growers who use diazinon or chlorpyrifos, or approximately $1200 per grower. While this alternative does not affect the potential range of costs, the cost of this alternative probably provides a likely high-end cost for monitoring, planning, and evaluation, as that growers would likely implement collective efforts to achieve cost savings. In the long run, if the number of discharges of diazinon or chlorpyrifos declines, and/or the amount of monitoring under the watershed approach has to be intensified in order to successfully identify sources in a watershed, a hybrid approach involving monitoring of individual discharges could become more similar in cost to the watershed monitoring approach.

9.2.2 Total Monitoring, Planning, and Evaluation Costs

The total cost for monitoring, planning, and evaluation would be approximately $1.6 to $6 million, depending on whether growers used a watershed approach or an individual approach, respectively.

9.2.3 Summary of Potential Cost to Agriculture

The estimated annual cost of monitoring, planning, and management practice evaluation ranges from approximately $1.6 to $6.0 million and the estimated annual cost of management practices ranges from $5 to $21.6 million. The total estimated cost to agriculture is $6.6 million to $27.6 million annually. These costs are a high end estimate, since they do not take into account other existing and potential future requirements, and since many of the applicable practices are already being implemented by many of the agricultural dischargers in the Project Area. Potential Sources of Financing for Agriculture The sources of funding identified in the Basin Plan for the agricultural subsurface drainage program and rice pesticide program are also potential funding sources for this program. These sources include:

1. Private financing by individual sources.
2. Bonded indebtedness or loans from government institutions.
3. Surcharge on water deliveries to lands contributing to the water quality problem.
4. Ad Valorem tax on lands contributing to the water quality problem.
5. Taxes and fees levied by a district created for the purpose of drainage management.
6. State or federal grants or low-interest loan programs.
7. Single purpose appropriations from federal or state legislative bodies (including land retirement programs).

Specific state and federal grant and loan programs include:

1. USDA Environmental Quality Incentive Program (EQIP) grants, administered by the Natural Resources Conservation Service (NRCS)
2. Clean Water Act Section 319 NPS Implementation Program grants
3. State Revolving Fund Loan program for NPS pollution

9.3 Estimated Costs to NPDES Permittees

Occasional monitoring by NPDES dischargers will be needed to determine if discharges have a potential to cause or contribute to an exceedance of the diazinon and chlorpyrifos water quality objectives. While monitoring and effluent limits for diazinon and chlorpyrifos have been included in some NPDES permits, they will likely need to be added to others. As in previous Basin Plan Amendments, it is assumed that additional treatment technologies will not be needed to meet the objectives within the compliance time period. In some cases, however, additional efforts may be needed by NPDES dischargers. These activities would include education and outreach efforts to encourage and facilitate proper disposal of remaining stored diazinon and chlorpyrifos, to encourage the use of integrated pest management to reduce the use of insecticides that pose significant risks to water quality. These education and outreach efforts can likely be performed within existing programs implemented by municipal storm water and wastewater dischargers, and are thus not expected to have significant additional costs. Therefore, the cost of the Proposed Amendment to NPDES dischargers should be the cost of monitoring for diazinon and chlorpyrifos, as well as monitoring for potential replacement products and potential additive toxic effects. These costs were estimated as described below and the detailed calculations are shown in appendix B. These costs of diazinon and chlorpyrifos monitoring will likely go down in the future as diazinon and chlorpyrifos concentrations are further reduced and requirements to monitor for them are relaxed or eliminated in response. Since pesticide uses and runoff concentration in urban areas are likely similar, collective programs for conducting representative monitoring and assessing potential replacement products and additive toxicity impacts could be implemented by storm water and, possibly, wastewater dischargers to meet Basin Plan requirements. If this approach were to be implemented by the dischargers, it would be much less expensive to implement.

Table B-6 shows the cost calculations for individual wastewater treatment plan compliance. In these calculations, it is assumed that monitoring four times per year for diazinon and chlorpyrifos and potential replacement products, and sediment chemistry and toxicity twice per year, during one year of the five-year permit cycle could adequately characterize concentrations in domestic wastewater treatment plant effluent. It is also assumed that toxicity monitoring will be already be required for these effluents as part of routine wastewater effluent monitoring., so that would not be an expense of the pesticide-specific Basin Plan requirements. The total cost of monitoring and reporting for the Basin Plan control programs is approximately $21,000 per five-year permitting cycle, or $4200 per year per facility.

Table B-7 shows the cost calculations for individual storm water discharger compliance. In these calculations, it is assumed that monitoring four times per year for diazinon and chlorpyrifos and potential replacement products and toxicity, and monitoring sediment toxicity and chemistry twice per year, during one year of the five-year permit cycle could adequately characterize concentrations in storm water. The total cost of monitoring and reporting for the Basin Plan control programs is approximately $31,000 per five-year permitting cycle, or $6200 per year for each storm water discharger. Table B-8 shows an alternative cost of compliance if a collective effort involving collective monitoring and reporting were uses. Under this program monitoring would be collected at representative facilities, but collected more frequently. Costs for this method of compliance were estimated at approximately $2300 per year for each storm water discharger.

Discharges of chlorpyrifos from the remaining non-agricultural uses have not been characterized or identified as significant sources, but there is potential for runoff from these sources. It is assumed that if discharges from these sites cannot be controlled when using chlorpyrifos, alternative products can be used at negligible added expense, as there are a number of insecticides available for general insect control in turf and other non-agricultural settings.

10. California Environmental Quality Act (CEQA) Review

This portion of the Staff Report primarily discusses the significant adverse environmental impacts that could occur as a result of the adoption of the Proposed Amendment, as well as the mitigation measures that could be employed to lessen these impacts. The discussion of these impacts, and the means by which these impacts can be mitigated, is mandatory pursuant to requirements imposed by the California Environmental Quality Act (CEQA) (Pub. Res. Code, § 21000 et seq.). Because the Board's basin planning process itself incorporates a rigorous environmental review, it has been deemed exempt from the requirement to prepare an environmental impact report. (Pub. Res. Code § 21080.5.; Cal. Code Regs., tit. 14, § 15251(g).)

When the Central Valley Water Board amends the Basin Plan, it first develops what is known as substitute environmental documentation, or an "SED." The SED contains a written report prepared for the board (this Staff Report), which must include an environmental analysis of the project. This environmental analysis must contain a description of the Proposed Amendment, a description of the significant or potentially-significant environmental effects that could occur as a result of the adoption of the Proposed Amendment, including those actions that would be considered reasonably-foreseeable methods of complying with the Proposed Amendment, and a description of the mitigation measures that could be imposed to lessen these potential environmental impacts. (Cal. Code Regs., tit. 23, § 3777.) The Board's environmental analysis must "take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites." (Pub. Res. Code § 21159(c).) A "reasonable range" does not require an examination of every site, but does require an examination of a reasonably-representative sample of them.

The Board's CEQA review determines the significance of environmental impacts relative to an environmental "baseline" that consists of the existing environment, absent the proposed project. In analyzing the potential direct and indirect environmental impacts that could result from the adoption and implementation of the Proposed Amendment, the Board made the following determinations:

- The Board used current agricultural practices as a baseline for determining the significance of the impacts that could be caused by the implementation of new agricultural management practices. Current crop management practices include field-crop and orchard maintenance such as tilling, irrigation, pest pressure assessments and responses, and runoff control, and the Board assumes the use of standard motorized farming equipment (e.g., tractors and their appurtenances –

tillers, spreaders, sprayers, etc.) and laborers to operate the equipment and to perform other normal crop-tending activities.

- The baseline for evaluating urban practices includes monitoring and outreach programs that are currently being implemented by municipalities to ensure compliance with waste discharge requirements, MS4 permits, and other regulatory measures, as well as the staff resources needed to implement such activities.
- Only those management practices (i.e., practices requiring materials or effort beyond that required for standard baseline agricultural activities) with the potential to significantly impact the environment are addressed in this analysis.
- The potential for management practices to significantly impact the environment are considered individually and cumulatively.

The selection of management practices for a particular site will be heavily dependent on local conditions, including, but not limited to, soil type, slope, crop, pesticide handling and application methods, timing, irrigation technology, and runoff control. In addition, pursuant to Water Code section 13360 the Board may not specify in waste discharge requirements or in any other order the manner in which regulated entities shall comply with the Board's requirements; the Board must allow regulated entities to comply with requirements in any lawful manner. Accordingly, the actual environmental impacts associated with the adoption of the Proposed Amendment will depend upon the particular suite of management practices that regulated entities will select in order to meet the performance goals delineated in the Basin Plan.

The Board expected that the phase-out of most urban uses of diazinon and chlorpyrifos would result in reductions of these pesticides from urban discharges to insignificant concentrations (Karkoski et al., 2003; Beaulaurier et al., 2005; McClure et al., 2006, Hann et al., 2007). However, as discussed in Section 1 of this Staff Report, recent monitoring data show that these reductions may not be occurring as quickly as anticipated. Therefore, the Board may be required to impose obligations on municipal storm water and wastewater dischargers to ensure that discharges of diazinon and chlorpyrifos into the water bodies addressed by the Proposed Amendment meet the proposed water quality objectives. The proposed control program may require urban dischargers to develop management plans to meet ensure their discharge will not cause or contribute to an exceedance of the objectives in the Proposed Amendment. Management plans are expected to include various control strategies to reduce the concentration of these pesticides in municipal storm water and wastewater dischargers, including education and outreach programs and monitoring programs. For wastewater treatment plants, evidence in the Board's files indicates that most facilities are already meeting their established wasteload allocations and that no additional actions will be required. However, wastewater treatment plants that receive combined wastewater and urban runoff flows may be an exception.

Pursuant to Public Resources Code section 21159, in conducting its analysis, the Board is not required to engage in speculation or conjecture; rather, this analysis evaluates reasonably foreseeable significant environmental impacts that could occur in each of the 18 Environmental Resource Categories due to the implementation of management practices employed by regulated entities to comply with the Proposed Amendment. This SED also describes measures by which potentially-significant environmental impacts could be managed or mitigated.

Index to CEQA Section

This Section consists of:

- A discussion of the types of Mitigation Measures discussed in this report (Section 10.1)
- A Project Description (Section 10.2).
- An Environmental Checklist (Section 10.3), which consists of an evaluation of the environmental impacts due to management measures that may be required to implement the Proposed Amendment.
- A Consideration of Economic Factors (Section 10.5).
- A Statement of Overriding Considerations (Section 10.6),
- A Preliminary Impact Determination (Section 10.7).

10.1 Mitigation Measures

The Central Valley Water Board is required to identify and analyze potentially-significant environmental effects that may occur as a result of the adoption of new standards, along with reasonably foreseeable mitigation measures that could reduce the significance of these potential effects. Mitigation is defined at California Code of Regulations, title 14, section 15370, as:

> (a) Avoiding the impact altogether by not taking a certain action or parts of an action;
> (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
> (c) Rectifying the impact by repairing, rehabilitating, or restoring the impacted environment;
> (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;
> (e) Compensating for the impact by replacing or providing substitute resources or environments.

Analyzing potential environmental impacts resulting from the adoption of an environmental policy or regulation (such as the Proposed Amendment) is considerably different from analyzing the types of impacts described in environmental impact reports for "typical" development projects (such as the building of limited amounts of residential housing or the construction of minor infrastructure projects). The environmental effects of a policy or regulation occur as a consequence of the implementation of management practices and/or the installation and operation of pollution control equipment utilized by regulated entities to comply with the policy or regulation, whereas the impacts analyzed in a "typical" environmental impact report occur as a result of the construction and operation of the project itself. Therefore, for the purposes of this environmental analysis, mitigation measures are considered those measures that could be implemented by regulated entities to ensure that the actions that they take comply with the Proposed Amendment result in minimal environmental impacts. Though the mitigation measures themselves might lead to further environmental impacts, any analysis of those attenuated impacts would be unduly speculative.

Because this review focuses on a program-level analysis of potential environmental impacts, it defers project-level environmental analyses to the time and place when the site-specific projects are approved. For example, a discharger or group of dischargers seeking waste discharge requirements from the Board must ensure that their discharges are in compliance with the Basin Plan, as amended, and may select among the methods of compliance identified in this evaluation, or may propose an innovative method of complying with the diazinon and chlorpyrifos provisions in the Basin Plan. Before the discharger's proposal is approved and the requirements are adopted, the Board will ensure that all elements of the Discharger's proposal have undergone environmental analysis, and that the site-specific environmental effects that could occur as a result of the Discharger's proposal are mitigated to the extent practicable.

Mitigation measures will be incorporated into the design and construction of site-specific projects. Implementation of the mitigation measures described below in each Environmental Checklist Category may be required through the Board's adoption of waste discharge requirements or waivers of waste discharge requirements, or may be imposed by other regulatory agencies as specified in the discussion.

10.2 Project Description

Project title

Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Discharges

Project sponsor's name and address

California Regional Water Quality Control Board, Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670

Contact person and phone number

Daniel J. McClure, P.E. Senior Water Resource Control Engineer (916) 464-4751

Project location

The Project Area extends from Shasta Dam, in the north, to Friant Dam, in the south, and includes water bodies in the Sacramento and San Joaquin Valley that lie below the major dams rimming the lower Sacramento and San Joaquin Valley watersheds, including:

- The lower Sacramento River watershed and the lower Feather River watershed, including the lower Sacramento River from below Shasta Dam to the Delta boundary and the lower Feather River from below Oroville Dam to the Sacramento River, and including tributaries to these watersheds below major dams;
- The Sacramento-San Joaquin Delta (Delta) as defined in Water Code section 12220, as well as the areas and tributaries that drain to the Delta below of major dams; and
- The lower San Joaquin River, from Friant Dam to the Delta boundary at Airport Way Bridge near Vernalis, and including tributaries to the lower San Joaquin River below major dams.

The land use in the Project Area, described further in the Section 1 of this Staff Report, is predominantly agricultural, but includes urban, open space/rangeland, public lands, and wildlife habitat.

General plan designation

Not applicable

Zoning

Not applicable

Description of project

The project is a Proposed Amendment to the Basin Plan that will establish water quality objectives to protect water bodies in the Sacramento and San Joaquin Valleys from impairment due to discharges of diazinon and chlorpyrifos associated with uses of these pesticides in agricultural operations and in urban areas.

The goal of the Proposed Amendment is to reduce diazinon and chlorpyrifos concentrations in Sacramento and San Joaquin Valley water bodies to levels that are protective of aquatic life (WARM and/or COLD) beneficial uses. The Proposed Amendment includes:

- Diazinon and chlorpyrifos water quality objectives for water bodies in the Sacramento and San Joaquin Valleys which have existing or designated WARM and/or COLD beneficial uses;
- Implementation requirements to ensure that the water quality objectives are achieved;

- Monitoring requirements to determine whether the objectives are being met;
- Provisions to address potential impacts from replacement pesticides; and

10.3 Environmental Checklist

Impacts due to implementation of new agricultural management practices: Following the adoption of the Proposed Amendment, which may result in additional scrutiny being placed on diazinon and chlorpyrifos discharges, regulated agricultural entities may need to implement additional management practices (or may need to implement already-imposed management practices on a shorter timeframe) to ensure that their discharges will be in compliance with the provisions of the Proposed Amendment. A range of these foreseeable management practices are described in Section 9.1.2. The Board used current agricultural practices as a baseline for determining the significance of the impacts that could be caused by the implementation of new agricultural management practices. For the most part, these new management practices consist primarily of minor modifications to currently-utilized standard agricultural practices.

Impacts due to implementation of new management practices in urbanized areas: Municipal dischargers may also be required to implement additional strategies or practices to reduce discharges of diazinon and chlorpyrifos. However, these impacts are expected to be fairly insignificant, because the phase-out of diazinon and chlorpyrifos in most urbanized uses will result in compliance without the implementation of significant new measures.

The Environmental Checklist consists of a category-by-category analysis of potential impacts in 18 Environmental Resource Categories. For each subcategory, the Board has evaluated the level of significance of the impacts that could occur due to the implementation of the Proposed Amendment. The four levels of potential impacts are described below.

> **"No Impact":** Most of the agricultural management practices that are expected to be utilized to meet the Proposed Amendment are based on generally-accepted standard agricultural practices. Where new management practices do not differ significantly from currently-implemented management practices, the new practices will not create negative impacts to environmental resources. Most, if not all, of the practices that are expected to be implemented in urban areas to fulfill the requirements of the Proposed Amendment are already being imposed by other regulatory programs. A "No Impact" box is checked in the Environmental Checklist if there are no potential significant environmental impacts associated with any new management practices.
>
> **"Less than Significant Impact":** A "Less than Significant Impact" box is checked if one or more new management practices could have an impact on the associated Environmental Resource Category, but this impact is considered to be less than significant.
>
> **"Less Than Significant Impact with Mitigation Incorporated":** A "Less than Significant Impact with Mitigation Incorporated" box is checked if one or more new

management practices could have a significant impact on the associated Environmental Resource Category, but mitigation measures can be incorporated that will reduce the potential significance of these impacts to less-than-significant levels.

"Potentially Significant Impact": A "Potentially Significant Impact" box is checked if one or more new management practices could have a significant impact on the associated Environmental Resource Category, and where mitigation measures would not reduce these potential impacts to less-than-significant levels.

Following the checklists for each Resource Category are discussions explaining the Board's rationale for how the checklists were filled out. Where mitigation measures must be incorporated to reduce the potential significance of the environmental impacts, or where the impacts remain potentially significant even after mitigation, the Board has included tables that explain the reasonably foreseeable methods of compliance, the reasonably foreseeable environmental impacts associated with the methods of compliance, and alternative methods of compliance or mitigation measures that could reduce the significance of these environmental impacts.

ENVIRONMENTAL RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT IMPACT	LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
I. AESTHETICS. Would the Project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☒
d) Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

Implementation of agricultural management practices to comply with the Proposed Amendment is unlikely to interfere with, degrade, or damage scenic resources because all the agricultural management practices within the range of practices likely to be implemented (described in Section 9.1.2) are expected to occur within presently-active agricultural acreage. Implementation of additional strategies or practices in urban areas to comply with the Proposed Amendment is unlikely to cause impacts to aesthetics because construction activities are not expected in urban areas.

ENVIRONMENTAL RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT IMPACT	LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED	LESS THAN SIGNIFICANT IMPACT	NO IMPACT

II.	AGRICULTURAL AND FORESTRY RESOURCES. Would the project:				
a)	Convert Prime Farmland, Unique Farmland, or Farmland of Statewide importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b)	Conflict with existing zoning for agricultural use or a Williamson Act contract?	☐	☐	☐	☒
c)	Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)) or timberland (as defined by Public Resources Code section 4526)?	☐	☐	☐	☒
d)	Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e)	Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

Implementation of management practices to comply with the Proposed Amendment is not expected to have any impacts on agricultural or forestry resources because they are not expected to result in the conversion of any agricultural or forestry lands to other uses. Management practices have already been developed and are already commonly used to manage pollutants and to conserve water; the Proposed Amendment is not expected to cause drastic changes in currently-employed management practices. It is likely that only relatively small portions of agricultural areas (e.g., field or orchard borders) will be removed from, or dedicated to, non-production implementation practices. Any agricultural areas converted to re-use, store, or treat recycled drainage water are considered as supplemental to standard, local, and project-level agricultural operations and, therefore, they remain agricultural uses. As a result, the implementation of management practices to comply with the Proposed Amendment would have no impact on agriculture and forestry resources.

Environmental resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
III. AIR QUALITY. Would the Project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☒	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)?	☐	☒	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☒	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐

Some of the alternative pest management practices could lead growers to switch from diazinon and chlorpyrifos to other pesticides. However, the reduced use of diazinon and chlorpyrifos would likely result in an improvement in air quality, even with an increase in the use of alternative pesticides, such as carbaryl or pyrethroids (Segawa, personal communication, 2010). These alternative pesticides are less volatile than chlorpyrifos and diazinon, as summarized in the California Department of Pesticide Regulation Environmental Fate Reviews (http://www.cdpr.ca.gov/docs/emon/pubs/envfate.htm), and consequently these possible replacements would be less prone to drift.

Although the switch to alternative pesticides will result in a positive effect on air quality, many counties within, or peripheral to, the Sacramento and San Joaquin Valley watersheds are designated by the USEPA as marginal, serious, or non-attainment areas for the federal 8-hour ozone standard or PM2.5 standard (USEPA, 2009). Because these areas already experience substantial air impairments, the Board is sensitive to any potential incremental negative impacts that might occur as the result of new regulatory actions. For the Proposed Amendment, minor incremental impacts could be caused by the construction and/or maintenance of measures designed to ensure compliance with the Proposed Amendment. As described below, all of these potentially-significant impacts can be mitigated to less than significant levels.

Table 10-1. Potential Air Quality Impacts and Associated Mitigation Measures

Management Practices Implemented to Comply with Proposed BPA	Potentially Significant Impacts	Mitigation Measures and Alternatives
Dischargers may change water management practices to reduce water use	▪ Changes to agricultural water management practices should result in improved water conservation, but could lead to drier croplands and, hence, a greater potential for airborne particulates. (Air Quality Impacts b, c, and d.)	Mitigation Measure III.1: Careful application timing of water or dust suppression chemicals and planting of cover crops or conservation tillage to mitigate windborne dust to less than significant levels.
Dischargers may need to construct features such as tailwater recovery systems or install pressurized irrigation.	▪ Earthmoving-based management practices could result in short-term, localized fugitive dust or emissions of criteria air pollutants from the exhaust of heavy equipment. (Possible Air Quality Impacts b, c, and d.) ▪ Motor emissions from construction activities may include criteria air pollutants and precursors of primary concern, ozone precursors (Reactive Organic Gas (ROG) and nitrogen oxide air pollutants (NO_X)), particulate matter with an aerodynamic resistance diameter of 10 microns or less (PM10), and fine particulate matter with an aerodynamic resistance diameter of 2.5 microns or less ($PM_{2.5}$). (Air Quality Impacts b, c, and d)	Mitigation Measure III.2: Construction contractors and system operators shall implement the following Best Management Practices (BMPs) as applicable during construction and operations: ▪ If necessary, facilities shall be required to comply with the rules and regulations from the applicable Air Quality Management District (AQMD) or Air Pollution Control District (APCD). ▪ Minimize idling time either by shutting equipment off when not in use or reducing the time of idling. ▪ Comply with state regulations to minimize truck idling. ▪ Maintain all equipment in proper working condition according to manufacturer's specifications. ▪ Use electric equipment when possible.
Dischargers will operate management features, such as diesel-powered wells in tailwater recovery systems.	▪ Diesel emissions or emissions from other engines may include criteria air pollutants and precursors of primary concern, ozone precursors (Reactive Organic Gas (ROG) and nitrogen oxide air pollutants (NO_X)), particulate matter with an aerodynamic resistance diameter of 10 microns or less (PM10), and fine particulate matter with an aerodynamic resistance diameter of 2.5 microns or less ($PM_{2.5}$). (Air Quality Impacts b, c, and d)	Mitigation Measure III.3: Facilities shall be required to comply with the rules and regulations from the applicable AQMD or APCD, and all equipment should be maintained in proper working condition according to manufacturer's specifications.

Environmental resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. BIOLOGICAL RESOURCES. Would the Project:				
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 California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐	☐
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?	☐	☐	☒	☐

The Sacramento and San Joaquin River Basins encompass thousands of acres of wetlands and marshes, and hundreds of species of birds and fish inhabit these watersheds. Seasonal wetlands and rice fields provide habitat for migratory birds of the Pacific Flyway, such as the state-listed Greater Sandhill Crane. In addition, several anadromous fish species such as American shad, salmon, steelhead trout, striped bass, and sturgeon reside in the lower-elevation rivers and streams during at least part of their life cycle, or pass through these water bodies on their way upstream to spawn. Many of the species that reside or migrate through the Delta’s wetland and upland areas are federally- or state-listed as endangered, threatened, rare, or candidate species.

The Proposed Amendment is designed to benefit biological resources by reducing diazinon and chlorpyrifos in surface waters. In general, management practices would be implemented on existing agricultural lands, which are unlikely to support native vegetation or special-status plants. Potential impacts do exist, though; regulated entities could shift to potentially more toxic pesticide alternatives or employ water conservation measures that may result in a loss of water entering downstream waterways. However, it is anticipated that the loss of sensitive communities or special-status plants resulting from reduced runoff would be minimal because habitats only present during times of irrigation are unlikely to support sensitive communities or special-status plants. The potentially significant impacts of implementing this project on biological resources are described in more detail below, along with the recommended mitigation measures for these impacts.

Table 10-2 Potential Biological Resource Impacts and Associated Mitigation Measures

Management Practices Implemented to Comply with Proposed BPA	Potentially Significant Impacts	Mitigation Measures and Alternatives
In order to prevent discharges of diazinon and chlorpyrifos from entering surface waters, dischargers may implement water management practices that reduce agricultural runoff, such as recirculating water or further limiting the application of irrigation water.	▪ These management practices could adversely affect riparian habitat and/or candidate, sensitive, or special status species that depend on agricultural surface runoff (Biological Resources Impacts a, b) ▪ These management practices could have a substantial effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (Possible Biological Resources Impact c)	Mitigation Measure IV.1: Where alternatives exist for preserving riparian habitat created by agricultural runoff, dischargers shall explore ways to preserve that habitat. Mitigation Measure IV.2: Regulated entities shall conduct a delineation of affected wetland areas to determine the acreage of loss in accordance with current United States Army Corps of Engineers (USACE) methods prior to implementing any management practice that will result in the permanent loss of wetlands. For compliance with the CWA section 404 permit and WDRs, compensate for the permanent loss (fill) of wetlands and ensure no net loss of habitat functions and values. Compensation ratios will be determined through coordination with the Central Valley Water Board and USACE as part of the permitting process. Compensation may be a combination of mitigation bank credits and restoration/creation of habitat, as described below: ▪ Purchase credits for the affected wetland type (e.g., perennial marsh, seasonal wetland) at a locally approved mitigation bank and provide written evidence to the resource agencies that compensation has been established through the purchase of mitigation credits. ▪ Develop and ensure implementation of a wetland restoration plan that involves creating or enhancing the affected wetland type.
Dischargers may need to construct features such as tailwater recovery systems, small-scale wetlands, or retention ponds (typically less than 5-acres) to prevent diazinon/chlorpyrifos discharges from entering surface waters.	Construction activities could adversely affect riparian habitat and/or candidate, sensitive, or special status species that depend on agricultural surface runoff (Possible Biological Resources Impacts a, b)	Mitigation Measure IV.3: Where detention basins are to be abandoned, retain the basin in its existing condition or ensure that sensitive biological resources are not present before modification. Mitigation Measure IV.4: Prior to constructing management features that may impact candidate, sensitive, or special status species, growers shall prepare a site assessment report to be submitted to CDFW for its review. It shall evaluate the project site's potential to

		support special-status plant and wildlife species (including critical habitat) and whether special-status species could be affected by construction and operations. If there are no special-status species or critical habitat present, no additional mitigation would need to be implemented. If the site assessment determines that special-status species could be affected by constructed features a plan, prepared by a qualified biologist, to mitigate or avoid any significant impacts on special-status species. This plan should be forwarded to the appropriate regional office of the CDFW, the Endangered Species Unit of the USFWS in Sacramento, and/or NMFS for review and approval of the mitigation strategy, when appropriate.

Environmental resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
V. CULTURAL RESOURCES. Would the Project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geological feature?	☐	☒	☐	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐

Cultural resources include historical or archaeological resources, unique paleontological resources, geological features, or human remains (Pub. Res. Code, § 21159). Implementation of management practices to comply with the Proposed Amendment are unlikely to affect cultural resources, since most of the management practices will disturb only previously-developed agricultural areas and are not expected to disturb additional areas. Because projects undertaken to comply with the requirements of the Proposed Amendment will not affect any known cultural resources, any potential impacts to cultural resources would occur as a result of construction occurring where previously-undiscovered cultural resources are located. The potentially significant impacts of implementing this project on cultural resources and their associated mitigation measures are described in more detail below.

Table 10-3 Potential Cultural Resource Impacts and Associated Mitigation Measures

Management Practices Implemented to Comply with Proposed BPA	Potentially Significant Impacts	Mitigation Measures and Alternatives
Dischargers may need to construct features such as tailwater recovery systems, small-scale wetlands, or retention ponds (typically less than 5-acres) to prevent diazinon/chlorpyrifos discharges from entering surface waters.	▪ Construction activities could adversely affect previously undiscovered archaeological resources, unique paleontological resources, geological features, or human remains (Possible Cultural Resources Impacts a, b)	Mitigation Measure V.1: If the implementation of management practices reveals previously undiscovered cultural resources, standard mitigation measures required by local ordinances will be followed, along with the mitigation measures listed below. ▪ Project redesign, such as the relocation of facilities outside the boundaries of archeological or historical sites. ▪ Where construction within areas that are likely to contain cultural resources cannot be avoided, conduct an assessment of the potential damage to cultural resources prior to construction; this may include hiring a qualified cultural resources specialist to identify evidence of cultural resources and to observe major excavation and earth-moving activities. ▪ Where assessment indicates that damage may occur, submit a non-confidential records search request to the appropriate California Historical Resources Information System information center and implement their recommendation. ▪ Where adverse effects to cultural resources cannot be avoided, develop site-specific mitigation measures to avoid or minimize the potential impacts. ▪ If any archaeological, paleontological, or historical resources are discovered during construction activities, construction should stop within the vicinity of the find and a qualified cultural resources specialist should assess the significance of the resources. If necessary, the cultural resources specialist will develop appropriate treatment measures for the find. ▪ If any human remains are

		discovered during construction activities, no further excavation or other site disturbance takes place. The local coroner must make a determination as to whether the remains are of Native American origin, or whether an investigation into the cause of death is required. If Native American remains are identified and descendants are found, the descendants may inspect the site of the discovery of the remains. The descendants may recommend means for treating or disposing of the remains within 48 hours of inspecting them. If the landowner rejects the recommendation of the descendants, the descendants fail to make a recommendation, or no descendants are identified, then the landowner re-inters the remains and any items associated with the Native American burials on the property in a location not subject to future subsurface disturbance.

ENVIRONMENTAL RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT IMPACT	LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
VI. GEOLOGY AND SOILS. Would the Project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction	☐	☐	☐	☒

or collapse?				
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒

Implementation of management practices to comply with the Proposed Amendment would result in a beneficial effect, if any, on geology and soils. Management practices will likely reduce soil erosion and sediment discharges and should result in improved water conservation. No significant seismic impacts are expected.

Any activities undertaken to comply with the Proposed Amendment that may disturb soils or sediments must comply with existing Basin Plan narrative water quality objectives for sediment and turbidity. Water and drainage management practices implemented by agricultural dischargers to comply with the proposed regulation are likely to reduce soil erosion and loss of topsoil that is already occurring in the Project Area.

ENVIRONMENTAL RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT IMPACT	LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
VII. GREENHOUSE GAS EMISSIONS. Would the Project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐
b) Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐

Global climate change refers to observed changes in weather features that occur across the Earth as a whole, such as temperature, wind patterns, precipitation, and storms, over a long period (CAT, 2006; CEC, 2006a; CEC, 2008; IPCC, 2007). Global temperatures are regulated by naturally-occurring atmospheric gases, such as water vapor, carbon dioxide, methane, and nitrous oxide. These gases allow sunlight into the Earth's atmosphere, but prevent radiative heat from escaping into outer space, thus altering Earth's energy balance in a phenomenon called the "greenhouse effect." The term "natural greenhouse effect" refers to how greenhouse gases trap heat within the system-troposphere system; the term "enhanced greenhouse effect" refers to an increased concentration of greenhouse gases (GHGs), which results in an increase in temperature of the surface-troposphere system. The three GHGs that could be generated during some agricultural practices are carbon dioxide, methane, and nitrous oxide.

GHGs tend to accumulate in the atmosphere because of their relatively long lifespan. Consequently, their impact on the atmosphere is mostly independent of the point of emission. In other words, GHG emissions are more appropriately evaluated on a regional, state, or even national scale, rather than on an individual level. Further, given the magnitude of state, federal, and national GHG emissions, it is unlikely that the minor amounts of GHG emissions resulting from vehicle and equipment exhaust would result in a discernible effect on global climate change. Consequently, this impact is considered less than significant at the local level, and no mitigation is required.

The primary source of GHG emissions related to management practices to comply with the Proposed Amendment will be from construction activities that require the use of fossil fuels. Expected construction activities include construction of retention ponds, which should only require short-term use of motorized equipment. Diesel-powered pumps for tailwater recovery systems may also generate a minor amount of GHGs. The GHG emissions from these sources are expected to be transitory and short term; therefore, the associated GHG emissions are expected to be miniscule.

A secondary source of GHG emissions is related to additional vehicle trips to conduct required monitoring. However, thorough monitoring of surface water bodies and of agricultural management practices is already standard practice for most agricultural operations, which means that additional vehicle miles would represent an insignificant contribution to GHG emissions.

Environmental resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
VIII. HAZARDS AND HAZARDOUS MATERIALS. Would the Project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒	☐
d) Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code §65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☒	☐
e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project result in a safety hazard for people residing or working in the Project area?	☐	☐	☒	☐
f) For a Project within the vicinity of a private airstrip, would the Project result in a safety hazard for people residing or working in the Project area?	☐	☐	☒	☐
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☒	☐

Implementation of management practices to comply with the Proposed Amendment is not expected to create a hazard to the public or the environment through the improper transport, release, use, or disposal of hazardous materials (e.g., pesticides or biological materials), or the accidental release of hazardous materials to the environment. The management practices should result in a decrease in pesticide usage or the use of pesticides that are less hazardous than chlorpyrifos and diazinon.

The primary pesticides that are used as alternatives to diazinon and chlorpyrifos that are potentially more hazardous than diazinon or chlorpyrifos, such as azinphos-methyl, methidathion, and carbaryl, are restricted use pesticides. Restricted use pesticides require permits to purchase and apply, and usually require special handling procedures. , So if a discharger chooses to use an alternative to diazinon and chlorpyrifos which is a restricted use pesticide, there will not likely be an increase in hazards or hazardous materials. It is not known how many dischargers may choose to use an alternative which is a restricted use pesticide, and it is anticipated that some dischargers would choose to use an alternative pesticide that is not on the restricted use list, which could mean a reduction in hazardous material. Thus, it is not expected that implementation of management practices to comply with the Proposed Amendment will result in increased environmental, worker, or public exposure to hazards or hazardous material.

Environmental resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
IX. HYDROLOGY AND WATER QUALITY. Would the Project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?	☐	☐	☒	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that results in flooding on- or off-site?	☐	☐	☒	☐
e) Create or contribute runoff water that exceeds the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐
f) Otherwise substantially degrade water quality?	☐	☒	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☒	☐
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

The Proposed Amendment is designed to ensure that existing surface water quality impairments will improve through the implementation management practices. For example, tailwater recovery would allow for the collection of surface runoff that could contain levels of pesticides that are above applicable water quality objectives, and would direct this water to a tailwater pond instead of to a natural water body. However, these practices could increase infiltration into soil and could potentially result in impacts to groundwater.

Improved water management would benefit water quality by improving the application of water and reducing runoff. Drip irrigation would improve groundwater and surface water quality because water would be applied at a rate that would allow for maximum plant consumption and would minimize the amount of groundwater infiltration, resulting in groundwater quality improvements.

Soils with moderate to high clay or organic matter content could also mitigate leaching. For example, pyrethroids, and some of the other alternatives to diazinon and chlorpyrifos, have very high soil or organic adsorption coefficients indicating that they would likely bind tightly to soils or organic materials and are unlikely to leach into groundwater. Other pesticides break down quickly through photolysis or microbial decomposition and, therefore, might not persist long enough to be leached into groundwater.

Water management practices, such as tailwater recovery systems, may reduce the amount of flow to some water bodies, slightly altering hydrologic patterns, but the amount of alteration is not considered a significant hydrologic impact. Implementation of the management practices would not increase erosion or siltation. In addition, implementation of management practices would only affect agricultural fields and would not alter any natural water body. None of the agricultural management practices, including changes to the timing of agricultural discharges to reduce diazinon and chlorpyrifos in runoff, are likely to result in changes in drainage patterns that would increase erosion or siltation, increase the rate or amount of surface runoff, increase the risk of flooding, contribute to increases in storm water runoff that would exceed the capacity of storm water drainage systems, or increase the chance of inundation by seiche, tsunami, or mudflow. Likewise, practices implemented for controlling pesticides in urban areas would not be expected to change drainage patterns significantly. Therefore, drainage patterns are not expected to be affected by implementation of management practices to comply with the Proposed Amendment.

The potentially significant impacts and associated recommended mitigation measures are described in more detail below.

Table 10-4. Potential Hydrology and Water Quality Impacts and Associated Mitigation Measures

Management Practices Implemented to Comply with Proposed BPA	Potentially Significant Impacts	Mitigation Measures and Alternatives
In order to prevent discharges of diazinon and chlorpyrifos to surface waters, dischargers may implement water management practices that result in increased infiltration.	▪ The infiltration of water with pesticides could negatively impact groundwater. (Potential Hydrology and Water Quality Impacts a, f)	Mitigation Measure IX.1: Dischargers or Coalitions will develop groundwater quality management plans to minimize waste discharges to groundwater from irrigated agricultural lands. The development of a groundwater quality management plan involves the collection and evaluation of groundwater data, identification of areas and constituents of concern, prioritization of the areas and constituents of concern, and the identification of the agricultural practices that may be causing or contributing to the problem.
Dischargers may apply alternatives to diazinon and chlorpyrifos, such as pyrethroids and carbamates.	Alternatives to diazinon and chlorpyrifos, such as pyrethroids and carbamates, could have a negative effect on water quality and aquatic organisms. (Potential Hydrology and Water Quality Impacts a, f)	Mitigation Measure IX.2: Dischargers or Coalitions will evaluate whether alternate pesticides they may consider for replacing diazinon or chlorpyrifos could potentially result in groundwater contamination or violation of water quality standards, and will be required to take measure to ensure discharges of pesticides will not result in groundwater contamination or a violation of water quality standards.

Environmental resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
X. LAND USE AND PLANNING. Would the Project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable Habitat Conservation Plan or Natural Community Conservation Plan?	☐	☐	☒	☐

Implementation of the Proposed Amendment should not result in any changes in land use or planning (Subsection II). Implementation of the Proposed Amendment will not physically divide an established community, nor conflict with any applicable land use plan, policy, or regulation. The Board has no evidence that the Proposed Amendment will not conflict with any Habitat Conservation Plans, Natural Community Conservation Plans, or other policies adopted for the purpose of avoiding or mitigating an adverse environmental effect. It is unlikely that implementing management plans to comply with the Proposed Amendment will cause any conversion of agricultural lands to other uses.

Environmental resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
XI. MINERAL AND ENERGY RESOURCES. Would the Project:				
a) Result in the loss of availability of a known mineral or energy resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

Implementation of the management practices to comply with the Proposed Amendment would not result in the loss of any known mineral resource.

Environmental resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
XII. NOISE. Would the Project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
c) A substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project?	☐	☐	☒	☐
e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project expose people residing or working in the Project area to excessive noise levels?	☐	☐	☐	☒
f) For a Project within the vicinity of a private airstrip, would the Project expose people residing or working in the Project area to excessive noise levels?	☐	☐	☐	☒

Management practices employed to satisfy the requirements of the Proposed Amendment may include a variety of construction activities to reduce diazinon and chlorpyrifos runoff. Use of heavy equipment, power tools, generators and other equipment could temporarily increase noise in the construction areas, but these noises would be indistinguishable from existing noise levels at sites where these activities would be expected to occur.

Environmental Resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
XIII. POPULATION AND HOUSING. Would the Project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

The Proposed Amendment will likely result in changes in pest management practices on certain crops, but those changes would not directly or indirectly induce population growth in the area, displace existing housing, or displace people. Therefore, no potential significant impacts are expected.

Environmental Resource Category	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
XIV. PUBLIC SERVICES.				
a) Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

The implementation of the Proposed Amendment would not result in foreseeable significant impacts to public service, or lead to the necessity for additional public service facilities. The increased costs to municipal dischargers are not likely to be significant, due to the fact that these entities are already required to meet narrative water quality objectives pursuant to permits issued by the Board, such as MS4 Permits and waste discharge requirements.

Therefore, the Proposed Amendment should not affect municipal budgets to the detriment of the provision of public services.

ENVIRONMENTAL RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT IMPACT	LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
XV. RECREATION.				
a) Would the Project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the Project include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☐	☐	☒

It is not anticipated that the Proposed Amendment would increase or decrease the use of recreational facilities, create a need for new recreational facilities, or result in any other foreseeable impact on recreational opportunities.

ENVIRONMENTAL RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT IMPACT	LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
XVI. TRANSPORTATION / TRAFFIC. Would the Project:				
a) Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio to roads, or congestion at intersections)?	☐	☐	☐	☒
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion/management agency for designated roads or highways?	☐	☐	☐	☒
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that result in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Result in inadequate parking capacity?	☐	☐	☐	☒
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☒

The Proposed Amendment should not have a significant or long-term impact on transportation/traffic. None of the agricultural implementation practices will result in changes in traffic or require changes in traffic infrastructure.

ENVIRONMENTAL RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT IMPACT	LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
XVII. UTILITIES AND SERVICE SYSTEMS. Would the Project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the Project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider, which serves or may serve the Project, that it has adequate capacity to serve the Project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the Project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

The Proposed Amendment would not result in foreseeable significant impacts that would cause a burden on existing utilities and service systems. It is likely water supply quality will improve as less diazinon and chlorpyrifos will be released to surface water bodies.

ENVIRONMENTAL RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT IMPACT	LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
XVIII. MANDATORY FINDINGS OF SIGNIFICANCE.				
a) Does the Project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☒	☐	☐	☐
b) Does the Project have impacts that are individually limited but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☒	☐	☐
c) Does the Project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☒	☐

The Proposed Amendment is designed to reduce diazinon and chlorpyrifos impairments in Sacramento and San Joaquin Valley water bodies, and to ensure that alternatives will not degrade water quality. The water quality objectives established by the Proposed Amendment are designed to eliminate detrimental aquatic life impacts due to diazinon and chlorpyrifos in the Sacramento and San Joaquin Valley watersheds.

The Proposed Amendment will result in improvements to pest management and water management practices. Growers may use other pesticides instead of diazinon and chlorpyrifos, or they may apply pesticides less frequently and discharge less water and pesticides. The Board's evaluation indicates that the implementation of additional agricultural management practices could have limited but significant effects upon the physical environment, but that most of these impacts are expected to be mitigated to less than significant levels through careful planning, design, and implementation. Mitigation measures can be incorporated into regulatory measures prescribed by the Board, such as waste discharge requirements and conditional waivers, or can be imposed by other regulatory agencies, such as local air quality management districts, the California Department of Pesticide Regulation, the California Department of Fish and Wildlife, or the California Air Resources Control Board. Properly designed and implemented pesticide control projects, conducted pursuant to regulatory measures prescribed by the Board and by other regulatory agencies, will mitigate and/or avoid any foreseeable significant cumulative adverse effects on the environment. However, there is one notable potential significant effects that could occur as a result of measures taken to implement the Proposed Amendment: This potential impacts is a reduction in aquatic and wetlands habitat due to the implementation of measures that will eliminate or reduce agricultural runoff from some agricultural operations (possibly impacting habitats that depend on this agricultural runoff).

10.4 Economic Factors

Public Resources Code section 21159 requires that economic factors be considered as part of the environmental analysis. The Board expects that regulated entities, when selecting which management practice(s) to implement, will take into account the effectiveness, potential environmental impacts and mitigation measures, and the overall economic costs associated with implementing these practices.

As detailed in Section 9 of this report, the estimated annual cost to agriculture of monitoring, planning, and management practice evaluation ranged from approximately $1.6 to $6.0 million. The annual cost to implement management practices are estimated to range from $5 to $22 million. The total estimated cost to agriculture is $6.6 million to $27.6 million annually. These are high-end estimates, since they do not take into account other requirements for implementing management practices, monitoring, planning and management practice evaluation.

The estimated monitoring cost for wastewater dischargers is approximately $4,200 per year per facility. The estimated monitoring cost for stormwater dischargers is approximately $6,200 per year per discharger. These estimate are expected to decrease rapidly as detections in municipal sources continue to decline. These costs are not expected to cause widespread impacts, as they are relatively low in comparison to other costs associated with agricultural production or with building and operating municipal storm water systems and wastewater treatment plants. In addition, the Proposed Amendment includes provisions under which the Board could reduce monitoring requirements after monitoring determines that particular dischargers or groups of dischargers no longer pose a threat to violate the diazinon and chlorpyrifos water quality objectives.

10.5 Interagency Cooperation for Mitigation of Impacts

Many of the recommended mitigation measures are outside the jurisdiction of the Central Valley Water Board and will require interagency cooperation. Table 10-5 summarizes which mitigation measures will be imposed by the Central Valley Water Board and which measures should be imposed by other agencies.

Table 10-5: Agencies Responsible for Imposing Recommended Mitigation Measures

Mitigation Measure	Public Agencies with Jurisdiction
Mitigation Measure III.1: Careful application timing of water or dust suppression chemicals and planting of cover crops or conservation tillage	California Air Resources Board Local air districts Central Valley Water Board via Irrigated Lands Regulatory Program
Mitigation Measure III.2 and III.3: Construction contractors and system operators shall implement Best Management Practices (BMPs) during construction and operations, and shall comply with the rules and regulations from the applicable AQMD or APCD and shall ensure that equipment is maintained in proper working condition.	California Air Resources Board Local air districts in and surrounding the Project Area
Mitigation Measure IV.1: Where alternatives exist for preserving riparian habitat created by agricultural runoff, dischargers shall explore ways to preserve that habitat.	Central Valley Water Board via Irrigated Lands Regulatory Program California Department of Fish and Wildlife
Mitigation Measure IV.2: Regulated entities shall conduct a delineation of affected wetland	Central Valley Water Board via Irrigated Lands Regulatory Program California Department of Fish and Wildlife United States Army Corps of Engineers
Mitigation Measure IV.3: Where detention basins are to be abandoned, retain the basin in its existing condition or ensure that sensitive biological resources are not present before modification.	Central Valley Water Board via the Irrigated Lands Regulatory Program
Mitigation Measure IV.4: Investigate impacts on candidate, sensitive, or special status species	Central Valley Water Board via Irrigated Lands Regulatory Program California Department of Fish and Wildlife United States Fish and Wildlife Service National Marine Fisheries Service
Mitigation Measure V.1:: Avoid and mitigate potential impacts to Cultural Resources	Central Valley Water Board via Irrigated Lands Regulatory Program California Native American Heritage Commission
Mitigation Measure IX.1: Dischargers will design groundwater quality management plans	Central Valley Water Board via Irrigated Lands Regulatory Program
Mitigation Measure IX.2: Dischargers will evaluate whether alternate pesticides they may consider for replacing diazinon or chlorpyrifos could potentially result in groundwater contamination	Central Valley Water Board via Irrigated Lands Regulatory Program California Department of Pesticide Regulation

10.6 Statement of Overriding Considerations

The Proposed Amendment is needed to improve water quality in the lower Sacramento and San Joaquin Valley watersheds. For the water bodies that are currently considered “impaired” due to the effects of diazinon and chlorpyrifos on aquatic life, the Board is required to adopt a TMDL or impose other effective pollution control requirements to address the impairments pursuant to section 303(d) of the federal Clean Water Act. Without the Proposed Amendment, aquatic life in the Project Area surface waters could remain impaired by discharges of diazinon, chlorpyrifos, or replacement pesticides. Although the Proposed Amendment will have an overall positive effect on the environment, adverse environmental effects could still result from the implementation of reasonably-foreseeable management practices. Environmental resources that may be impacted include:

- Air Quality (and Greenhouse Gas Emissions)
- Biological Resources
- Cultural Resources
- Hydrology and Water Quality

These effects can be mitigated to less than significant levels with the implementation of feasible mitigation measures. Some mitigation measures taken to mitigate possible impacts to biological resources (including aquatic and wetland habitat) and hydrological resources fall under the jurisdiction of the Central Valley Water Board, and so the Board can oversee the implementation of these mitigation measures. Mitigation of air quality pollutants, including greenhouse gas emissions, falls under the jurisdiction of the California Air Resources Board and local air districts, which can impose mitigation measures to ensure that no significant air quality effects occur. Impacts to cultural resources caused by implementing the Proposed Amendment would be mitigated by project proponents in accordance with section 15091(a) (1) of the State CEQA Guidelines.

However, despite the benefits that will result from the implementation of the Proposed Amendment, and despite the fact that most significant effects can be easily and economically mitigated to less-than significant levels, there is still one notable potential significant effect that could occur as a result of measures taken to implement the Proposed Amendment. This potentially-significant and unavoidable impact is a reduction in aquatic and wetlands habitat due to the implementation of measures that will eliminate or reduce agricultural runoff from some agricultural operations (possibly impacting habitats that depend on this agricultural runoff). It should be noted that the purpose of the Proposed Amendment is to reduce the levels of pesticides that adversely impact aquatic life. So, while there is a potentially significant and unavoidable impact of reduction in aquatic and wetland habitats, the remaining habitats will be enhanced by the provision of better quality water.

The economic impacts of the Proposed Amendment are relatively small, as most measures are already required pursuant to existing regulatory programs. The Proposed Amendment is needed to fulfill legal requirements imposed on the Board by the federal Clean Water Act, and is needed to establish control programs to address impairment and provide reasonable protection of beneficial uses. Remedying the impairments in surface waters imparts environmental and social benefits, such as the enhancement of aquatic habitats and drinking water. Mitigation measures imposed by the Proposed Amendment are well within the technological capabilities of all regulated municipalities and agricultural interests. Furthermore, the only habitat that may be impacted by the adoption of the Proposed Amendment is sub-optimal habitat dependent on agricultural flows that are discharging runoff water containing high levels of diazinon and chlorpyrifos.

For the above reasons, the Board finds that the substantial and significant benefits to aquatic life, water quality, and air quality outweigh the potentially-significant adverse environmental effects that could occur as a result of the Proposed Amendment.

10.7 Environmental Determination

On the basis of this evaluation and the other elements of the Staff Report:

- ☐ I find that the Proposed Amendment could not have a significant effect on the environment.
- ☐ I find that although the Proposed Amendment could have a significant effect on the environment, there will not be a significant effect in this case because feasible alternatives and/or feasible mitigation measures exist that would substantially lessen any significant impact.
- ☒ I find that the Proposed Amendment may have a significant effect on the environment. Even with the implementation of feasible alternatives and/or mitigation measures, it is possible that significant adverse impacts could occur. However, these environmental risks are acceptable considering the substantial and significant benefits to aquatic life, water quality, and air quality that will result from the adoption of the Proposed Amendment.

original signed by
PAMELA C. CREEDON, Executive Officer

28 March 2014
Date

11. Peer Review

Staff has determined that the scientific portions and scientific basis of the Proposed Amendment are based on source material that has already been peer reviewed. The Proposed Amendment is itself just a new application of earlier, adequately peer reviewed work products, specifically, the 2005 San Joaquin River (Resolution No. R5-2005-0138) and 2006 Delta (Resolution No. R5-2006-0061) Basin Plan Amendments to control diazinon and chlorpyrifos discharges. The Proposed Amendment does not depart from the scientific approach of these Basin Plan Amendments from which it is derived. Therefore, the proposed amendment has satisfied the peer review requirement of Health and Safety Code 57004 and does not require additional peer review.

12. Public Participation and Agency Consultation

CEQA scoping meetings and public workshops on a Central Valley Pesticide TMDL and Basin Plan Amendment were held on 2 February 2006 in Modesto, on 8 February 2006 in Chico, and on 9 February 2006 in Rancho Cordova. Approximately 60 people total attended the three meetings. Attendees were primarily from other agencies, pesticide manufacturers, and agricultural coalitions.

A series of stakeholder meetings were held at the Central Valley Water Board office in May 2006, October 2006, April 2007, May 2008, April 2009, July 2009, November 2009, January 2010, May 2010, July 2010, and September 2012. These meetings were attended by representatives of municipalities, agricultural coalitions, pesticide manufacturers, DPR, and the government agencies listed below. Participants provided feedback on reports that identified water bodies and beneficial uses (Lee and Davis, 2010), and pesticides of concern (Lu and Davis, 2009), and on the UC Davis method for deriving water quality criteria and the UC Davis water quality criteria reports. Participants in stakeholder meetings also provided feedback on preliminary Basin Plan Amendment language. Comments received on the reports listed above were responded to in writing before finalizing those documents. While those reports have been finalized, how they are interpreted and used is still open to public comment during the public processes for Basin Plan Amendments.

A previous draft of the Proposed Amendment and Staff Report was released for public comment in March 2013. A public hearing on the Proposed Amendment was held at the 11/12 April 2013 Central Valley Water Board meeting. Due to significant changes in response to comments received on the first public review draft Staff Report and proposed amendment, this second public review draft Staff Report, which includes responses to comments on the first draft, is being released for a second comment period which ends on 18 February 2013. A draft final Staff Report and Proposed Amendment, including responses to comments received during the comment period and any changes made in response to comments, is planned to be brought before the Central Valley Water Board for potential adoption at the March 2013 Central Valley Water Board meeting.

The following agencies participated in the development of this public review draft Basin Plan Amendment, through receipt of mailings pertaining to development of the Basin Plan Amendment, attendance at public workshops, and submission of comments on the Basin Plan Amendment: California Department of Pesticide Regulation; National

Oceanic and Atmospheric Administration –Fisheries; U.S. Fish and Wildlife Service; and U.S. Environmental Protection Agency.

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