CENTRAL VALLEY REGIONAL
WATER QUALITY CONTROL BOARD

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

FOR

THE CONTROL OF DIAZINON AND CHLORPYRIFOS RUNOFF INTO THE LOWER SAN JOAQUIN RIVER

FINAL STAFF REPORT

October 2005

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
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DISCLAIMER

This publication is a report by staff of the California Regional Water Quality Control Board, Central Valley Region. This report contains the evaluation of alternatives and technical support for the adoption of an amendment to the Water Quality Control Plan for the Sacramento and San Joaquin River Basins(Resolution No. R5-2005-0138). Mention of specific products does not represent endorsement of those products by the Regional Board.

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REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

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List of Acronyms and Abbreviations

§	Section (as in a law or regulation)
µg/L	Micrograms/liter (0.10 µg/L = 100 ng/L)
a.i.	Active ingredient of a pesticide
Basin Plan	Water Quality Control Plan for the Sacramento River and San Joaquin River Basins
CCC	Criterion Continuous Concentration
CDEC	California Data Exchange Center
CDFG	California Department of Fish and Game
CMC	Criterion Maximum Concentration
Regional Board	Central Valley Regional Water Quality Control Board
CWA	Federal Clean Water Act
Water Code	California Water Code
Delta	Sacramento-San Joaquin Delta
DPR	California Department of Pesticide Regulation
DWR	California Department of Water Resources
ELISA	Enzyme-Linked Immunosorbent Assay
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
g/day	Grams/day
in	Inches
LA	Load Allocation
lbs	Pounds
LC	Loading Capacity
MP	Management Practice
MOS	Margin of Safety
NCDC	National Climatic Data Center
ng/L	Nanograms/liter (100 ng/L = 0.10 µg/L)
NWIS	National Water Information System
Porter-Cologne	Porter-Cologne Water Quality Control Act
PUR	Pesticide Use Report
Regional Board	Regional Water Quality Control Board
SJR	San Joaquin River
State Board	State Water Resources Control Board
TIE	Toxicity Identification Evaluation
TMDL	Total Maximum Daily Load
UCIPM	University of California Integrated Pest Management Project
USDA	United States Department of Agriculture
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WDR	Waste Discharge Requirements
WLA	Waste Load Allocation

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Executive Summary

This report provides the technical and policy foundation for a proposed amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan). This final report incorporates the substantive changes to the August 2005 draft adopted by the Central Valley Water Board, as well as minor editing and format changes.

The amendment addresses impairments to the lower San Joaquin River (SJR) caused by the organophosphorous (OP) insecticides diazinon and chlorpyrifos. It proposes new numeric water quality objectives and Total Maximum Daily Loads (TMDLs) for both these insecticides. Diazinon and chlorpyrifos waste load allocations for point sources and load allocations for non-point sources are included, and have been designed to meet existing and proposed water quality objectives for diazinon and chlorpyrifos in the lower SJR from the Mendota Dam to the Airport Way Bridge near Vernalis.

Monitoring since 1991 by state and federal agencies and other groups has confirmed the presence of diazinon, chlorpyrifos, and other pesticides in the SJR and its tributaries. The San Joaquin River was placed on the Clean Water Act Section 303(d) List for aquatic toxicity due to diazinon and chlorpyrifos (SWRCB. 2002). The sources of these compounds are agricultural and urban runoff. Agriculture will be the dominant source in the SJR Basin since the United States Environmental Protection Agency (US EPA) has banned the sale of all non-agricultural uses of diazinon and most non-agricultural uses of chlorpyrifos.

Pesticides applied to orchards and fields are transported primarily by stormwater runoff, and by drainage or runoff of irrigation water. Agricultural sources can be subdivided by season of application. Dormant season pesticide applications occur in the SJR Basin during the winter months, generally from December through February. During the dormant season, OP pesticides are carried to surface water by stormwater runoff. Pesticide residues deposited on trees and on the soil migrate with runoff water during rain events. Irrigation season applications generally occur from March through September. During the irrigation season, chlorpyrifos and diazinon move with irrigation water from agricultural fields to the SJR and tributaries that flow into the SJR.

Designated Uses - This amendment recommends that no changes be made to existing designated uses for the SJR. The use that is most sensitive to diazinon and chlorpyrifos (freshwater habitat beneficial use designation) has already been designated, so additional use designations are not necessary at this time.

Water quality objectives - For both diazinon and chlorpyrifos, this amendment recommends adoption of Water Quality Objectives derived using the US EPA method and applied to datasets screened by the California Department of Fish and Game.

Implementation and Time Schedule- This amendment recommends that, if neither Waste Discharge Requirements (WDRs) nor a Waiver of WDRs apply to diazinon and chlorpyrifos discharges, then a prohibition of discharge would apply when objectives or allocations are not met. The prohibition is constructed to address the two seasons of use. A five-year time schedule for compliance with chlorpyrifos water quality objectives and diazinon and chlorpyrifos allocations and loading capacity is recommended. Approximately five years from Regional Board adoption of the Basin Plan Amendment should provide sufficient time to attain the objectives and allocations, and should be sufficient to get a comprehensive system for control of pesticide runoff into place.

TMDL Elements-The amendment establishes the loading capacity, waste load allocations, and load allocations for diazinon and chlorpyrifos discharges to the San Joaquin River. The loading capacity and allocations are established at levels necessary to attain the applicable numeric and narrative water quality objectives. A combined additive toxicity formula, found in the Basin Plan, is used to account for the joint toxicity of diazinon and chlorpyrifos. Load allocations are established by subarea. The allocations apply to both the irrigation and dormant season. Equating the allocations to the loading capacity provides an implicit margin of safety, since no dilution credit is given.

Submission of Management Plans-Dischargers must submit a management plan that describes the actions that the discharger will take to reduce diazinon and chlorpyrifos discharges during the dormant season and the irrigation season, and to meet the applicable allocations by the required compliance dates.

Surveillance and Monitoring -Surveillance and monitoring required of dischargers will include water quality monitoring, evaluation of changes in pesticide use, surveys of adoption of management practices to reduce diazinon and chlorpyrifos in runoff, and an evaluation of the effectiveness of management practices in reducing pesticide runoff.

Consideration of Economics and CEQA - A discussion of the potential economic effects of the proposed amendment, as well as a CEQA checklist, are provided in this staff report. This proposed Basin Plan Amendment is designed to reduce diazinon and chlorpyrifos concentrations in the lower SJR, and to ensure that increased use of alternatives to those pesticides will not degrade water quality. The water quality objectives and TMDLs established by this amendment are designed to eliminate the impacts of diazinon and chlorpyrifos to aquatic life in the lower SJR. This Basin Plan Amendment does not require or allow any changes in pesticide application practices that could degrade the quality of the environment, or have environmental effects that could cause substantial indirect or direct adverse effects on human beings.

1 Introduction, Background and Need for a Basin Plan Amendment

1.1 Introduction

This report provides the technical and policy foundation for a proposed amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan)[1]. This report provides an analysis of alternatives and evaluation of potential environmental impacts in accordance with California Environmental Quality Act (CEQA) and State Water Resources Control Board (SWRCB) regulations. The amendment addresses impairments to the lower San Joaquin River (SJR) caused by the organophosphorous (OP) insecticides diazinon and chlorpyrifos. It proposes new numeric water quality objectives and Total Maximum Daily Loads (TMDLs) for both these insecticides. Diazinon and chlorpyrifos waste load allocations for point sources and load allocations for non-point sources are included, and have been designed to meet the applicable water quality objectives for diazinon and chlorpyrifos in the lower SJR from the Mendota Dam to the Airport Way Bridge near Vernalis.

California Water Code (Water Code) §13240 authorizes the Central Valley Regional Water Quality Control Board (Regional Board) to formulate and adopt Basin Plans for all areas within their region. The Basin Plan is the basis for regulatory actions taken for water quality control and satisfies §303 of the Federal Clean Water Act (CWA), which requires states to adopt water quality standards. Basin Plans are adopted and amended by the Regional Board through a structured process involving full public participation and state environmental review. Basin Plan amendments do not become effective until approved by the State Water Resources Control Board (State Board) and Office of Administrative Law (OAL). Additionally, U.S. Environmental Protection Agency (US EPA) approval is required for Basin Plan amendments that affect surface water quality standards.

If adopted, the Basin Plan amendment proposed as part of this report would establish:

- Numeric water quality objectives for diazinon and chlorpyrifos in the lower SJR from the Mendota Dam to the Airport Way Bridge near Vernalis
- A diazinon and chlorpyrifos TMDL to meet the applicable water quality objectives
- New policies to achieve the water quality objectives and TMDL
- Specific monitoring goals to evaluate compliance with the proposed water quality objectives and TMDL.

Portions of the text of this report are similar to the Basin Plan Amendment Staff Report for the Control of Orchard Pesticide Runoff and Diazinon Runoff into the Sacramento and Feather Rivers (Karkoski, et al, 2003). Only those portions of the Karkoski et al (2003) report considered to be applicable to this proposed amendment have been included. The major difference between this report and the Basin Plan Amendment Staff Report for the Sacramento and Feather Rivers is that, while the Sacramento and Feather Rivers are impaired by diazinon

[1] Hereafter, references to the Basin Plan includes all amendments approved by the Office of Administrative Law through September 2004. No other amendments to the Basin Plan have been approved by the Office of Administrative Law between September 2004 and the date of this report. A copy of the current version of the Basin Plan can be found at: http://www.waterboards.ca.gov/centralvalley/available_documents/basin_plans/SacSJR.pdf .

during the dormant season, the San Joaquin River is impaired by both diazinon and chlorpyrifos year-round.

1.1.1 Organization of the Basin Plan Amendment Staff Report

Section 1 - This section provides background information on the amendment process and the need for the amendment. It describes the two seasons of agricultural use (dormant season and irrigation season) of the two pesticides, and discusses historical water chemistry data collected from 1991 to the present.

Section 2 – This section provides the proposed additions and changes in the Basin Plan language.

Section 3 – This section provides a review of the existing laws and policies that pertain to this Basin Plan amendment.

Section 4 – This section describes and evaluates the alternatives that were considered for modification of the Basin Plan. The following Basin Plan chapters were considered for modification.

- Introduction
- Existing and potential beneficial uses
- Water quality objectives
- Implementation
- Surveillance and monitoring

Section 5 – This section provides the economic analysis for the proposed amendment. Water Code Section §13141 requires that prior to implementation of any agricultural Basin Plan amendment, an estimate of the total cost of such a program and identification of sources of funding be indicated in the Basin Plan. Additionally, Water Code Section §13241 requires a consideration of economics for adoption of new water quality objectives.

Section 6 – This section contains the CEQA checklist and conclusions of the CEQA analysis. The Basin Plan amendment process is a certified regulatory program pursuant to the California Environmental Quality Act (CEQA). The Basin Plan amendment staff report therefore serves as a substitute document for Environmental Impact Report or Negative Declaration.

Section 7 – This section contains a description of the public participation and agency consultation process for this amendment. The Basin Plan is amended by the Regional Board through a structured process involving full public participation and consultation with other appropriate state and federal agencies (e.g. US EPA, California Department of Pesticide Regulation [DPR]).

Section 8 -– This section contains the references used in the development of this report.

Appendices – The appendices include supplemental information for the evaluation of alternatives.

- Appendix A - contains detailed descriptions of the project subareas
- Appendix B - contains pesticide use information for the subareas
- Appendix C - contains historical pesticide concentrations for individual sampling locations, and comprehensive historical pesticide concentration data
- Appendix D - contains detailed economic cost information and scenarios
- Appendix E -– contains staff recalculations of diazinon and chlorpyrifos criteria

1.1.2 Watershed Characteristics

The SJR watershed is bounded by the Sierra Nevada Mountains on the east, the Coast Range on the west, the Delta to the north, and the Tulare Lake Basin to the south. From its source in the Sierra Nevada Mountains, the SJR flows southwesterly until it reaches Friant Dam. Below Friant Dam, the SJR flows westerly to the center of the SJR Valley near Mendota, where it turns northwesterly to eventually join the Sacramento River in the Sacramento-San Joaquin Delta (Delta). The main stem of the entire SJR is about 300 miles long and drains approximately 13,500 square miles (Figure 1.1).

The major tributaries to the SJR upstream of the Airport Way Bridge near Vernalis (the legal boundary of the Delta) are on the east side of the SJR Basin, with drainage basins in the Sierra Nevada Mountains. These major east side tributaries are the Stanislaus, Tuolumne, and Merced Rivers. The Cosumnes, Mokelumne, and Calaveras Rivers flow into the SJR downstream of the Airport Way Bridge. 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. Flows in the San Joaquin River are highly managed, and portions of the river are completely dry. This TMDL is being developed explicitly to address pesticide contamination, and does not propose to address the issues contributing to the diminished flows in the San Joaquin River.

The geographic scope or project area of this amendment consists of 130 miles of the lower SJR, from the Mendota Dam to the Airport Way Bridge near Vernalis. The SJR Basin is the area draining to the SJR downstream of the Mendota Dam and upstream of the Airport Way Bridge near Vernalis. The SJR Basin includes the lower reaches of the major eastside tributaries, downstream of the major dams and reservoirs: New Don Pedro, New Melones, Lake McClure, and similar eastside reservoirs in the SJR Basin. The southeastern boundary of the project area is formed by the SJR from the Friant Dam to the Mendota Dam. The SJR Basin, as defined here, drains approximately 2.9 million acres, including approximately 1.4 million acres of agricultural land use. More detailed description of the project area can be found in Appendix A.

1.2 Background

Monitoring since 1991 by state and federal agencies and other groups has confirmed the presence of diazinon, chlorpyrifos, and other pesticides in the SJR and its tributaries. The Regional Board placed the San Joaquin River on the Clean Water Act Section 303(d) list due to aquatic toxicity caused by diazinon and chlorpyrifos. In the past, the sources of these pesticides have been both agricultural and urban runoff, however these pesticides are no longer sold for urban residential use, and agriculture is the dominant source in the SJR Basin. Pesticides applied to orchards and fields are transported by stormwater runoff and by runoff of irrigation water.

Aerial pesticide applications may result in direct drift to surface waters, and may be another source of pesticide contamination. For rice crops in Colusa and Glenn counties, aerial application of methyl parathion has been found to be a significant pathway (Kollman et al., 1992). Volatilization and atmospheric transport of pesticides are also likely to affect surface water quality. One study by the USGS (USGS, 1995) documented atmospheric deposition as a transport mechanism during runoff events, when precipitation and direct surface runoff are the major sources of streamflow. Locally high concentrations of pesticides in rain and air are very seasonal, correlated to local use, and usually occur during the spring and summer months. High concentrations of pesticides can also occur in rain, air, and fog during the fall and winter months in areas where there is high use, as in the stone-fruit orchards in the Central Valley. A second USGS study indicated that pesticides in precipitation could contribute significantly to pesticide loads in stormwater runoff (USGS, 2003).

Inappropriate mixing and loading practices, and poor disposal procedures during pesticide application can result in spills of concentrated liquid or dry material on the soil surface. Such spills may contribute to the presence of these pesticides in surface water. Additionally, conventional pesticide application technology (i.e. air-blast sprayer) is designed primarily for durability and ease of use, rather than for optimal efficiency of pesticide application to the tree or crop. Unlike many other countries, the U.S. has no standards for sprayer design, no performance standards and no testing procedures. A review of sprayer studies in orchards showed that 40 to 60% of the applied spray was deposited on the orchard floor, while only 9 to 16% was deposited on the trees (Giles and Downey, 2003). Recent studies of sensor-controlled sprayers indicate that pesticide application rates can be reduced by up to 45%, and ground deposition can be reduced by up to 58% (Downey, 2004 pers.comm.)

1.2.1 Agricultural Sources and Seasonality

Agricultural sources can be subdivided by season of application, either dormant or irrigation season. Dormant season pesticide applications occur in the SJR Basin during the winter months, generally from December through February. During the dormant season, OP pesticides are carried to surface water by stormwater runoff. Pesticide residues deposited on trees and on the ground migrate with runoff water during rain events.

Irrigation season applications generally occur from March through September. During the irrigation season, residual chlorpyrifos and diazinon migrate with irrigation water, and occasionally storm water, from agricultural fields and enter tributaries that flow into the SJR. During both seasons, localized drift from pesticide applications and atmospheric deposition can also contribute to pesticides being introduced into surface water. Although practices are available to minimize pesticide drift, once pesticides enter the atmosphere through volatilization only natural degradation limits their movement and fallout during rainstorms.

Dormant Season Use

Pesticides applied during the dormant season, from December through February, are periodically washed off fields by storms large enough to generate runoff. For the project area, studies have shown that the amount of pesticide washed off is usually a very small fraction of the amount applied, ranging between 0.05 and 0.13 percent for diazinon and 0.06 to 0.08 percent for chlorpyrifos (Kratzer et al., 2002; Kratzer, 1999). Although the quantity of pesticide is small, it is large enough to cause toxicity to aquatic invertebrates.

These invertebrates provide the foundation for the aquatic food web, upon which higher trophic levels, such as salmon and other fishes, depend. Studies of invertebrate and fish populations have been conducted primarily in the upper San Francisco Estuary by the Interagency Ecological Program (IEP). Since the area described in this report drains to the Estuary, this is the best available source of relevant data on fish and invertebrate population levels. The most recent published information (2002 and 2003) on invertebrate populations from the IEP states that, "The general picture of greatly reduced abundance compared to baseline conditions in the early 1970s did not change in 2003, although some taxa did increase over 2002 levels….The most abundant cladoceran genera in the upper estuary are *Bosmina, Daphnia* and *Diaphanosoma*. They are all native freshwater genera that have shown downtrends since the early 1970s in all seasons, especially in fall. Summer abundance has stabilized since the late 1980s and may even be gradually increasing. Abundance increased slightly in 2003 for all seasons" (Mecum, W.L. 2004). In addition, populations of striped bass, delta smelt, longfin smelt and threadfin shad are also decreasing and many are at all-time low (Bryant, M. and Souza, K. 2004). The ocean catch of Central Valley Chinook salmon decreased in both the commercial and recreational fisheries in 2002 (Chappell, E. 2004). There are many factors that have contributed to these declines, and pesticides are likely to be one of these factors (Sommer, T. et. al. 2005).

The amount of pesticide available to be carried by runoff will be approximately equal to the amount applied during the dry period preceding the rainfall event, minus any that has volatilized, degraded, infiltrated into the ground, or remained bound to sediment particles at the ground surface, or to the plant itself. Highest concentrations have been observed to coincide with the first major storm after a prolonged dry period. During the winter precipitation season, the high variability in pesticide concentrations is attributed to rapid changes in the source of stream flow during a storm.

In addition to the amount of pesticide applied, other factors are likely to affect the amount of pesticide in storm runoff and pesticide loading. Soils with poor drainage characteristics, such as those on the west side of the SJR Basin (where the soil is fine-grained and highly erodible), may have higher runoff potential than the more permeable soils on the east side. Antecedent moisture conditions may also be important. Pesticides applied to fields with higher moisture content may be expected to generate larger storm loads than if the soil was drier. When soils are dry, more precipitation, and dissolved pesticide, will be lost through infiltration into the soil. Other factors affecting runoff include field slope and the presence and type of cover crop.

Irrigation Season Use

The irrigation season (in-season) is defined as the months of March through September, although storms occasionally occur during the earlier months of this period. During the irrigation season, diazinon and chlorpyrifos migrate with irrigation water from agricultural fields and enter tributaries that flow into the lower SJR.

Irrigation methods may affect the magnitude of pesticide loading in the river. With furrow or flood irrigation, tailwater drains from the end of the field and is usually discharged to a drainage channel that leads to a stream. In some cases, systems are in place to recycle tailwater to another field, or to blend it with fresh irrigation water and reapply it to another field. Tailwater return flows from flood and furrow irrigation probably generate the largest loads because large volumes of water are discharged directly. Relative to flood and furrow irrigation, sprinkler irrigation is likely to increase pesticide wash-off from foliage, but will generate less tailwater if used appropriately. Drip irrigation systems typically generate little or no runoff. If appropriately used, such irrigation methods are likely to minimize irrigation season pesticide runoff from treated sites during the irrigation season.

1.2.2. Urban Pesticide Use

Urban Residential Use

Prior to the elimination of residential sales, diazinon and chlorpyrifos from urban sources were primarily introduced into surface water through application to impervious surfaces and to landscaping, followed by runoff from storm runoff and over watering. Agricultural pesticide applications can also drift into urban areas and fall out during storms (USGS. 2003). Unlike agricultural pesticide use, which must be reported to the DPR, pesticides used in the urban environment include both reported and unreported uses. Only professional urban applications must be reported to DPR. Professional applications include structural and landscape pest control, and restaurant and commercial building pest-control. Residential pesticide use, such as animal-care products, and home and garden pest control are not reported. Chlorpyrifos and diazinon are no longer available for sale for urban residential uses. Consumers will be able to use their remaining supplies until depleted. The ban on residential urban use of chlorpyrifos, and the phase-out of urban use of diazinon should eventually reduce the potential for water quality impacts from these pesticides in urban areas, however pyrethroids and carbamates are being used as replacements for many urban (and agricultural) uses, and there is increasing evidence of aquatic toxicity impacts from these pesticides (Weston et al, 2004, TDC Environmental. 2003).

Urban Non-Residential Use

Sales of both diazinon and chlorpyrifos for use in indoor and outdoor areas where children could be exposed (schools, playgrounds, parks) was cancelled by recent US EPA regulations. Sales of chlorpyrifos for indoor use were cancelled effective December 31, 2001. Sales of diazinon for indoor use were prohibited effective December 31, 2002. A few "low risk" uses of chlorpyrifos, where children are not exposed are still permitted. These uses include ship holds, railroad boxcars, industrial plants, manufacturing plants, food processing plants, golf courses, road medians, treatment of utility poles and other outdoor wood products, fire ant mounds and mosquito control.

1.2.3 Historical Diazinon and Chlorpyrifos Agricultural Use Data Summary

This discussion refers to data Tables 1.1 through 1.4, which provide a summary of diazinon and chlorpyrifos use on agricultural crops in the lower San Joaquin Basin (Fig.1.1) from 1995 to

2002. All data in these tables were obtained from the CDPR Pesticide Use Report (PUR) database.

Diazinon
Between 1995 and 2002, diazinon was used on more than 40 agricultural commodities. The majority of diazinon use (by weight) occurs in the dormant season. The crops that accounted for 98% of diazinon dormant season use by weight were, in order of greatest to least use, almonds (65%), peaches (14%), apricots (6%), prunes (4%), apples (4%), nectarines (3%) and plums (2%). Irrigation season crops that accounted for 86% of diazinon use were almonds (27%), cantaloupe (11%), peaches (9%), tomatoes (7%), melons (7%), prunes (7%), walnuts (5%), apricots (4%), alfalfa (4%), nectarines (3%) and plums (2%). Overall diazinon use during both seasons has declined significantly since 1995. Almonds are by far the largest user of diazinon in the TMDL area, and the number of growers who applied diazinon in the dormant season decreased by 56% from 1995 to 2002. Many growers have switched to the use of pyrethroids (Zhang and Zhang. 2004). Figures 1.2 and 1.3 illustrate examples of the distribution of diazinon use in the TMDL area for the dormant and irrigation seasons of 2002. Preliminary PUR results for 2003 indicate that diazinon use appears to continue to decline.

The rankings of diazinon use during the dormant season in the San Joaquin subareas, from highest to lowest are Fresno-Chowchilla, Northeast Bank, Westside Creeks, Merced, Bear Creek, Turlock, Grasslands, Stanislaus, Tuolumne, and Greater Orestimba. During the irrigation season the rankings are Fresno-Chowchilla, Greater Orestimba, Westside Creeks, Bear Creek, Northeast Bank, Tuolumne and Merced (Appendix B).

Chlorpyrifos
Chlorpyrifos was used on more than 45 crops during the same time period. The crops that accounted for 90% of dormant season use (by weight) were, in order of greatest to least use, almonds (53%), apples (19%), peaches (13%) and alfalfa (5%). The majority of chlorpyrifos use (by weight) occurs in the irrigation season. Irrigation season crops that accounted for 92% of use were almonds (39%), cotton (16%), alfalfa (15%), walnuts (14%), corn (5%) and apples (3%). As with diazinon, chlorpyrifos use during both seasons, has declined significantly since 1995. Almonds are the major dormant season chlorpyrifos user, and the number of almond growers who applied chlorpyrifos decreased from 80 in 1995 to 29 in 2002. From 1995 to 2002, chlorpyrifos use during the irrigation season decreased by 26% in almonds, 91% on cotton and 64% on alfalfa (Zhang and Zhang. 2004). Figures 1.4 and 1.5 illustrate examples of the distribution of chlorpyrifos use in the TMDL area for the dormant and irrigation seasons of 2002. Preliminary PUR results for 2003 indicate that chlorpyrifos use appears to have increased during the irrigation season.

Use ranking by subarea in the dormant season, for highest to lowest use, is Fresno-Chowchilla, Merced, Northeast Bank, Bear Creek, Tuolumne and Turlock. Irrigation season use ranking is Grasslands, Fresno-Chowchilla, Merced, Tuolumne, Northeast Bank, Bear Creek, Turlock, Greater Orestimba, Stanislaus and North Stanislaus (Appendix B).

1.2.5 Historical Water Quality Data Summary
Pesticide water quality data have been collected in the SJR by a variety of agencies and organizations since the 1980's (Domagalski et.al. 1997; Foe, 1995; Foe and Sheipline, 1993; Kratzer 1999; Kratzer et.al. 2002; MacCoy et.al. 1995; Ross et. al. 1999; USGS, 1995; USGS

2003; Appendix C). Figures 1.6 through 1.13 and Tables 1.5 through 1.10 illustrate water quality data collected in the SJR from 1991 to the present for the mainstem and tributaries. Pesticide concentrations are plotted on a logarithmic scale. Non-detect concentrations are treated as zero values (0 µg/L). The proposed acute diazinon toxicity value (0.16 µg/L) and the proposed acute chlorpyrifos toxicity value (0.025 µg/L) are plotted for reference as horizontal lines on the appropriate graphs. Graphs are included for diazinon and chlorpyrifos concentrations and also for combined (additive) toxicity. Combined diazinon and chlorpyrifos toxicity values were determined using two different methods.

The first method uses the equation provided below from the Basin Plan (CRWQCB-CVR. 1998):

$$\frac{C_1}{O_1} + \frac{C_2}{O_2} = S$$

Where:
C = The concentration of each pesticide.

O = The proposed acute toxicity water quality target for diazinon to protect invertebrates (0.16 µg/L) and the proposed acute water quality objective for chlorpyrifos (0.025 µg/L).

S = The sum. A sum equal to, or exceeding, one (1.0) indicates that the beneficial use may be impacted.

The results of this analysis are shown in Figure 1.8 and Table 1.7 (mainstem sites) and Figure 1.12 and Table 1.10 (tributary sites).

The second method used to calculate additive toxicity was the Chlorpyrifos Toxic Equivalents (TEQ) method, suggested by Felsot (Felsot 2005). This method was used by US EPA to calculate the cumulative human health risk of all OP pesticides. (US EPA, 2002). In this method the ratio of the relative potency of chlorpyrifos to diazinon (the Relative Potency Factor or RPF) is multiplied by the diazinon concentration to express the diazinon concentration in terms of chlorpyrifos toxicity. This transforms the diazinon concentration into an equivalent chlorpyrifos concentration based on the relative toxicity of these two chemicals. The transformed diazinon concentration is then added to the measured chlorpyrifos concentration, and the sum is compared to the chlorpyrifos objective. The following equation illustrates the RPF method:

$$\text{ChlorTEQ} = C_{Diaz} \times RPF_{(Chlor/Diaz)} + C_{chlor} \leq \text{WQO}_{\text{Chlor}}$$

where

ChlorTEQ = chlorpyrifos toxic equivalents.
C_{Diaz} = diazinon concentration
C_{Chlor} = chlorpyrifos concentration
RPF (Chlor/Diaz) = relative potency factor – ratio of chlorpyrifos to diazinon toxicity.
WQO_{Chlor} = acute or chronic chlorpyrifos water quality objective in µg/L

The results of this analysis are shown in Figures 1.9 (mainstem) and 1.13 (tributaries). Appendix E provides a comparison of the two methods (Basin Plan method and TEQ method), and demonstrates that both methods give the same results.

Rates of exceedance of proposed water quality values were calculated for both mainstem sites (Tables 1.5, 1.6, 1.7) and tributary sites (Tables 1.8, 1.9, 1.10). These exceedance rates were defined as the number of samples that exceeded the appropriate water quality value, divided by the total number of samples collected, expressed as a percentage. The Tables show annual exceedance rates from 1991 through 2005.

San Joaquin River Mainstem Sites

Diazinon
Figure 1.6 shows diazinon concentration data collected in the mainstem SJR from 1991 through 2005. These data indicate that water column concentrations of diazinon have generally declined over time, however years with higher sampling frequency also had greater numbers of exceedances.

Table 1.5 shows that exceedance rates in the mainstem have ranged from 0% up to 50%, however the highest exceedance rates are associated with small sample numbers (n=2). The higher rates generally occurred during the early 1990's, although exceedance rates of 14% were observed as recently as 2001, when sampling activity was relatively intense. No exceedances were detected from 2002 through 2005. This may be a result of the declining use of diazinon.

Chlorpyrifos
Figure 1.7 shows chlorpyrifos concentration data collected in the mainstem SJR from 1991 through 2005. These data indicate that water column concentrations of chlorpyrifos have decreased slightly over time, although exceedances have been found during the most recent 5-year time period.

Table 1.6 shows that exceedance rates have ranged from 0% to 50%. Exceedance rates during the most recent 5-year period ranged from 0% to 50%.

Combined Toxicity
Figure 1.8 shows combined diazinon and chlorpyrifos concentration data collected in the mainstem SJR from 1991 through 2005. These data are analyzed using the formula from the Basin Plan described at the beginning of this section. A reference line is provided at one (1). Values above one indicate non-attainment of applicable toxicity and pesticide objectives. These data indicate that the combined pesticide concentrations exceeded one from 1991 through 1995, and again from 2000 through 2004. The magnitude and number of exceedances is less during the most recent 5 year time period then it was during the early 1990's. Between 1996 and 1999, the intensity of sampling may have been too low to identify any instances where combined toxicity occurred.

Table 1.7 shows that exceedance rates ranged from 0% to 50%, although again the highest rates were associated with low sample numbers (n=2). During the most recent 5-year time period, rates of exceedance of the combined toxicity value of 1 ranged from 0% to 38%, with sample numbers ranging from 9 to 64.

Figure 1.9 shows the same combined diazinon and chlorpyrifos concentration data, but the data are analyzed using the TEQ method. A reference line is provided at the proposed acute chlorpyrifos water quality objective (0.025 ug/L). Results are the same as those found using the Basin Plan method.

Tributary Sites

As discussed in later sections, allocations are assigned to the watersheds that discharge into different reaches of the San Joaquin River. The allocations are defined to be equivalent to the loading capacity in the San Joaquin River (i.e. the targets for the San Joaquin River apply to the discharge from the watersheds). The following discussion presents data from tributaries to the San Joaquin River in comparison to the proposed allocations. Note that the allocations would not apply to the whole tributary stream reach, but only to the discharge point to the San Joaquin River. The data for 1996 and 1997 is dominated almost exclusively by results from a special study on Orestimba Creek.

Diazinon
Figure 1.10 shows diazinon concentration data collected in the SJR tributaries from 1991 through 2005. Since a number of the tributaries are dominated by agricultural runoff and have less dilution available, the magnitude and number of exceedances is greater than in the San Joaquin River. A comparison of the most recent 5-year period to the early and mid-1990's indicates that peak concentrations have decreased somewhat, although many exceedances still occurred as recently as early 2005. Table 1.8 shows that exceedance rates ranged from 0 to 25% within the last five years.

Chlorpyrifos
Figure 1.11 shows chlorpyrifos concentration data collected in the SJR tributaries from 1991 through 2005. The greater magnitude and number of exceedances seen for diazinon is also apparent for chlorpyrifos. The general trend of lower peak concentrations in the most recent 5-year period is also observed for chlorpyrifos. Table 1.9 shows that within the last five years exceedance rates ranged from 0 to 33%.

Combined Toxicity
Figure 1.12 displays the combined toxicity data for the SJR tributaries, using the Basin Plan method. The individual trends observed for diazinon and chlorpyrifos are also apparent for the combined toxicity. The exceedance magnitudes in the tributaries are greater than in the San Joaquin River. Exceedance rates in the last five years have ranged from 0 to 30%.

Table 1.10 (using the Basin Plan method) shows that exceedance rates ranged from 0% to 100%, although the highest rates (and some of the lowest rates) were associated with low sample numbers (n=1 or 2). During the most recent 5-year time period, rates of exceedance of the combined toxicity value of 1 ranged from 0% to 30%, with sample numbers ranging from 2 to 49.

Figure 1.13 shows the same combined diazinon and chlorpyrifos concentration data, but the data are analyzed using the TEQ method. A reference line is provided at the proposed acute chlorpyrifos water quality objective (0.025 ug/L). Results are the same as those obtained in the analysis using the Basin Plan method.

1.3 Recent Developments Affecting Diazinon and Chlopyrifos Use

Lawsuits against US EPA regarding pesticides and endangered species

The Washington Toxics Coalition (WTC) and the Californians for Alternatives to Toxics, filed citizen lawsuits against US EPA for failure to consult with NOAA Fisheries regarding potential adverse impacts of pesticides on endangered salmonids in Washington, Oregon and California. On January 22, 2004 the 9th District Court issued an order requiring the establishment of pesticide buffer zones in areas adjacent to water bodies determined to be "salmon supporting waters" in portions of these states. This order requires that pesticides not be applied within 20 yards of surface water bodies for ground applications, and within 100 yards for aerial applications. This order was upheld on appeal by the 9th Circuit Court in June 2005.

Diazinon and chlorpyrifos are included in the list of pesticides subject to the buffer requirement. US EPA has determined that diazinon and chlorpyrifos may affect the listed salmonid species, and has initiated consultations with NOAA Fisheries on these pesticides. The buffers are to remain in effect until US EPA completes formal consultations with NOAA Fisheries, and NOAA issues a biological opinion. It is anticipated that it will require several years to complete these consultations. Once completed, US EPA will determine whether any permanent measures should be adopted under FIFRA.

The basis for the court's action was Section 7 of the Endangered Species Act (ESA), and the court applied the jeopardy standard in its decision. This decision causes pesticide use to be viewed as a habitat-related impact as defined in Section 7, and the restrictions are co-extensive with the designation of critical habitat for salmon and steelhead Evolutionarily Significant Units (ESUs). Therefore buffers are required adjacent to water bodies located in the geographic areas of these ESUs. The California Central Valley Steelhead ESU is included in the SJR TMDL area, and according to US EPA, buffers are required for applications of diazinon and chlorpyrifos adjacent to surface waters in the following counties: San Joaquin, Stanislaus, Merced and Fresno.

California Department of Pesticide Regulation Proposed Dormant Insecticide Regulation

On June 15, 2005 the Department of Pesticide Regulation (DPR) released a Notice of Proposed Regulatory Action and opened the comment period for the proposed action. The proposed action would restrict ground and aerial applications of dormant insecticides to areas 100 feet from any irrigation or drainage ditch, canal, or any other body of water in which the presence of dormant insecticides could adversely impact any of the beneficial uses of the waters of the state. The proposed action would also specify wind speeds in which dormant insecticides may be applied. The proposed action would allow aerial application only if soil conditions do not allow field entry, or approaching bloom conditions require aerial applications. The proposed action would prohibit all dormant insecticide applications when soil moisture is at field capacity and a storm event is to occur within 48 hours following application, or a storm event likely to produce runoff from the treated area is forecast 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

California Supplemental Diazinon Label

The manufacturer of diazinon developed a supplemental label that was to have taken effect in January 2005 (R. Ehn. 2004. pers.comm.) 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 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.

1.4 Need for a Revision to the Basin Plan

Currently, the Basin Plan does not include a specific program of implementation to address diazinon and chlorpyrifos runoff from orchards and fields in the San Joaquin River watershed. In addition, there are no numeric water quality objectives for diazinon or chlorpyrifos in the Basin Plan for the San Joaquin River.

The Pesticide Management Plan established under the MAA between the State Water Resources Control Board and the Department of Pesticide Regulation, and existing Regional Board Basin Plan pesticide policies outline approaches that could result in the establishment of an implementation program and performance measures to assess attainment of water quality objectives. Each of those plans or policies suggests that the Regional Board should take action if an implementation program has not been established and water quality is not protected.

The Bay Protection Toxic Hot Spots Clean Up Plan (Clean Up Plan; State Board Resolution No. 2004-0002) requires the adoption of a Basin Plan Amendment to control diazinon and chlorpyrifos in the San Joaquin River. The Clean Up Plan states that the Amendment will include: water quality objectives for diazinon and chlorpyrifos; an implementation program and framework; a compliance time schedule; a monitoring program; and other required TMDL elements.

Federal law requires the establishment of TMDLs for waters not attaining water quality standards (CWA § 303(d)(1)(C)). Federal regulations require the incorporation of approved TMDLs into the State's water quality management plan (40 CFR § 130.7(d)(2)). Every region's Basin Plan and any statewide plans or policies constitute California's water quality management plan. Based on the federal and State requirements and policies discussed above, the Regional Board must develop a control program to address diazinon and chlorpyrifos discharges into the San Joaquin River.

The approach proposed in this Basin Plan Amendment is to establish an agricultural runoff control program that is focused on protecting the San Joaquin River from the impacts of diazinon and chlorpyrifos. The proposed control program is a year-round program, since both pesticides have been detected and criteria have been exceeded throughout the year. Adoption of the Basin Plan Amendment will result in: the establishment of water quality objectives for diazinon and chlorpyrifos; a specific time frame for compliance with applicable objectives and allocations; the establishment of the necessary elements of a TMDL; and an implementation framework for ensuring compliance.

A number of tributaries in the San Joaquin River watershed have been identified as not attaining standards due to elevated levels of diazinon and chlorpyrifos (Azimi-Gaylon et. al, 2001). A more comprehensive Basin Plan Amendment revision is not proposed at this time, since the data and information available for the tributaries are more limited, and the level of effort required to meet water quality objectives is less clear. It is anticipated that a future amendment to the Basin Plan will be required to address diazinon and chlorpyrifos runoff in the tributaries to the San Joaquin River.

2 Proposed Amendments to the Basin Plan

The proposed Basin Plan amendment consists of additions and modifications to several sections of the current Basin Plan. This section contains the proposed changes to the Basin Plan. Deletions are shown in strikeout, and additions are shown by underline.

The appropriate location of each change is provided by the Basin Plan page numbers in the lower right corner. The final placement of the proposed changes in the Basin Plan may differ from the placement indicated in this section, since there are a number of amendments to the Basin Plan that are currently pending. Any change in placement will be done to enhance the readability of the Basin Plan and will not result in a change in meaning or intent.

The recommended changes to Chapter I are identical to those contained in Regional Board Resolution No. R5-2004-0108. Should that resolution become effective prior to Regional Board adoption of this Basin Plan Amendment, the recommended changes to Chapter I contained in this Amendment will be moot and will be removed.

Under the Chapter I heading: "Basin Description beginning on page I-1.00, make the following changes:

This Basin Plan covers the entire area included in the Sacramento and San Joaquin River drainage basins (see maps in pocket* and Figure II-1). The 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.

*NOTE: The planning boundary between the San Joaquin River Basin and the Tulare Lake Basin follows ~~the northern boundary of Little Panoche Creek basin~~ the southern watershed boundaries of the Little Panoche Creek, Moreno Gulch, and Capita Canyon to boundary of the Westlands Water District. From here, the boundary follows the northern edge of the Westlands Water District until its intersection with the Firebaugh Canal Company's Main Lift Canal. The basin boundary then follows the Main Lift Canal to the Mendota Pool and continues eastward along the channel of the San Joaquin River to Millerton Lake in the Sierra Nevada foothills, and then follows along the southern boundary of the San Joaquin River drainage basin.

The Sacramento River and San Joaquin River Basins cover about one fourth of the total area of the State and over 30% of the State's irrigable land. The Sacramento and San Joaquin Rivers furnish roughly 51% of the State's water supply. Surface water from the two drainage basins meet and form the Delta, which ultimately drains to San Francisco Bay. Two major water projects, the Federal Central Valley Project and the State Water Project, deliver water from the Delta to Southern California, the San Joaquin Valley, Tulare Lake Basin, the San Francisco Bay area, as well as within the Delta boundaries.

The Delta is a maze of river channels and diked islands covering roughly 1,150 square miles, including 78 square miles of water area. The legal boundary of the Delta is described in Section 12220 of the Water Code (also see Figure III-1 of this Basin Plan).

Ground water is defined as subsurface water that occurs beneath the ground surface in fully saturated zones within soils and other geologic formations. Where ground water occurs in a saturated geologic unit that contains sufficient permeability and thickness to yield significant quantities of water to wells or springs, it can be defined as an aquifer (USGS, Water Supply Paper 1988, 1972). A ground water basin is defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers (Todd, *Groundwater Hydrology*, 1980).
Major ground water basins underlie both valley floors, and there are scattered smaller basins in the foothill areas and mountain valleys. In many parts of the Region, usable ground waters occur outside of these currently identified basins. There are water-bearing geologic units within ground water basins in the Region that do not meet the definition of an aquifer. Therefore, for basin planning and regulatory purposes, the term "ground water" includes all subsurface waters that occur in fully saturated zones and fractures within soils and other geologic formations, whether or not these waters meet the definition of an aquifer or occur within identified ground water basins.

Sacramento River Basin

The Sacramento River Basin covers 27,210 square miles and includes the entire area drained by the Sacramento River. For planning purposes, this includes all watersheds tributary to the Sacramento River that are north of the Cosumnes River watershed. It also includes the closed basin of Goose Lake and drainage sub-basins of Cache and Putah Creeks.

The principal streams are the Sacramento River and its larger tributaries: the Pit, Feather, Yuba, Bear, and American Rivers to the east; and Cottonwood, Stony, Cache, and Putah Creeks to the west. Major reservoirs and lakes include Shasta, Oroville, Folsom, Clear Lake, and Lake Berryessa.

DWR Bulletin 118-80 identifies 63 ground water basins in the Sacramento watershed area. The Sacramento Valley floor is divided into 2 ground water basins. Other basins are in the foothills or mountain valleys. There are areas other than those identified in the DWR Bulletin with ground waters that have beneficial uses.

San Joaquin River Basin

The San Joaquin River Basin covers 15,880 square miles and includes the entire area drained by the San Joaquin River. It includes all watersheds tributary to the San Joaquin River and the Delta south of the Sacramento River and south of the American River watershed. The southern planning boundary is described in the first paragraph of the previous page.

The principal streams in the basin are the San Joaquin River and its larger tributaries: the Cosumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers. Major reservoirs and lakes include Padre, New Hogan, Millerton, McClure, Don Pedro, and New Melones.

DWR Bulletin 118-80 identifies 39 ground water basins in the San Joaquin watershed area. The San Joaquin Valley floor is divided into 15 separate ground water basins, largely based on political considerations. Other basins are in the foothills or mountain valleys. There are areas other than those identified in the DWR Bulletin with ground waters that have beneficial uses.

Grassland Watershed

The Grassland watershed is a valley floor sub-basin of the San Joaquin River Basin. The portion of the watershed for which agricultural subsurface drainage policies and regulations apply covers an area of approximately 370,000 acres, and is bounded on the north by the alluvial fan of Orestimba Creek and by the Tulare Lake Basin to the south. The San Joaquin River forms the eastern boundary and Interstate Highway 5 forms the approximate western boundary. The San Joaquin River forms a wide flood plain in the region of the Grassland watershed.

The hydrology of the watershed has been irreversibly altered due to water projects, and is presently governed by land uses. These uses are primarily managed wetlands and agriculture. The wetlands form important waterfowl habitat for migratory waterfowl using the Pacific Flyway. The alluvial fans of the western and southern portions of the watershed contain salts and selenium, which can be mobilized through irrigation practices, and can impact beneficial uses of surface waters and wetlands if not properly regulated.

Lower San Joaquin River Watershed and Subareas

Technical descriptions of the Lower San Joaquin River (LSJR) and its component subareas are contained in Appendix 41. General descriptions follow: The LSJR watershed encompasses approximately 4,580 square miles in Merced County and portions of Fresno, Madera, San Joaquin, and Stanislaus counties. For planning purposes, the LSJR watershed is defined as the area draining to the San Joaquin River downstream of the Mendota Dam and upstream of the Airport Way Bridge near Vernalis, excluding the areas upstream of dams on the major Eastside reservoirs: New Don Pedro, New Melones, Lake McClure, and similar Eastside reservoirs in the LSJR system. The LSJR watershed excludes all lands within Calaveras, Tuolumne, San Benito, and Mariposa Counties. The LSJR watershed has been subdivided into seven major sub areas. In some cases major subareas have been further subdivided into minor subareas to facilitate more effective and focused water quality planning (Table I-1).

Table I-1 Lower San Joaquin River Subareas

Major Subareas		Minor Subareas	
1	LSJR upstream of Salt Slough	1a	Bear Creek
		1b	Fresno-Chowchilla
2	Grassland		-- --
3	East Valley Floor	3a	Northeast Bank
		3b	North Stanislaus
		3c	Stevinson
		3d	Turlock Area
4	Northwest Side	4a	Greater Orestimba
		4b	Westside Creeks
		4c	Vernalis North
5	Merced River		-- --
6	Tuolumne River		-- --
7	Stanislaus River		-- --

1. Lower San Joaquin River upstream of Salt Slough

This subarea drains approximately 1,480 square miles on the east side of the LSJR upstream of the Salt Slough confluence. The subarea includes the portions of the Bear Creek, Chowchilla River and Fresno River watersheds that are contained within Merced and Madera

Counties. The northern boundary of the subarea generally abuts the Merced River Watershed. The western and southern boundaries follow the San Joaquin River from the Lander Avenue Bridge to Friant, except for the lands within the Columbia Canal Company, which are excluded. Columbia Canal Company lands are included in the Grassland Subarea. This subarea is composed of the following drainage areas:

1a. Bear Creek (effective drainage area)
This minor subarea is a 620 square mile subset of lands within the LSJR upstream of Salt Slough Subarea. The Bear Creek Minor Subarea is predominantly comprised of the portion of the Bear Creek Watershed that is contained within Merced County.

1b. Fresno-Chowchilla
The Fresno-Chowchilla Minor Subarea is comprised of approximately 860 square miles of land within the southern portion of the LSJR upstream of Salt Slough Subarea. This minor subarea is located in southeastern Merced County and western Madera County and contains the land area that drains into the LSJR between Sack Dam and the Bear Creek confluence, including the drainages of the Fresno and Chowchilla Rivers.

2. Grassland
The Grassland Subarea drains approximately 1,370 square miles on the west side of the LSJR in portions of Merced, Stanislaus, and Fresno Counties. This subarea includes the Mud Slough, Salt Slough, and Los Banos Creek watersheds. The eastern boundary of this subarea is generally formed by the LSJR between the Merced River confluence and the Mendota Dam. The Grassland Subarea extends across the LSJR, into the east side of the San Joaquin Valley, to include the lands within the Columbia Canal Company. The western boundary of the subarea generally follows the crest of the Coast Range with the exception of lands within San Benito County, which are excluded.

3. East Valley Floor
This subarea includes approximately 413 square miles of land on the east side of the LSJR that drains directly to the LSJR between the Airport Way Bridge near Vernalis and the Salt Slough confluence. The subarea is largely comprised of the land between the major east-side drainages of the Tuolumne, Stanislaus, and Merced Rivers. This subarea lies within central Stanislaus County and north-central Merced County. Numerous drainage canals, including the Harding Drain and natural drainages, drain this subarea. The subarea is comprised of the following minor subareas:

3a. Northeast Bank
This minor subarea of the East Valley Floor contains all of the land draining the east side of the San Joaquin River between the Maze Boulevard Bridge and the Crows Landing Road Bridge, except for the Tuolumne River subarea. The Northeast Bank covers approximately 123 square miles in central Stanislaus County.

3b. North Stanislaus
The North Stanislaus minor subarea is a subset of lands within the East Valley Floor Subarea. This minor subarea drains approximately 68 square miles of land between the Stanislaus and Tuolumne River watersheds that flows into the San Joaquin River between the Airport Way Bridge near Vernalis and the Maze Boulevard Bridge.

3c. Stevinson
This minor subarea of the East Valley Floor contains all of the land draining to the LSJR between the Merced River confluence and the Lander Avenue (Highway 165) Bridge. The Stevinson Minor Subarea occupies approximately 44 square miles in north-central Merced County.

3d. Turlock Area
This minor subarea of the East Valley Floor contains all of the land draining to the LSJR between the Crows Landing Road Bridge and the Merced River confluence. The Turlock Area Minor Subarea occupies approximately 178 square miles in south-central Stanislaus County and northern Merced County.

4. Northwest Side
This 574 square mile area generally includes the lands on the West side of the LSJR between the Airport Way Bridge near Vernalis and the Newman Waste way confluence. This subarea includes the entire drainage area of Orestimba, Del Puerto, and Hospital/Ingram Creeks. The subarea is primarily located in Western

Stanislaus County except for a small area that extends into Merced County near the town of Newman and the Central California Irrigation District Main Canal.

4a. Greater Orestimba
The Greater Orestimba Minor Subarea is a 285 square mile subset of the Northwest Side Subarea located in southwest Stanislaus County and a small portion of western Merced County. It contains the entire Orestimba Creek watershed and the remaining area that drains into the LSJR from the west between the Crows Landing Road Bridge and the confluence of the Merced River, including Little Salad and Crow Creeks.

4b. Westside Creeks
This Minor Subarea is comprised of 277 square miles of the Northwest Side Subarea in western Stanislaus County. It consists of the areas that drain into the west side of the San Joaquin River between Maze Boulevard and Crows Landing Road, including the drainages of Del Puerto, Hospital, and Ingram Creeks.

4c. Vernalis North
The Vernalis North Minor Subarea is a 12 square mile subset of land within the most northern
portion of the Northwest Side Subarea. It contains the land draining to the San Joaquin River from the west between the Maze Boulevard Bridge and the Airport Way Bridge near Vernalis.

5. Merced River
This 294 square mile subarea is comprised of the Merced River watershed downstream of the Merced-Mariposa county line and upstream of the River Road Bridge. The Merced River subarea includes a 13-square-mile "island" of land (located between the East Valley Floor and the Tuolumne River Subareas) that is hydrologically connected to the Merced River by the Highline Canal.

6. Tuolumne River
This 294 square mile subarea is comprised of the Tuolumne River watershed downstream of the Stanislaus-Tuolumne county line, including the drainage of Turlock Lake, and upstream of the Shiloh Road Bridge.

7. Stanislaus River
This 157 square mile subarea is comprised of the Stanislaus River watershed downstream of the Stanislaus-Calaveras county line and upstream of Caswell State Park.

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.

- Total identifiable persistent chlorinated hydrocarbon pesticides shall not be present in the water column at concentrations detectable within the accuracy of analytical methods approved by the Environmental Protection Agency or the Executive Officer.

- Pesticide concentrations shall not exceed those allowable by applicable antidegradation policies (see State Water Resources Control Board Resolution No. 68-16 and 40 C.F.R. Section 131.12.).

- Pesticide concentrations shall not exceed the lowest levels technically and economically achievable.

- Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the Maximum Contaminant Levels set forth in California Code of Regulations, Title 22, Division 4, Chapter 15.

- Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of thiobencarb in excess of 1.0 μg/l.

Pesticide concentrations shall not exceed the levels identified in Table III-2A. Where more than one objective may be applicable, the most stringent objective applies.

For the purposes of this objective, the term pesticide shall include: (1) any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever, or (2) any spray adjuvant, or (3) any breakdown products of these materials that threaten beneficial uses. Note that discharges of "inert" ingredients included in pesticide formulations must comply with all applicable water quality objectives.

TABLE III-2A

SPECIFIC PESTICIDE OBJECTIVES

PESTICIDE	MAXIMUM CONCENTRATION AND AVERAGING PERIOD	APPLICABLE WATER BODIES
Chlorpyrifos	0.025 µ g/L ; 1-hour average (acute) 0.015 µ g/L ; 4-day average (chronic) Not to be exceeded more than once in a three year period.	San Joaquin River from Mendota Dam to Vernalis (Reaches include Mendota Dam to Sack Dam (70), Sack Dam to Mouth of Merced River (71), Mouth of Merced River to Vernalis (83))

PESTICIDE	MAXIMUM CONCENTRATION AND AVERAGING PERIOD	APPLICABLE WATER BODIES
Diazinon	0.16 µ g/L ; 1-hour average (acute) 0.10 µ g/L ; 4-day average (chronic) Not to be exceeded more than once in a three year period.	San Joaquin River from Mendota Dam to Vernalis (Reaches include Mendota Dam to Sack Dam (70), Sack Dam to Mouth of Merced River (71), Mouth of Merced River to Vernalis (83))

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.

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 antidegradation policies. This will primarily be done as pesticide discharges are evaluated on a case-by-case basis.

Insert to Chapter IV Implementation after 7. Diazinon Discharges into the Sacramento and Feather Rivers

8. Control of Diazinon and Chlorpyrifos Runoff into the San Joaquin River

Beginning December 1, 2010, the direct or indirect discharge of diazinon or chlorpyrifos into the San Joaquin River is prohibited during the dormant season (1 December through 1 March) if any exceedance of the chlorpyrifos or diazinon water quality objectives, or diazinon and chlorpyrifos loading capacity occurred during the previous dormant season.

Beginning March 2, 2011, the direct or indirect discharge of diazinon or chlorpyrifos into the San Joaquin River is prohibited during the irrigation season (2 March through 30 November) if any exceedance of the chlorpyrifos or diazinon water quality objectives, or diazinon and chlorpyrifos loading capacity occurred during the previous irrigation season.

These prohibitions apply only to i) dischargers who discharge the pollutant causing or contributing to the exceedance of the water quality objective or loading capacity; and ii) dischargers located in those subareas not meeting their load allocations.

These prohibitions do not apply if the discharge of diazinon or chlorpyrifos is subject to a waiver of waste discharge requirements implementing the diazinon and chlorpyrifos water quality objectives and load allocations for diazinon and chlorpyrifos for the San Joaquin River, or governed by individual or general waste discharge requirements.

Insert to Chapter IV Implementation page 36.01

Diazinon and Chlorpyrifos Runoff in the San Joaquin River Basin

1. The pesticide runoff control program shall:
   a. Ensure compliance with water quality objectives applicable to diazinon and chlorpyrifos in the San Joaquin River through the implementation of management practices.
   b. Ensure that measures that are implemented to reduce discharges of diazinon and chlorpyrifos do not lead to an increase in the discharge of other pesticides to levels that cause or contribute to violations of applicable water quality objectives and Regional Water Board plans and policies; and
   c. Ensure that discharges of pesticides to surface waters are controlled so that pesticide concentrations are at the lowest levels that are technically and economically achievable.

2. Dischargers must consider whether any proposed alternative to the use of diazinon or chlorpyrifos has the potential to degrade ground or surface water. If the alternative has the potential to degrade groundwater, alternative pest control methods must be considered. If the alternative has the potential to degrade surface water, control measures must be implemented to ensure that applicable water quality objectives and Regional Board plans and policies are not violated, including State Water Resources Control Board Resolution 68-16.

3. Compliance with applicable water quality objectives, load allocations, and waste load allocations for diazinon and chlorpyrifos in the San Joaquin River is required by December 1, 2010.

   The water quality objectives and allocations will be implemented through one or a combination of the following: the adoption of one or more waivers of waste discharge requirements, and general or individual waste discharge requirements. To the extent not already in place, the Regional Water Board expects to adopt or revise the appropriate waiver(s) or waste discharge requirements by December 31, 2007.

4. The Regional Board intends to review the diazinon and chlorpyrifos allocations and the implementation provisions in the Basin Plan at least once every five years, beginning no later than December 31, 2009.

5. Regional Board staff will meet at least annually with staff from the Department of Pesticide Regulation and representatives from the California Agricultural Commissioners and Sealers Association to review pesticide use and instream pesticide concentrations during the dormant spray and irrigation application seasons, and to consider the effectiveness of management measures in meeting water quality objectives and load allocations.

6. The Waste Load Allocations (WLA) for all NPDES-permitted dischargers, Load Allocations (LA) for nonpoint source discharges, and the Loading Capacity of the San Joaquin River from the Mendota Dam to Vernalis shall not exceed the sum (S) of one (1) as defined below.

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

where

C_D = diazinon concentration in µg/L of point source discharge for the WLA; nonpoint source discharge for the LA; or San Joaquin River for the LC.
C_C = chlorpyrifos concentration in µg/L of point source discharge for the WLA; nonpoint source discharge for the LA; or San Joaquin River for the LC.
WQO_D = acute or chronic diazinon water quality objective in µg/L.
WQO_C = acute or chronic chlorpyrifos water quality objective in µg/L.

Available samples collected within the applicable averaging period for the water quality objective will be used to determine compliance with the allocations and loading capacity. For purposes of calculating the sum (S) above, analytical results that are reported as "non-detectable" concentrations are considered to be zero.

At a minimum, Loading Capacity shall be calculated for each of the following six water quality compliance points in the San Joaquin River:

- San Joaquin River at the Airport Way Bridge near Vernalis (United States Geological Survey (USGS) Identification Number 11303500)
- San Joaquin River at the Maze Boulevard (Highway 132) Bridge (USGS Identification Number 11290500)
- San Joaquin River at Las Palmas Avenue near Patterson (USGS Identification Number 11274570)
- San Joaquin River at Hills Ferry Road
- San Joaquin River at Highway 165 near Stevinson (USGS Identification Number 11260815)
- San Joaquin River at Sack Dam

6. The load allocations for non-point source discharges into the San Joaquin River are assigned to the following subareas:

   a. The combined Stanislaus River; North Stanislaus; and Vernalis North subareas.
   b. The combined Tuolumne River; Northeast Bank; and Westside Creek subareas.
   c. The combined Turlock; Merced; and Greater Orestimba subareas.
   d. The combined Stevinson and Grassland subareas.
   e. The combined Bear Creek and Fresno-Chowchilla subareas.

7. The established waste load and load allocations for diazinon and chlorpyrifos, and the water quality objectives for chlorpyrifos and diazinon in the San Joaquin River represent a maximum allowable level. The Regional Water Board shall require any additional reductions in diazinon and chlorpyrifos levels necessary to account for additional additive or synergistic toxicity effects or to protect beneficial uses in tributary waters.

8. Pursuant to CWC Section 13267, the Executive Officer will require dischargers to submit a management plan that describes the actions that the discharger will take to reduce diazinon and chlorpyrifos discharges and meet the applicable allocations by the required compliance date.

   The management plan may include actions required by State and federal pesticide regulations. The Executive Officer will require the discharger to document the relationship between the actions to be taken and the expected reductions in diazinon and chlorpyrifos discharges. The Executive Officer will allow individual dischargers or a discharger group or coalition to submit management plans.

   The management plan must comply with the provisions of any applicable waiver of waste discharge requirements or waste discharge requirements.

   The Executive Officer may require revisions to the management plan if compliance with applicable allocations is not attained or the management plan is not reasonably likely to attain compliance.

9. If the loading capacity in the San Joaquin River is not being met by the compliance date, dischargers in subareas where load allocations are not being met will be required to revise their management plans and implement an improved complement of management measures to meet the loading capacity.

10. Any waiver of waste discharge requirements or waste discharge requirements that govern the control of pesticide runoff that is discharged directly or indirectly into the San Joaquin River must be consistent with the policies and actions described in paragraphs 1 – 9.

11. In determining compliance with the waste load allocations, the Regional Water Board will consider any data or information submitted by the discharger regarding diazinon and chlorpyrifos inputs from sources outside of the jurisdiction of the permitted discharger, including any diazinon and chlorpyrifos present in precipitation, and other available relevant information; and any applicable provisions in the discharger's NPDES permit requiring the discharger to reduce the discharge of pollutants to the maximum extent possible.

Add to "Estimated Costs of Agricultural Water Quality Control Programs and potential Sources of Financing" section-

The total estimated costs for management practices to meet the diazinon and chlorpyrifos objectives for the San Joaquin River range from -$56,000 to $2.5 million for the dormant season, and from $3.9 million to $5.3 million for the irrigation season. The estimated costs for discharger compliance monitoring, planning and evaluation range from $600,000 to $3.1 million. The estimated total annual costs range from $4.4 million to $10.9 million (2004 dollars).

Potential funding sources include:

1. Those identified in the San Joaquin River Subsurface Agricultural Drainage Control Program and the Pesticide Control Program.

Add to Chapter 5 Surveillance and Monitoring

The Regional Water Board requires a focused monitoring effort of pesticide runoff from orchards and fields in the San Joaquin Valley.

The monitoring and reporting program for any waste discharge requirements or waiver of waste discharge requirements that addresses pesticide runoff from orchards and fields in the San Joaquin valley must be designed to collect the information necessary to:

1.determine compliance with established water quality objectives and the loading capacity applicable to diazinon and chlorpyrifos in the San Joaquin River;
2. determine compliance with established load allocations for diazinon and chlorpyrifos;
3. determine the degree of implementation of management practices to reduce off-site movement of diazinon and chlorpyrifos;
4. determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon and chlorpyrifos;
5. determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts;
6. determine whether the discharge causes or contributes to a toxicity impairment due to additive or synergistic effects of multiple pollutants; and
7. demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable.

Dischargers are responsible for providing the necessary information. The information may come from the dischargers' monitoring efforts; monitoring programs conducted by State or federal agencies or collaborative watershed efforts; or from special studies that evaluate the effectiveness of management practices.

Add to Appendices

Add a new Appendix 41 titled "San Joaquin Area Subarea Descriptions". The proposed language is in Appendix A of this report.

3 Review of Existing Laws and Policies

Any proposed changes to the Regional Board Basin Plans must be consistent with existing law and adopted State and Regional Board policies. Water Code Section 13146 requires that, in carrying out activities which affect water quality, all state agencies, departments, boards and offices must comply with state policy for water quality control unless otherwise directed or authorized by statute, in which case they shall indicate to the state board in writing their authority for not complying with such policy. These activities must also be consistent with existing Management Agency Agreements (MAAs) between the State Board and other agencies. This section summarizes existing State and Regional Board policies, MAAs and laws that are relevant to the changes proposed in this Basin Plan amendment.

3.1 Central Valley Regional Board Policies

Water Quality Limited Segments Policy

The Water Quality Limited Segments Policy states in part: *"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."*

The proposed Basin Plan amendment establishes a TMDL and allocates the allowable load to dischargers by subarea and to individual NPDES dischargers. Therefore, the proposed Basin Plan amendment is consistent with this policy.

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 Regional Water Board, and that may be reasonably controlled."

The evaluation of management practices in Section 4.4.2 and in two additional reports (Reyes and Menconi. 2002. Azimi-Gaylon et al. 2002.) shows that a variety of methods to control the runoff of diazinon and chlorpyrifos are available. Implementation of these control measures should result in attainment of the proposed water quality objectives within a reasonable period of time. There are no other factors that would cause these water quality objectives to be exceeded.

Anti-degradation Implementation Policy

"High quality waters will be maintained consistent with the maximum benefit to the people of the State. The directives of Section 13000 of the Water Code and State Board Resolution No 68-16 are applied when the Regional Board issues a permit, or in an equivalent process, regarding any discharge of waste which may affect the quality of surface or ground waters in the region."

"Implementation of this policy to prevent or minimize surface and ground water degradation is a high priority for the Regional Board. In nearly all cases, preventing pollution before it happens is much more cost-effective that cleaning up pollution after it has occurred. Once degraded, surface water is difficult to clean up when it has passed downstream. The prevention of degradation is therefore an important strategy to meet the policy's objectives."

The proposed water quality objectives and program of implementation are designed to reduce concentrations of diazinon and chlorpyrifos in the mainstem SJR to levels that are protective of beneficial uses, and should result in an improvement of water quality. Implementation of some practices to reduce diazinon and chlorpyrifos concentrations may result in increased infiltration, or in the increased use of other pesticides that could degrade water quality. Therefore this amendment includes new policies that require dischargers to prevent groundwater contamination and to ensure compliance with existing Regional Board water quality objectives and policies. In addition, any monitoring and reporting program will require the discharger to demonstrate that the lowest pesticide levels in surface water that are technically and economically achievable are being attained. The proposed amendment is therefore consistent with the anti-degradation policy.

Watershed Policy

"The Regional 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."

The Regional Board conducted outreach to the stakeholders in the area covered by this amendment. Six staff workshops were conducted at various locations in the watershed between 2000 and 2002. The range of alternatives considered for the program of implementation included alternatives where stakeholders take the lead in overseeing implementation. The proposed approach for load allocations is based on subwatersheds, in order to encourage local participation. These activities have been conducted as part of implementation of the watershed policy, and therefore the proposed Amendment is consistent with the watershed policy.

Policy for Application of Water Quality Objectives

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 Regional Boards will apply to regional waters in order to protect beneficial uses. Where compliance with narrative objectives is required, the Regional 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 Regional 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 Regional Board in making determinations:

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

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 amendment proposes establishment of acute and chronic numeric objectives for diazinon and chlorpyrifos. Since diazinon and chlorpyrifos have the same toxicological effect, this amendment also requires compliance based upon the additive toxicity of these two pesticides when present together. The loading capacity and allocations for diazinon and chlorpyrifos explicitly account for the additive effects of these pesticides.

3.2 State Water Board Policies and Management Agency Agreements

Policy for Implementation and Enforcement of the Nonpoint Source Pollution Program

The Nonpoint Source Pollution Program Policy (Policy) clarifies the applicability of Porter-Cologne to nonpoint sources. The Policy also describes the key elements that must be included in a nonpoint source implementation program.

The Policy makes it clear that all nonpoint source discharges must be regulated under waste discharge requirements, waivers of waste discharge requirements, a basin plan prohibition or some combination of those administrative tools. An implementation program developed by the Regional Board, State Board, discharger, or third party must include the following elements:

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 antidegradation requirements.

KEY ELEMENT 2: An NPS control implementation program shall include a description of the MPs 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 MPs, and the process to be used to ensure and verify proper MP implementation.

KEY ELEMENT 3: Where a RWQCB 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 RWQCB, dischargers, and the public can determine whether the program is achieving its stated purpose(s), or whether additional or different MPs or other actions are required.

KEY ELEMENT 5**:** Each RWQCB shall make clear, in advance, the potential consequences for failure to achieve an NPS control implementation program's stated purposes.

This amendment is consistent with the NPS policy. A prohibition of discharge applies, if the discharge is not addressed by a WDR or waiver of WDRs and objectives are not attained. The amendment includes requirements:

to meet water quality objectives (Key Element 1);
to submit management plans and evaluate management practices (Key Element 2);
to comply with objectives and allocations within a specified time frame (Key Element 3);
to conduct monitoring on the success of management practices (Key Element 4).
The conditional prohibition of discharge provides a clear consequence for failure to attain objectives and obtain a waiver of WDRs or WDR (Key Element 5).

Policy with Respect to Maintaining High Quality of Water in California

This policy was adopted by the State Board in 1968, and it generally restricts the Regional Boards and dischargers from reducing the water quality of surface or ground waters even though such a reduction in water quality might still allow the protection of the beneficial uses associated with the water prior to the quality reduction. The goal of the policy is to maintain high quality waters. Changes in water quality are allowed only if the change is consistent with the maximum benefit to the people of the State; does not unreasonably affect present and anticipated beneficial uses; and, does not result in water quality less than that prescribed in water quality control plans or policies.

This amendment is designed to result in an improvement in water quality and not a reduction. It is, therefore, consistent with the policy.

Water Quality Control Policy for the Enclosed Bays and Estuaries of California

This policy was adopted by the State 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 Regional Board must enforce the policy and take actions consistent with its provisions.

The Delta flows into the San Francisco Bay and forms the Bay-Delta. Since the SJR flows into the Delta, an improvement in SJR water quality should result in an improvement in Bay-Delta water quality.

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

In 1991 the State Board signed a Memorandum of Understanding (MOU) with the DPR 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. This agreement was revised in 1997 to facilitate implementation of the original agreement. The State and Regional Boards 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 described a four-stage process for DPR 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 Agricultural Commissioners, and stage four is a regulatory approach based on Regional 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.

The stage two process described in the MAA has not been put into effect for diazinon or chlorpyrifos in the San Joaquin River. A QRL or QRLs for diazinon or chlorpyrifos have not been developed and no sponsor has been identified. DPR began the stage 3 process in February 2003 (CDPR, 2003a) by placing diazinon into the reevaluation process, and later placed chlorpyrifos into reevaluation (CDPR, 2004). DPR initiated the rule-making process for its proposed dormant spray regulations (CDPR 2003b). The public comment period closed on August 1, 2005. Additionally, the supplemental labels for diazinon dormant sprays have been approved by DPR and are currently binding in California. Similarly, agricultural products containing chlorpyrifos also have new updated labeling, which includes requirements and advisories for protecting water quality. Those labels are currently under DPR review.

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

The Regional Board is obligated by both federal and state law to develop a program to address the discharge of diazinon and chlorpyrifos, so the stage four process applies. This 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 Amendment to address the control of diazinon and chlorpyrifos discharges.

Bay Protection Toxic Hot Spots Cleanup Program

The State Board adopted the Consolidated Toxic Hot Spots Cleanup Plan (SWRCB Resolution No. 2004-0002), which includes cleanup plans for diazinon and chlorpyrifos in the Sacramento-San Joaquin Delta. The Cleanup Plan for the Delta requires the development of a Basin Plan Amendment for the San Joaquin River that addresses both diazinon and chlorpyrifos. Technical Reports were to be prepared by March 2003. The proposed Basin Plan Amendment was to be given to the Regional Board for consideration by September 2003 and the Amendment was to be adopted by December 2003. Amendments are required to include: water quality objectives for diazinon and chlorpyrifos; an implementation program and framework; a compliance time schedule; a monitoring program; and other required TMDL elements. State Board Resolution 2004-0002 requires the submission of Management Plans to remedy or restore the pesticide impairment in the Delta. This Amendment includes all of the elements identified in the Cleanup Plan.

CALFED Bay-Delta Program

CALFED includes a goal to:

"Improve and/or maintain water quality conditions that fully support healthy and diverse aquatic ecosystems in the Bay-Delta estuary and watershed, and eliminate to the extent possible, toxic impacts to aquatic organisms, wildlife and people."

Since the San Joaquin River flows into the Bay-Delta, an improvement in San Joaquin water quality should result in an improvement in Bay-Delta water quality. The Amendment is, therefore, consistent with CALFED program goals.

4 Basin Plan Chapters

The primary purpose of this Basin Plan amendment is to update the Basin Plan with new water quality objectives and an implementation plan. Section 2 of this staff report presents the recommended Basin Plan language (revisions, deletions, and/or additions). This section presents the analysis of alternatives and basis for the recommendations.

The Basin Plan consists of five chapters:

1. Introduction;
2. Existing and potential beneficial uses;
3. Water quality objectives;
4. Implementation options; and
5. Surveillance and monitoring

An analysis of alternatives is described for each Basin Plan chapter.

4.1 Introduction

The discussion below is identical to that contained in CRWQCB-CVR 2004a. Should Regional Board Resolution No. R5-2004-0108 become effective prior to Regional Board adoption of this Basin Plan Amendment, the following discussion will be moot and will be removed.

The alternatives considered were to: 1) make no changes to the Introduction chapter; or 2) to add descriptions of the subareas as discussed below. Since the load allocations are based on subarea that are not described elsewhere, it is recommended that subarea descriptions be added

The introductory chapter of the Basin Plan contains a description of the planning area and the major hydrologic features of the basin. The Basin Plan area is subdivided into two major watershed delineations: the Sacramento River Basin and the San Joaquin River Basin.

The Basin Plan now includes an inaccurate description of the planning boundary between the San Joaquin Basin and the Tulare Lake Basin. Current Basin Plan language indicates that the divide between these two basins is formed by the northern boundary of the Little Panoche Creek Basin. The Little Panoche Creek Basin is, however, contained entirely in the San Joaquin River Basin. Changes are proposed to correct this error. The boundary between the San Joaquin River Basin and the Tulare Lake basins actually follows the natural drainage divide from the crest of the Coast Range along the southern portions of the Little Panoche Creek, Moreno Gulch, and Capita Canyon drainages to boundary of the Westlands Water District. From here, the boundary runs along the northern edge of the Westlands Water District until the intersection with the Firebaugh Canal Company's Main Lift Canal. The basin boundary then follows the Main Lift Canal to the Mendota Pool and continues eastward along the channel of the San Joaquin River to Millerton Lake in the Sierra Nevada foothills, and then follows along the southern boundary of the San Joaquin River drainage basin.

In 1996 a description of the Grassland Watershed was added to the Basin Plan to implement the existing control program for agricultural subsurface drainage discharges. Similarly, additional sub-watershed delineations (subareas) need to be added to the Basin Plan to facilitate implementation of the proposed control program. The LSJR watershed will be divided into seven major geographic subareas. The Grassland Subarea will replace the existing description of the Grassland Watershed. In some cases, major subareas have been further subdivided into minor subareas. The addition of these subareas will allow implementation efforts to be prioritized on the most important sources of pollution. Other water quality control programs may also use the new subareas.

4.2 Beneficial Uses

Beneficial uses designated by the Regional Board for the San Joaquin River from the Mendota Dam to Vernalis (i.e. the south Delta boundary) in the Basin Plan include: a potential domestic supply (MUN) use; agriculture irrigation and stock watering (AGR); industrial process supply (PROC); contact recreation (REC-1); non-contact recreation (REC-2); warm freshwater habitat (WARM); warm and cold migration (MIGR) and warm spawning (SPWN); and wildlife habitat (WILD) (see Chapter II of Basin Plan).

Porter-Cologne requires that the “Past, present, and probable future beneficial uses of water” be considered in establishing water quality objectives. The Basin Plan defines 21 categories of uses that could be applied to surface waters in the Central Valley. Some of these uses likely apply to the San Joaquin River, but have not yet been designated by the Regional Board. This section will consider whether additional use designations are necessary in order to establish appropriate diazinon and chlorpyrifos water quality objectives.

4.2.1 Alternatives Considered

The alternatives considered are to adopt new uses, modify existing uses, or make no change to current use designations. The primary factor used in choosing the appropriate alternative is whether new or modified use designations are necessary to establish the appropriate diazinon or chlorpyrifos water quality objectives.

With respect to consideration of protection of beneficial uses, the discussion contained in a previous Regional Board report for the Sacramento and Feather Rivers (Karkoski, et al., 2003) has been reviewed and also applies to the San Joaquin River. There is no information available that would indicate that WARM or COLD habitat species in the San Joaquin River would be more or less sensitive to diazinon and chlorpyrifos than those species found in the Sacramento and Feather Rivers.

No Changes in Uses for the San Joaquin River

This alternative would consider no changes in the already existing uses for the San Joaquin River from the Mendota Dam to Vernalis.

Aquatic invertebrates have been identified as the most sensitive aquatic organisms to diazinon and chlorpyrifos. The Warm Freshwater Habitat use is defined as follows: "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." The existing designated use for the San Joaquin River, therefore, should address the use that is most sensitive to diazinon and chlorpyrifos.

Modification of Uses Affected by Diazinon and Chlorpyrifos for the San Joaquin River
This alternative would result in creating a sub-category of the designated WARM use to account for factors that would make attainment of the WARM use infeasible. The factors that could be considered in establishing a sub-category of the WARM use include (from 40 CFR § 131.10(g)): 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 the Clean Water Act would result in substantial and widespread economic and social impact.

None of those factors is expected to make attainment of designated uses infeasible with respect to diazinon and chlorpyrifos. Diazinon and chlorpyrifos are not natural pollutants (Factor 1). Flow conditions in the San Joaquin River 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 extensive hydro modification, discharges of diazinon and chlorpyrifos are not impacted by those modifications (Factor 4). The natural features of the river do not prevent attainment of the use (Factor 5). As discussed elsewhere in this report (Section 5) the cost for compliance is expected to be relatively modest for the size of the geographic area covered (Factor 6).

Addition of Uses for the San Joaquin River
There are a number of defined uses in the Basin Plan that likely apply to the San Joaquin River. Those uses include: Commercial and Sport Fishing; Preservation of Biological Habitats of Special Significance; Rare, Threatened, or Endangered Species; and Shellfish Harvesting. None of these uses is more sensitive to diazinon and chlorpyrifos than the WARM use.

4.2.2 Recommended Alternative for Beneficial Uses
It is recommended that no change be made to existing designated uses for the San Joaquin River. The use that is most sensitive to diazinon and chlorpyrifos has already been designated, so additional use designations are not necessary at this time.

4.3 Water Quality Objectives for Diazinon and Chlorpyrifos
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 and the water quality criteria designed to

protect those uses. Individual states are responsible for reviewing, establishing, and revising water quality standards, and these water quality standards are then submitted to the US EPA for approval. In California, these criteria are established as water quality objectives.

In California, the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (Regional Boards) are responsible for developing and submitting water quality standards to US EPA, under the state's Porter-Cologne Water Quality Control Act. Upon US EPA approval, these water quality objectives are included in the Water Quality Control Plan (Basin Plan) of the appropriate Regional Board, through a Basin Plan Amendment.

The Basin Plan does not currently contain numeric water quality objectives for diazinon or chlorpyrifos in the San Joaquin River. This section examines and evaluates alternatives for establishing numeric water quality objectives and describes the basis for the recommended alternative.

The alternative water quality standards methodologies reviewed in the Sacramento and Feather Rivers are reviewed in this report for the San Joaquin River. The detailed description of those methodologies that were provided previously (Karkoski, et al., 2003) is not repeated.

The Probabilistic Ecological Risk Assessment (PERA) approach conducted by Novartis is not evaluated for the San Joaquin River. 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 Regional 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 for the San Joaquin River.

4.3.1 Water Quality Objectives

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

- 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 antidegradation policies, and

- Pesticide concentrations shall not exceed the lowest levels technically and economically achievable.

The Basin Plan defines pesticides as: "…any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, …or, any spray adjuvant; or, any breakdown products of these materials that threaten beneficial uses. Note that discharges of "inert" ingredients included in pesticide formulations must comply with all applicable water quality objectives."

The Basin Plan's narrative water quality objective for toxicity 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 Regional Water Board." 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. US EPA 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 LC50 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:

$$\frac{C_1}{O_1} + \frac{C_2}{O_2} + \ldots + \frac{C_i}{O_i} = S$$

> 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, the State Board's policy for maintaining high quality waters (Resolution 68-16) 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.

Available Criteria for Protection of Beneficial Uses

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 specified in Section 3 are not available. The criteria in Tables 4.1 and 4.2 show that the freshwater habitat beneficial use designations are the most sensitive to diazinon and chlorpyrifos in the San Joaquin River.

Alternatives Considered for Deriving Water Quality Objectives

Water quality objectives adopted by the Regional Board must protect the beneficial uses designated for the applicable water bodies, be consistent with State and Federal regulations, and be approved by the SWRCB, the US EPA, and the Office of Administrative Law. Alternate methods for deriving water quality objectives are discussed below, followed by an evaluation of the methods and their suitability for use in deriving a water quality objective.

Invertebrates are specifically mentioned in the definition of freshwater habitat 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 CFR §131.11(a)), which for this use specifically includes invertebrates.

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
- US EPA Water Quality Criteria methodology

- Canadian methodology
- Australian and New Zealand methodology

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

No Change in Water Quality Objectives

As discussed above, the Basin Plan currently contains narrative water quality objectives regarding pesticides and toxicity. The Regional Board uses available guidelines and criteria to interpret existing narrative water quality objectives. The Regional Board currently uses the CDFG criteria for diazinon and chlorpyrifos (Siepmann and Finlayson, 2000) to interpret compliance with its narrative toxicity and pesticide water quality objectives.

The manufacturer of diazinon (Makhteshim Agan of North America, Inc. or MANA) has provided information that suggests that the results from one of the studies used to derive the CDFG diazinon criteria (and the US EPA draft criteria) were reported incorrectly (Weinberg, 2004a, b). The toxicity test was on the species *Gammarus fasciatus* and was the lowest acceptable acute toxicity test result identified by CDFG or US EPA. The data sheets MANA provided came from the archives of the laboratory that conducted the toxicity tests. Regional Board staff concluded that the data sheets were inconsistent in how test results were reported (CRWQCB-CVR, 2004b). The toxicity test results reported in the literature could neither be definitively confirmed nor changed to a value an order of magnitude higher as suggested by MANA.

The California Department of Fish and Game (CDFG) has recalculated their diazinon criteria without the study in question (Finlayson, 2004). The recalculated acute criterion is 0.16 μg/L and the chronic criterion is 0.10 μg/L. The recalculations were based solely on the studies that CDFG had previously evaluated, minus the questionable results. CDFG did not attempt to review the literature that may have become available since their earlier (Siepmann and Finlayson, 2000) report was prepared. Regional Board staff also recalculated the diazinon criteria using the CDFG and US EPA contractor data sets (Appendix E) and derived the same criteria as CDFG.

The Basin Plan states that the Regional Board will consider 1/10th of the 96-hour LC50 of the most sensitive organism to interpret narrative objectives when water quality objectives or appropriate criteria are not available (see section 4.1.1 above). If the toxicity test result for the *Gammarus fasciatus* test is not considered reliable, the next most sensitive species is *Ceriodaphnia dubia*. *Ceriodaphnia dubia* is a zooplankton of the order cladocera (waterfleas), which are typically abundant in healthy freshwater ecosystems. The species mean acute value for *Ceriodaphnia dubia* reported by U.S. EPA (U.S. EPA, 2003) is 0.3773 μg/L and the value reported by CDFG (Siepmann and

Finlayson. 2000) is 0.44 μg/L. Based on existing Regional Board policy, the diazinon concentration used to interpret applicable narrative objectives would be between 0.03773 μg/L and 0.044 μg/L as a daily maximum.

Basin Plan policy also requires consideration of other available information when interpreting narrative objectives (e.g. no observed effect levels or lowest observed effect levels). As was pointed out by NOAA Fisheries (NMFS, 2003), effects of diazinon on salmon have been observed at levels as low as 0.1 μg/L, although the effects were not statistically significant when compared to controls. Since these effects were observed after short-term (2 hour) exposure of the fish to diazinon (Scholz, et al., 2000), it is likely that longer-term exposure to diazinon would have a more pronounced effect even at the lowest level tested.

Under the "no change" alternative for diazinon, the Regional Board would not rely on any criteria that include the *Gammarus fasciatus* test result from the U.S. Fish & Wildlife Service laboratory. Based on existing Regional Board policies, compliance with narrative pesticide and toxicity objectives would be determined by using the Regional Board's recalculation of the California Department of Fish and Game criteria (0.16 μg/L one-hour average; 0.10 μg/L 4-day average)[2]. Under the "no change" alternative for diazinon, a daily maximum based on 1/10th of the 96-hr LC50 of the most sensitive species (*C. dubia*) could also be used (0.042μg/L).

The "no change" alternative will be considered for both diazinon and chlorpyrifos, since it would apply if new water quality objectives were not established. For the "no change" alternative for chlorpyrifos, the Regional Board's recalculation of the CDFG chlorpyrifos criteria would be used to interpret compliance with narrative objectives (see Appendix E)[3].

For the "no change" alternative for diazinon the recalculated CDFG diazinon criteria should protect aquatic invertebrates from acute and chronic effects of diazinon. The majority of the most sensitive invertebrates used in the development of the CDFG criteria were freshwater zooplankton, which are typically abundant in healthy freshwater ecosystems. When additive toxicity is considered in determining compliance, the recalculated CDFG diazinon criteria along with the recalculated CDFG chlorpyrifos criteria would be used.

[2] Note that the recalculation of the CDFG diazinon criteria (Finlayson, 2004) did not include a comprehensive review of data and information available since the Siepmann and Finlayson (2000) report was published. The recalculation only considered the effect of removing the *Gammarus fasciatus* results from the data set, but did not consider the possible effect on the criteria of any other recently available data or information.

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

Numeric Water Quality Objectives Based on No Diazinon or Chlorpyrifos

The Regional Board could adopt water quality objectives that would maintain "natural" water quality conditions. Water quality objectives based on these levels would mean no detected concentrations of diazinon or chlorpyrifos. State and federal anti-degradation policies would allow 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 Resolution 68-16 and 40 CFR 131.12.)

The Regional Board could make a determination that the presence of diazinon or chlorpyrifos in surfacewaters 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 Regional 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 considered, since anti-degradation policies suggest that the Regional Board could determine that the presence of diazinon or chlorpyrifos in the San Joaquin River is not to the maximum benefit of the people of the State. Since diazinon and chlorpyrifos are not natural compounds, no diazinon or chlorpyrifos would correspond to natural conditions.

Numeric Water Quality Objectives Based on US EPA Method for Deriving Numeric Water Quality Criteria

US EPA guidelines (US EPA, 1985) for deriving numeric water quality criteria (WQC) for aquatic organisms provide a method to review available toxicity data for a water quality constituent and to 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.

US EPA WQC are intended to protect all species for which acceptable toxicity data exist, and species for which those in the data set serve as surrogates. 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, at a given location.

The US EPA guidelines also suggest 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 show that a lower value than that suggested by the Final Chronic Value, the Final Plant Value, or the Final Residue Value should be used, that lower value should be applied as the Criterion Continuous Concentration (CCC) or chronic criterion (US EPA, 1985).

US EPA Draft Criteria for Diazinon and Final Criteria for Chlorpyrifos

Water quality criteria for diazinon in freshwater have been derived using the guidelines described above by contractors to the US EPA and are being proposed by the US EPA as national criteria (US EPA, 2003). Acceptable acute toxicity data were available for twelve invertebrate, ten fish, and one amphibian species. Six chronic toxicity values for five species of freshwater organisms were evaluated. The draft acute criterion was calculated to be 0.10 µg/L. The chronic criterion was calculated to be 0.10 µg/L, or equivalent to the acute criterion. The US EPA data set includes the *Gammarus fasciatus* results that were also used by CDFG. No saltwater acute or chronic criteria were calculated for diazinon, due to insufficient data for saltwater species. Regional Board staff used the US EPA data set, minus the *Gammarus fasciatus* results, to recalculate the acute and chronic diazinon criteria. The results obtained were an acute criterion of 0.15 µg/L and a chronic criterion of 0.15 µg/L.

The US EPA published national water quality criteria for chlorpyrifos in 1986 (US EPA, 1986). Acceptable freshwater acute toxicity data were available for seven fish species and eleven invertebrate species. Acceptable salt water acute toxicity data were available for ten species of fish and five species of invertebrates. Acceptable chronic toxicity data were available for one freshwater and seven saltwater species. The calculated freshwater acute criterion was 0.083 µg/L and the chronic criterion was 0.041 µg/L. The calculated saltwater acute criterion was 0.011 µg/L and the chronic criterion was 0.0056 µg/L.

California Department of Fish and Game Criteria for Diazinon and Chlorpyrifos

In 2000 the California Department of Fish and Game (CDFG) published freshwater WQC for diazinon (Siepmann and Finlayson, 2000), using the US EPA guidelines described above (US EPA, 1985).

Forty acceptable acute toxicity values were available to calculate freshwater criteria 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 0.08 µg/L and a chronic criterion of 0.05 µg/L. Insufficient data were available to calculate acute or chronic saltwater WQC for diazinon.

As discussed above, CDFG has recalculated the diazinon criteria using the dataset in the Siepmann and Finlayson (2000) report minus the reported values for *Gammarus fasciatus*. The recalculated CDFG values are an acute criterion for diazinon of 0.16 µg/L and a chronic criterion of 0.10 µg/L. Regional Board staff confirmed these recalculations.

Forty-three acute toxicity values were available to calculate freshwater criteria for chlorpyrifos. Acceptable acute toxicity tests were available for thirteen invertebrate and seven fish species. Eight acute to chronic ratios for seven species (both fresh and salt water) were available to calculate a chronic criterion for chlorpyrifos. CDFG calculated an acute criterion for chlorpyrifos of 0.02 μg/L and a chronic criterion of 0.014 μg/L in freshwater.

The calculations that are part of the US EPA methodology (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 acute criterion is rounded to two significant figures using the data set that CDFG found acceptable, the acute criterion is 0.025 μg/L, rather than 0.02 μg/L, and the chronic criterion is 0.015 μg/L, rather than 0.014μg/L.

Forty acute toxicity values were available to calculate saltwater criteria for chlorpyrifos. Acceptable acute toxicity tests were available for six invertebrate and ten fish species. CDFG calculated an acute criterion for chlorpyrifos of 0.02 μg/L and a chronic criterion of 0.009 μg/L in saltwater.

US EPA Methodology

Most States and the US EPA use the US EPA methodology to establish aquatic life water quality criteria and standards. For diazinon, US EPA has recently proposed national criteria (based on a contractor's work in 2000) and CDFG has published recommended criteria. Both of those criteria include study results for a sensitive species, *Gammarus fasciatus*, which cannot be confirmed from the available lab sheets (also see discussion in Section 1.2.1). CDFG has recalculated the diazinon criteria to exclude the study in question, but has also noted that the recalculation assumes no new information has been collected that would affect the criteria (Finlayson, 2004). Regional Board staff has also recalculated the diazinon criteria based on both the CDFG and US EPA data sets, respectively (Appendix E). The salmon studies by Scholz, as well as any other new information, would need to be evaluated to determine the appropriate criteria based on the US EPA methodology. The peer reviewer analyzed the Scholz study and the Regional Board responded to the peer review comments.

Deriving criteria based on the US EPA methodology requires careful research and evaluation of available studies. Such a scientific study is outside the scope of this report, however the use of the US EPA methodology will be considered further as a basis for alternative diazinon water quality objectives.

In contrast to diazinon, there are no known issues related to the data set used to derive the chlorpyrifos criteria. The CDFG criteria for chlorpyrifos will be considered further as an alternative water quality objective. The acute criterion derived by CDFG will be adjusted to 0.025 μg/L, rather than 0.02 μg/L, and the chronic criterion will be adjusted to 0.015 μg/L, to be consistent with the US EPA method with respect to significant figures.

Canadian Guidelines

The Canadian protocol for deriving water quality guidelines depends on the available data. For guidelines derived from chronic studies, the most sensitive lowest-observable-effect level (LOEL) for a given pollutant is multiplied by a safety factor of 0.1 (CCME, 1999a).

Guidelines can also be derived from acute studies. One approach is to calculate acute to chronic (ACRs) ratios (expressed as the LC50/NOEL (no-observed-effect level)). The guideline value is then derived by dividing the most sensitive LC50 or EC50 by the most appropriate ACR (CCME, 1999a).

If ACRs are not available, the alternate method is to derive the guideline value by multiplying the most sensitive LC50 or EC50 by a universal application factor. The application factor for non-persistent pollutants is 0.05 and for persistent pollutants is 0.01 (CCME, 1999a).

The guideline values are expressed as a single maximum concentration that is not to be exceeded. The maximum concentration represents a long term no effects concentration.

The Canadian guideline for protection of freshwater aquatic life for chlorpyrifos (CCME, 1999b) is found by multiplying the lowest acceptable primary effects concentration (0.07 μg/L – the 96-hour LC50 for *G. pulex*) by the application factor for non-persistent pollutants (0.05). The guideline value is 0.0035 μg/L.

The Canadian protocol provides a simple and easy to apply approach for assessing pollutant levels. The application factors used should provide a margin of safety to ensure protection of aquatic life, since the factors are applied to test results for the most sensitive organisms and the most sensitive endpoint. The Canadian protocol does not take into account the number of toxicity studies available or the variability between study results. This can lead to the guideline being unnecessarily high or low, since the application factor is the same, whether much or very little is known about the pollutant. In contrast, the US EPA methodology takes into account the number of valid study results and the variability between studies (at least for the four most sensitive genera).

Although the Canadian protocol is relatively simple, it requires an evaluation and review of available toxicity study results to determine the most appropriate approach for deriving the guideline value. Such an evaluation and review has not been conducted for diazinon and is beyond the scope of this report.

Due to the lack of an available guideline value for diazinon, an alternative diazinon water quality objective based on the Canadian protocol will not be evaluated further. An alternative water quality objective for chlorpyrifos based on the Canadian protocol will not be evaluated further. Chlorpyrifos criteria based on other methods (e.g. the US EPA method) are available that take into consideration the number of studies and variability of study results.

Australian and New Zealand Guidelines

Australia and New Zealand have developed a multi-pronged approach to developing guidelines (or trigger values) (ANZECC, 2000 – Figure 8.3.2). The approach defines "High", "Moderate", and "Low" reliability trigger values.

High reliability trigger values are based on no-observed effect concentration (NOEC) values (either for multiple species tests or single species tests). If NOEC values are available for more than five species a statistical distribution method is applied to the data. Protection levels for 95% and 99% of the species at a 50% certainty level are found. In other words, the trigger value should be at or above the NOEC for all but 5% or 1% of the species, depending on the level of protection chosen. If the statistical distribution requirements are not satisfied, then the lowest NOEC is divided by 10.

Moderate reliability trigger values are derived from EC/LC50 data available for greater than or equal to 5 species. If the data satisfy the statistical distribution requirements, the 95% or 99% protection level is divided by 10 or a calculated acute to chronic ratio. If the data do not satisfy the statistical distribution requirements, then the lowest LC50 is divided by 100 or by 10 times the acute to chronic ratio.

Low reliability trigger values are derived based on the type of data available and the type of pollutant. In general, the approach is to divide the lowest NOEC or EC/LC50 value by an application factor. Application factors can range from 20 to 1000 depending on the type of data available and the type of contaminant.

The Australian and New Zealand (ANZ) guidelines are meant to protect ambient waters from sustained exposures to toxicants. No specific averaging period or allowed frequency of exceedance is associated with the trigger values. The guidelines suggest that a number of samples be collected and that the median value be compared to the trigger value. The ANZ guidelines also suggest that transient exposure should be incorporated in the decision process to determine whether there is a problem. The ANZ guidelines suggest that some chemicals can cause delayed toxic effects after a brief exposure. For this reason, the ANZ guidelines do not include trigger values for brief exposures based solely on acute toxicity. The lack of acute toxicity guidelines is based on the concern that concentration levels that may protect organisms from acute toxicity may not protect organisms from transient exposures.

For chlorpyrifos, a high reliability trigger value of 0.01 μg/L was derived for chlorpyrifos using the statistical distribution method with 95% protection. The 99% protection level was found to be 0.00004 μg/L.

For diazinon, a moderate reliability trigger value of 0.01 μg/L was derived using the statistical distribution method with a 95% protection level and an ACR of 17.5.

The chlorpyrifos number was, therefore, based on NOEC data and the diazinon number was derived from acute toxicity test results.

The ANZ guidelines provide a robust framework for deriving water quality criteria that are protective of aquatic life. The guidelines allow the derivation of trigger values whether very little or a great deal of toxicity test results for species are available. Such an approach allows water quality managers to take initial management steps, if necessary, rather than allowing degradation to continue while studies are being performed. In Australia and New Zealand, the "trigger values" are meant to indicate a potential environmental problem and "trigger" a management response. The response can lead to development of a site-specific guideline or the development of water quality objectives.

The focus on NOEC data and protecting aquatic systems from chronic effects should generally result in the derivation of guidelines that are protective of aquatic life. Two issues not addressed by the guidelines are the appropriate averaging period associated with the trigger values and guidelines for protecting aquatic systems from acute toxic events.

As discussed above, the ANZ guidelines suggest that the median concentration of monitoring data collected should be compared to the trigger value. Comparison of the trigger value to the median concentration could mask significant water quality problems that may occur seasonally or episodically, since it is not clear if the median is evaluated over a day, week, month, year, or several year time frame. The lack of a criterion to protect aquatic life from acute effects could mean that significant, short duration pollution events are not addressed.

The ANZ guidelines have potential application for the derivation of water quality objectives in California. Further refinement of those guidelines for application to diazinon and chlorpyrifos is beyond the scope of this report. Therefore, an alternative water quality objective for diazinon or chlorpyrifos based on the ANZ guidelines will not be evaluated further.

Summary of Potential Water Quality Objectives Derived by Alternate Methods

The alternative potential water quality objectives are summarized in Table 4.3. The three alternatives for diazinon and chlorpyrifos will be evaluated with respect to Porter-Cologne requirements and other applicable laws and policies.

The "No change" alternative would not establish water quality objectives for diazinon or chlorpyrifos, but would use either the criteria developed from the CDFG data set, or 1/10th of the LC50 for the most sensitive species, to interpret the narrative objective.

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

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

Water quality objectives for diazinon and chlorpyrifos do not necessarily have to be selected from the same alternative, for example the "no change" alternative could be selected for diazinon, while a different alternative could be selected for chlorpyrifos.

Additive Toxicity

Studies by CDFG and the University of California, Davis indicate that diazinon and chlorpyrifos exhibit additive toxicity when they co-occur (CDFG 1999, Bailey et al. 1997). The tests were conducted on *Ceriodaphnia dubia*, which is one of the four most sensitive species used to calculate the diazinon and chlorpyrifos criteria.

As discussed in Section 4.1.1, existing Regional Board water quality objectives require that additive toxicity effects be 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.

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

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.

The diazinon and chlorpyrifos water quality objectives adopted by the Regional Board would be applied to the above formula when both diazinon and chlorpyrifos are present. In the absence of an established water quality objective for either diazinon or chlorpyrifos, the best available information would be used to identify an appropriate criterion for the formula.

It should be noted that when applying the additive toxicity formula, care must be taken in choosing the criteria to ensure that the additive effects being assessed are comparable. For example, if one criterion was driven by fish toxicity test results and another by aquatic invertebrate test results, it may not be appropriate to use those criteria together to determine whether there is an additive effect.

Another method that can be used to evaluate the additive toxicity of similar toxicants is the Toxic Equivalents (TEQ) method suggested by Felsot (2005). This method was used by US EPA to calculate the cumulative human health risk of OP pesticides. (US EPA, 2002). In this case the ratio of the relative potency of chlorpyrifos to diazinon (the Relative Potency Factor or RPF) is multiplied by the diazinon concentration to express the diazinon concentration in terms of chlorpyrifos toxicity. This transforms the diazinon concentration into an equivalent chlorpyrifos concentration based on the relative toxicity of these two chemicals. The transformed diazinon concentration is then added to the measured chlorpyrifos concentration, and the sum is compared to the chlorpyrifos objective.

This can be expressed as:

$$ChlorTEQ = C_{Diaz} \times RPF_{(Chlor/Diaz)} + C_{chlor} \leq WQO_{Chlor}$$

where

ChlorTEQ = chlorpyrifos toxic equivalents.
C_{Diaz} = diazinon concentration.
C_{Chlor} = chlorpyrifos concentration.
RPF (Chlor/Diaz) = relative potency factor – ratio of chlorpyrifos to diazinon toxicity.
WQO_{Chlor} = acute or chronic chlorpyrifos water quality objective in µg/L

Comparison of Water Quality Data to Alternative Objectives
Table 4.4 compares historical data to the alternate water quality objectives. The studies evaluated used different sampling frequencies (either event-based or a specified frequency) and different analytical methods, which had different detection limits. Therefore, caution should be used in drawing any conclusions regarding trends or differences between sites. For the "no diazinon" and "no chlorpyrifos" method, any detection of diazinon would be counted as an exceedance.

4.3.1 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. Section §13241 of Porter-Cologne specifies the following considerations in establishing water quality objectives:

- Past, present, and probable future beneficial uses of water.
- Environmental characteristics of hydrographic unit, 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 4.5 and 4.6 present qualitative assessments of the alternate methods for their consistency with Porter-Cologne and other state and federal requirements. The rationale for each assessment is discussed below.

4.3.2 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 CFR § 131.11(a)). State law requires the reasonable protection of beneficial uses and those beneficial uses of water be considered in establishing water quality objectives (CWC § 13241, et seq.).

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 narratives 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 to establish total maximum daily loads (TMDLs) or for other quantitative applications that require numeric criteria.

Existing numeric criteria, such as the CDFG water quality criteria, have been used for specific water bodies to determine if beneficial uses are being protected. The CDFG criteria have been used 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 US EPA methodology to the CDFG datasets were considered the most appropriate. The datasets were evaluated by a California state agency charged with protecting fish and wildlife and the US EPA methodology is used specifically to derive numeric criteria that should protect aquatic life beneficial uses.

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

The recalculated diazinon criteria using the US EPA methodology and CDFG dataset provide the best available information on protection of aquatic invertebrates from diazinon. A lower acute value (0.10 µg/L) for the protection of salmon from diazinon effects was also considered (see Endangered Species Section below). Other beneficial uses are less sensitive to diazinon than the freshwater habitat uses. With no change in the water quality objectives, the recalculated CDFG criteria would be used to interpret the narrative objective.

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.

Numeric Water Quality Objectives Based on US EPA Method

The US EPA criteria method, as applied by CDFG (and recalculated by the Regional 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 US EPA for almost twenty years to establish water quality criteria, and has been used by the CDFG since the late 1980s to assess hazards to aquatic organisms in the Sacramento-San Joaquin Rivers and Delta. All available information indicates that the recalculated CDFG diazinon criteria and the recalculated CDFG chlorpyrifos criteria (both recalculated by Regional Board staff using the US EPA method of calculating significant figures-see Appendix E) should be protective of all freshwater habitat uses in the San Joaquin River.

4.3.3 Environmental Characteristics and Quality of Water Available

Diazinon and chlorpyrifos enter the San Joaquin River system primarily from applications to a variety of crops both during the dormant season and the irrigation season. Diazinon and chlorpyrifos are washed off crops during irrigation or rainfall events and carried to surface water in the resulting runoff.

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, and of the water quality available to it.

4.3.4 Water Quality Conditions Reasonably Achievable

Diazinon and chlorpyrifos concentrations detected in the San Joaquin River system 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 San Joaquin River system would decline rapidly. The evidence for this can be seen in the seasonality of diazinon and chlorpyrifos levels in ambient water that correspond directly to diazinon and chlorpyrifos use patterns (Appendix C).

The difficulty and cost of preventing diazinon and chlorpyrifos from entering surface waters is the key element in achieving the water quality objectives for these pesticides. Options for reducing the amount of pesticides entering the San Joaquin River systems are presented in Section 5 and in Reyes and Menconi (2002). It is reasonable to assume that the lower the water quality objective, the more difficult it will be to achieve, and the more cost and effort will be required to meet it. However, some options presented in Section 5 and in Reyes and Menconi (2002) are more likely to be effective than others, and it is currently unknown which options will deliver the greatest reductions for the least cost and effort. If current water quality data (Tables 1.5 - 1.10) are indicative of conditions likely to occur in the future, there appear to be sufficient alternatives to current pest management practices to attain standards on a consistent basis, even when the joint toxicity of diazinon and chlorpyrifos are considered. Therefore the selection of numeric criteria developed using the US EPA methodology to implement this TMDL does appear to be reasonably achievable. More significant changes may be needed to meet the no detectable levels of diazinon or chlorpyrifos alternative (e.g. additional controls to prevent diazinon and chlorpyrifos runoff).

4.3.5 Economic Considerations

It is likely that at least some changes in pest management practices will be necessary to reduce diazinon and chlorpyrifos concentrations in the San Joaquin River. Alternative pesticides and practices have been identified by the University of California Integrated Pest Management Program (Zalom et al., 1999) and described in Section 5 and in Reyes and Menconi (2002). An economic analysis of some of these alternate practices is provided in Section 5.

The cost of diazinon or chlorpyrifos applications represents 1% or less of the total production costs for crops that receive the highest applications of those pesticides. The cost of replacements for diazinon and chlorpyrifos would be a similar proportion of total production cost. 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 0% to 11% (see Section 5). The same costs would be incurred with no change in water quality objectives, because growers would still need to meet the applicable narrative objectives. The criteria being considered for the new numeric objectives provide the best available information to interpret the narrative objectives.

For the “no diazinon” or “no chlorpyrifos” alternative, all growers would either need to use a different pesticide product or implement measures to prevent surface water runoff. Using an alternative to diazinon or chlorpyrifos would not necessarily lead to a greater cost to the grower (see Section 5). Preventing off-site movement of diazinon or chlorpyrifos would be more costly since both runoff and aerial drift would need to be controlled. NPDES dischargers would likely be able to meet the criteria with no additional cost, given enough time for the ban on the sale of non-agricultural uses of diazinon and chlorpyrifos to take full effect, including the depletion of existing homeowner supplies.

4.3.6 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 San Joaquin River is expected to affect housing.

4.3.7 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 the San Joaquin River is expected to affect the development or use of recycled water.

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

Anti-degradation Policy

Establishing a water quality objective based on "no diazinon/chlorpyrifos" would be consistent with the anti-degradation policy, since water quality would improve in the absence of diazinon and chlorpyrifos.

The "no change" alternative is protective of beneficial uses, since the existing narrative objectives are consistent with the anti-degradation policy.

Chlorpyrifos and diazinon water quality objectives based on the US EPA methodology should be protective of beneficial uses and would not cause degradation of the existing quality of the San Joaquin River.

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 CFR § 131.11 (b) et seq.).

Making no change in the current narrative water quality objectives would be consistent with the Clean Water Act. The Regional Board would need to interpret the existing narrative objectives to adopt TMDLs. 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 then those necessary to protect beneficial uses. Criteria based on the US EPA methodology would be consistent with the Clean Water Act, since the methodology is part of the 304(a) Guidance.

Endangered Species Act

The Sacramento splittail (*Pogonichthys macrolepidotus*), listed by the California Department of Fish and Game (CDFG. 2005) and USFWS (USFWS. 2005) as a species of concern, occurs in the San Joaquin River. The Central Valley Evolutionarily Significant Unit (ESU) of the steelhead (*Oncorhynchus mykiss)* is federally listed as threatened (NOAA Fisheries. 2005). This species appears to be extinct within most of the San Joaquin Basin with the possible exception of a small population in the lower Stanislaus River (Moyle, 2002a). Indirect effects of diazinon and chlorpyrifos on these fishes could occur if populations of sensitive arthropods were reduced at critical periods when they are needed as food by juvenile fish.

The Central Valley ESU of the spring-run Chinook salmon (*Oncorhynchus tshawytscha*) is currently listed as federally threatened (NOAA Fisheries. 1999). and the Central Valley Fall and late fall run ESU is listed as a species of concern (NOAA Fisheries. 2004).

The spring run is extinct in the San Joaquin River basin, due to lack of flow because of diversions from Friant dam. The fall run still spawns in the Tuolumne River. The juvenile emergence period for the fall run occurs from December through April (Moyle, 2002b), and coincides with occurrences of pesticide concentrations that are toxic to aquatic invertebrates.

A study conducted on Chinook salmon found that diazinon significantly inhibited olfactory-mediated avoidance response to predators at concentrations as low as 1 μg/L. An effect, although not statistically significant, was also found at 0.100 μg/L. The authors conclude that this inhibition could have negative consequences for survival and reproduction (Scholz, et al., 2000).

Water quality objectives must protect these species and the food web on which they depend. 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 the US EPA methodology would still be protective, although the methodology is based on data from tested species, and these species are surrogates for resident or endangered species. The currently available diazinon criteria derived using the US EPA methodology did not consider the recent study by Scholz. Peer review of the previous version of this staff report (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. Regional 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.

4.3.9 Recommended Alternative for Diazinon Water Quality Objectives in the San Joaquin River

The alternative that uses the US EPA method of derivation of water quality objectives and applies this method to the CDFG datasets for diazinon and chlorpyrifos (Alternative 3) is recommended.

The recalculated CDFG criteria using the US EPA methodology (Finlayson, 2004; Appendix E) are driven by toxicity studies for aquatic invertebrates. The criteria would, therefore, be appropriate to use as water quality objectives when assessing the additive toxicity of diazinon and chlorpyrifos. The Scholz 2000 study indicated that effects on salmon behavior from short-term exposure to diazinon begin to occur at a concentration somewhere between 0.100 μg/L and 1.0 μg/L, however additional study is needed in order to determine a concentration that would be appropriate to apply as a water quality criterion. The analysis conducted suggests that the objectives would be feasible to attain and protective of beneficial uses, based on available information. The concern with adopting this alternative is that there is some uncertainty regarding the potential impacts of diazinon on salmonids, which may occur between 0.100 μg/L and 1.0 μg/L. If new information becomes available that suggests the numeric objectives were not protective enough, the Regional Board could still apply the narrative objectives to ensure protection of beneficial uses while it went through the process of amending the numeric objective.

The "No Change" alternative is not recommended. Sufficient scientific information is available to support the adoption of the recalculated CDFG criteria as water quality objectives. In addition, several comments received also supported the adoption of water quality objectives for diazinon.

The "No Diazinon" alternative is not recommended at this time. It may not be feasible to totally prevent off-site movement of diazinon given current allowed uses, seasons of use, and application methods.

4.3.10 Recommended Alternative for Chlorpyrifos in the San Joaquin River

The chlorpyrifos criteria based on the CDFG dataset are the recommended water quality objectives. A number of alternative management practices are available to reduce the amount of chlorpyrifos introduced into the San Joaquin River. Available data indicate that the proposed objectives are often attained in the San Joaquin River.

The U.S. EPA water quality criteria were developed in 1986. The CDFG criteria and the dataset CDFG used are more recent (2000), and include additional and more recent toxicity studies. The CDFG criteria and dataset went through agency review by staff from the California Department of Pesticide Regulation, the Central Valley Water Board, and U.S. EPA prior to their publication.

Toxicity studies used in criteria derivation often serve as surrogates for species that may or should be present in natural freshwater systems. Such an approach is necessary, since it is not always possible to develop viable testing protocols for all species of interest.

Another important factor considered is that criteria are derived from a small number of species when compared to the actual number that are likely to be present in the aquatic environment. The proposed diazinon objectives were based on toxicity studies of 17 species of invertebrates and fish and the chlorpyrifos objectives were based on toxicity studies of 20 species.

Although an exact aquatic species count for the San Joaquin River watershed is not available, a recent study (Brown and May, 2004) found 126 taxa of macroinvertebrates present at five sties in the lower San Joaquin River Basin. Brown and May collected a large number of organisms, but were only able to classify 87 groups of organisms to the species level. Twenty-five groups of organisms were classified to genus, 10 to family, 2 to order and 2 to class. Since each higher level of taxonomic classification encompasses a greater number of species, it is likely that the 126 taxa of macroinvertebrates identified actually represent a much larger number of species. Additionally, Brown and May collected benthic macroinvertebrates, which are found in the streambed, but did not collect zooplankton, which would be found in the water column.

With respect to fish species, Moyle (2002) provides an estimate of 68 native and introduced fish species in the Central Valley subprovince, which includes both the Sacramento and San Joaquin Rivers.

The limited information available on aquatic species in the San Joaquin River watershed suggest that the objectives are based on less than 1/10th of the number of invertebrate and fish species present in the San Joaquin River. The objectives, therefore, may not capture the full range of sensitivity to diazinon and chlorpyrifos. The limited number of studies used to derive the criteria, compared to the number of species likely present in the San Joaquin River, suggest that any adopted water quality objectives for diazinon and chlorpyrifos should be conservative to ensure protection of the full range of aquatic species.

The "No Chlorpyrifos" alternative is not recommended at this time. It may not be feasible to totally prevent off-site movement of 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 a chlorpyrifos objective, which will provide a clear goal for dischargers of chlorpyrifos.

4.4 Program of Implementation

The proposed program of implementation describes how the Regional Board plans to ensure compliance with the adopted water quality objectives and TMDLs for diazinon and chlorpyrifos in the SJR. The first part of this section describes how the loading capacity and load allocations have been calculated, including consideration of the additive toxicity of the two pesticides. The rest of this section contains a discussion of the alternative regulatory tools available to control discharge of diazinon and chlorpyrifos runoff.

4.4.1 Recommended Diazinon and Chlorpyrifos Water Quality Objectives Used to Establish Loading Capacity

In section 4.3, staff recommended adoption of diazinon and chlorpyrifos water quality objectives. Both diazinon and chlorpyrifos objectives can be used directly to establish the loading capacity.

4.4.2 Loading Capacity and Allocations

Section 303(d)(1)(C) of the Clean Water Act requires the establishment of a Total Maximum Daily Load (TMDL) for waters identified on the 303(d) list, if the US EPA Administrator has determined that the pollutant is suitable for a TMDL calculation. The TMDL must be "…established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."

Federal regulations provide further definition of the structure and content of TMDLs. TMDLs shall "… take into account critical conditions for stream flow, loading, and water quality parameters" (40 CFR § 130.7(c)(1)).

TMDLs are defined as the sum of the individual waste load allocations (WLAs) and load allocations (LAs). TMDLs can be expressed in terms of "… mass per time, toxicity, or other appropriate measure." WLAs are the portion of the receiving water's loading capacity allocated to existing or future point sources and LAs are the portion of the receiving water's loading capacity allocated to existing or future nonpoint sources of pollution or to natural background sources. The Loading Capacity is the greatest amount of a pollutant a water can receive without violating water quality standards (40 CFR § 130.2 (f), (g), (h), (i)). Although the term "load" often refers to "mass", the federal regulations do not restrict the expression of a TMDL to units of mass. In this section, the discussion of load allocations; waste load allocations; and loading capacity can include consideration of mass per time or other appropriate measures (e.g. concentration or toxic unit calculations).

This section provides an overview of the alternatives considered, the factors considered in selecting a recommended alternative, and a description of the recommended alternatives for defining the loading capacity, the waste load allocations, and load allocations for diazinon and chlorpyrifos in the SJR.

4.4.2 Factors Considered in Selecting the Recommended Alternative

The following factors were considered in selecting the recommended method for determining the loading capacity and allocation method:

1. The ability of the method to adequately assess the loading capacity;
2. The availability of adequate data to apply to the method;
3. The ability of the method to account for seasonal variations;
4. The degree of uncertainty associated with the method;
5. The ease of determining compliance; and
6. Equity of the methodology.

4.4.3 Loading Capacity

The Loading Capacity of the SJR for diazinon and chlorpyrifos is the amount of diazinon and chlorpyrifos that can be assimilated by the SJR without exceeding the proposed water quality targets. Since diazinon and chlorpyrifos can both be present at levels of concern in the SJR, additive toxicity, discussed in Section 4.2, must be considered in determining the loading capacity. Both concentration-based and mass-based loading capacities were considered in the development of this proposed Basin Plan Amendment.

Figure 4.1 shows the locations on the lower SJR that are proposed as the sites for determining compliance with its loading capacities. The 130-mile lower SJR from Mendota Dam to Vernalis can be divided into six unique reaches, so that flow regimes for these six reaches can be characterized by the flow regimes at six locations. These six locations are the downstream points of these reaches. The six reaches, the corresponding seven sampling locations that define the extent of these reaches (and could be used for determining compliance with the loading capacities), and the subwatersheds that drain to each of these reaches, are listed in Table 4.7.

4.4.4 Concentration-Based Loading Capacity

The Loading Capacity for the SJR could be defined in terms of maximum allowable concentrations. A Loading Capacity for the SJR based on attaining the diazinon and chlorpyrifos water quality objectives was considered in developing this Basin Plan Amendment. Under this scenario, diazinon or chlorpyrifos concentrations must not exceed the recommended objectives in order to meet the TMDL. Such an approach would be appropriate if diazinon and chlorpyrifos were never present in the SJR at the same time.

Since diazinon and chlorpyrifos can and do co-occur in the SJR, the joint toxicity of these chemicals must be considered (see Basin Plan; pages IV-18.00 and IV-35.00). To address the joint toxicity of these chemicals, the Loading Capacity can be expressed as a measurement of the additive toxicity of diazinon and chlorpyrifos. The Loading Capacity can be established so that the sum of the ratios of diazinon and chlorpyrifos concentrations in the stream to their respective objectives does not exceed one (1.0; in other words, the threshold for cumulative impacts to aquatic life cannot be exceeded –see Equation 1).

$$\frac{C_{diaz}}{O_{diaz}} + \frac{C_{chlor}}{O_{chlor}} = S \qquad \text{[Equation 1]}$$

Where:

C_{diaz} = concentration of diazinon in the water body

O_{diaz} = diazinon objective

= 0.160 µg/L (acute) 1-hour average

= 0.100 µg/L (chronic) 4-day average

C_{chlor} = concentration of chlorpyrifos in the water body

O_{chlor} = chlorpyrifos objective

= 0.025 µg/L (acute) 1-hour average

= 0.015 µg/L (chronic) 4-day average

S = The sum, Loading Capacity. A sum exceeding one (1.0) indicates that the beneficial use may be impacted.

An alternative to the equation used in the Basin Plan has also been suggested (Felsot, 2005). The concentration of one chemical can be expressed in terms of the concentration of another chemical by comparing the relative toxicities of the two chemicals. In this case, the relative potency of chlorpyrifos to diazinon can be found by using the final acute values and final chronic values derived from application of the U.S. EPA methodology[4].

An acute relative potency factor (ARPF) is defined as the ratio of the chlorpyrifos final acute value to the diazinon final acute value (Equation 2). A chronic relative potency factor (CRPF) is defined as the ratio of the chlorpyrifos final chronic value to the diazinon final chronic value (Equation 3). The chlorpyrifos toxic equivalent of ambient diazinon levels can then be expressed in terms of chlorpyrifos concentration by multiplying the appropriate RPF by the diazinon concentration (Equation 4). Since diazinon has now been normalized to chlorpyrifos concentration, the ambient chlorpyrifos concentration can be added to the chlorpyrifos toxic equivalent concentration of diazinon and compared to the chlorpyrifos water quality objective.

$$ARPF_{(chlor/diaz)} = \frac{FAV_{chlorpyrifos}}{FAV_{diazinon}} = 0.1638 \qquad \text{[Equation 2]}$$

Where:
$FAV_{chlorpyrifos}$= Final Acute Value for chlorpyrifos = 0.0509 μg/L
$FAV_{diazinon}$ = Final Acute Value for diazinon = 0.3107 μg/L

$$CRPF_{(chlor/diaz)} = \frac{FCV_{chlorpyrifos}}{FCV_{diazinon}} = 0.1403 \qquad \text{[Equation 3]}$$

Where:
$FCV_{chlorpyrifos}$= Final Chronic Value for chlorpyrifos = 0.01454 μg/L
$FCV_{diazinon}$ = Final Chronic Value for diazinon = 0.1036 μg/L

$$ChlorTEQ = C_{Diaz} \times RPF_{(Chlor/Diaz)} + C_{chlor} \leq WQO_{Chlor} \qquad \text{[Equation 4]}$$

Where the “ChlorTEQ” represents the “chlorpyrifos toxic equivalents”. “ChlorTEQ” is compared to either the chronic or acute chlorpyrifos objective and the corresponding acute or chronic “RPF” is used.

4.4.5 Mass-Based Loading Capacity

A mass-based Loading Capacity would be defined in terms of a mass per unit time, such as grams per day. Determination of a mass-based loading capacity for a river or stream requires an estimate of the volume of water or the amount of flow available to assimilate

[4] The acute criteria are not used, since they include a safety factor. Since the safety factor applied to the criteria is the same (2), the ratio of the final acute values and the acute criteria produces a similar result. The only difference is the U.S. EPA methodology suggests that the final acute value be expressed to four significant figures and the acute criterion be expressed to two significant figures.

the pollutant load. For a pollutant in a stream or river site, where flow is only in one direction, the loading capacity, or allowable loading over a given time interval, can be determined by finding the product of flow and the objective concentration. Both Fixed and Variable mass-based Loading Capacity were considered in the development of this Basin Plan amendment. Variable Loading Capacity would be based on actual flow in the river at the time compliance is being determined. Fixed loading capacities are based on non-variable design flows that would be determined using historical flow data.

The variable approach directly assesses the actual available assimilative capacity. Since the loading capacity varies with flow, seasonal variations are explicitly considered. There is no uncertainty in the calculation of the loading capacity. There is some uncertainty associated with the measurement of flow under this option, which would need to be taken into consideration in determining the Margin of Safety under this scenario.

The design (or fixed) loading capacity approach adequately assesses the loading capacity under critical conditions. There is a sufficient historical flow record to allow calculation of the design loading capacity. There is some uncertainty in the method, since it is based on historic flow, and, therefore implicitly assumes that the future flow distribution will be similar to the historical flow distribution. Because the fixed loading capacity is established based on critical low-flow conditions, the dischargers could be meeting the water quality objectives but still exceed the Fixed Loading Capacity. Both the Variable and Fixed mass-based approaches to determining Loading Capacity for the SJR are described in greater detail in Azimi-Gaylon et al., 2003.

The joint toxicity of diazinon and chlorpyrifos must also be considered when determining either a Fixed or Variable Mass-Based Loading Capacity. The mass-based Loading Capacity and Load are found by multiplying the Flow (either variable or fixed) times the applicable numeric objective. Equation 1 is then expressed in terms of mass loads instead of concentrations and becomes

$$\frac{L_D}{LC_D} + \frac{L_C}{LC_C} \leq 1.0 \qquad \text{[Equation 5]}$$

where

L_D = Diazinon Load (g/day)
LC_D = Diazinon Loading Capacity (g/day)
L_C = Chlorpyrifos Load (g/day)
LC_C = Chlorpyrifos Loading Capacity (g/day)

There are a number of potential ways to disaggregate the one unit of combined mass loads between diazinon and chlorpyrifos to determine the allowable mass loads for the individual pesticides. The allowable loads of each pesticide could be based on a reduction of the existing loads of each pesticide. This would require either assuming that the existing loads are currently well characterized, or the implementation of extensive monitoring to characterize the current loads. Such an approach could penalize those who are already reducing their pesticide contribution by implementing effective runoff control.

The allowable loads of each pesticide could be set according to the acreage in the watershed upstream of the compliance point that is planted in crops for which each pesticide is registered or commonly used. This could be difficult to define, since not all growers of the commodities for which diazinon or chlorpyrifos are registered use diazinon or chlorpyrifos on those crops. This alternative would also be somewhat complicated and cumbersome to implement, since it would require frequent, extensive land-use data collection since crops planted can vary extensively from year to year, especially for field crops.

Another method of splitting the total mass Loading Capacity between diazinon and chlorpyrifos would be to make the allowable load of each pesticide proportional to the use of each pesticide in the area upstream of that point. This method would be equitable, since it is based on current use. This alternative would be complicated and cumbersome to implement, however, due to the temporal and spatial variability of the use patterns in the SJR watershed, and the delay in the availability of the pesticide use data (e.g. compliance could not be evaluated for up to a year after any violations occurred, since compilation of use data occurs from 1 to 1 1/2 years after use is reported.).

4.4.6 Recommended Loading Capacity

The recommended Loading Capacity is a concentration- based loading capacity that addresses the additive toxicity of diazinon and chlorpyrifos. The equation used in the Basin Plan to assess the additive toxicity is recommended. The recommended Loading Capacity is therefore:

Loading Capacity (LC) = [Equation 1]

$$S = \frac{C_{diaz}}{O_{diaz}} + \frac{C_{chlor}}{O_{chlor}} \leq 1$$

The recommended Loading Capacity is consistent with the narrative toxicity water quality objective which states, in part "…This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances…" The Loading Capacity is also consistent with the pesticides narrative objective that states, in part "No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses" (see Basin Plan; pages III-6.00 and III-8.00).

The recommendation for this method of defining the Loading Capacity was made after considering all the factors listed in section 4.4.2. The recommended method of defining the Loading Capacity is more straightforward than any of the mass-based methods in terms of defining and assessing compliance with the allowable amounts of diazinon and chlorpyrifos in the SJR. Because the recommended method of determining the loading capacity is so straightforward, there is no error involved in applying this method to adequately assess the loading capacity. Similarly there are no data gaps that need to be filled in order to use the proposed method, and since the Loading Capacity is based on an hourly and 4-day basis, all seasonal variations are taken into account. For these reasons, there is minimal uncertainty associated with this method of defining the loading capacity. Determining the Loading Capacity is relatively straightforward, since it only requires measuring concentrations in the SJR and does not require the extensive discharge measurements and loading calculations involved in the other scenarios.

In this case, the "sum of one" approach, as defined in the Basin Plan, for defining Loading Capacity and the "toxic equivalents" approach, give essentially equivalent results[5]. Therefore, the analysis and conclusions regarding the "toxic equivalents" approach apply to the "sum of one" approach already contained in the Basin Plan.

4.4.7 Allocations

This report identifies scenarios for defining the load allocations for nonpoint sources, and wasteload allocations for point sources of the diazinon and chlorpyrifos in the SJR. These allocations are defined so when the allocations are considered in whole, along with a margin of safety, they will be equal to the Loading Capacity for the SJR.

4.4.8 Wasteload Allocations

The point sources with potential to discharge diazinon and chlorpyrifos into the SJR are the municipal wastewater treatment plants and the municipal stormwater discharges in the SJR watershed. Since sales of all non-agricultural uses of diazinon have been banned since December 31, 2004 (US EPA, 2001), diazinon levels in municipal wastewater treatment plant discharges and stormwater discharges are expected to decline rapidly. Since the majority of the non-agricultural uses of chlorpyrifos were banned after December 2001 by US EPA, a significant reduction in the concentrations of chlorpyrifos in urban runoff and wastewater treatment plant effluent is also expected.

Infrequent outdoor applications of diazinon may occur for several years after the phase-out and some fraction of the diazinon applied may be discharged in storm water. A few minor non-agricultural uses of chlorpyrifos will still be allowed. Some fraction of these chlorpyrifos applications may be discharged in storm water or wastewater treatment plant effluent. For these reasons a waste load allocation should be established for chlorpyrifos and diazinon in urban stormwater discharges and wastewater treatment plant discharges. The proposed diazinon and chlorpyrifos waste load allocations for these point sources are equivalent to the Loading Capacity defined above. Since chlorpyrifos and diazinon from agricultural sources may still be present in rainfall in urban areas, these "background" concentrations may need to be considered in assessing compliance with the waste load allocations.

Based on the phase out of urban uses of diazinon and the ban in 2001 of the majority of non-agricultural chlorpyrifos uses, the presence of diazinon and chlorpyrifos in urban runoff is expected to be infrequent and below the waste load allocations.

[5] See Appendix E for the mathematical proof and further details.

4.4.9 Load Allocations

There are several load allocation scenarios that could be used to allocate the available Loading Capacity to agricultural sources. Methods used to allocate loads could be based upon a geographic split, crop or land-use patterns, pesticide use patterns, present loading rates, or a mix of these methods. Load allocation scenarios without a geographic component were not considered because of the difficulty in measuring compliance with such scenarios. Scenarios based on current loading rates were not considered because this would disadvantage dischargers and areas that have already effectively minimized offsite movement of pesticides through implementation of management practices. In addition, insufficient information is available to characterize current loading rates from all areas. Scenarios based on pesticide use rates were also not considered since this may disadvantage areas and dischargers that try to minimize offsite movement of pesticide through reduced use. The remaining scenarios are described and evaluated below.

The load allocations for nonpoint sources could be established by dividing up the Loading Capacity for the San Joaquin River among the subwatersheds defined in Figure 4.1. For each of the six points on the SJR listed in Figure 4.1, the available loading capacity would be allocated among the subwatersheds upstream of that point. The effective allocation for each subwatershed would be the least of the allocations from each of the points on the SJR downstream of that subwatershed. The Loading Capacity could be split in proportion to the size of each subwatershed, or in proportion to the area within each subwatershed that is being used to grow the crops upon which the majority of diazinon and chlorpyrifos are used. These allocation scenarios are discussed in detail in Azimi-Gaylon et al. (2003).

The load allocations for each subwatershed could be set at the proposed Loading Capacity for the SJR. Under this scenario, the concentrations of diazinon and chlorpyrifos coming into the SJR from each subwatershed would be required to be no greater than the concentrations which would be allowable in the SJR, as defined by proposed Loading Capacity. In order to make determination of compliance more straightforward, the nonpoint source load could be allocated to the discharges to each of the reaches of the SJR listed in Table 4.7 so that there would be one load allocation associated with the discharges to each reach of the SJR. The reaches of the SJR, the monitoring points on the SJR that define these reaches, and the subwatersheds that drain to each of these reaches are listed in Table 4.7 and shown in Figure 4.1

The latter scenario for defining the Load Allocations is the proposed methodology for determining the allowable nonpoint source loads. The recommendation for this method of defining the Load Allocations was made after considering all the factors listed in section 4.4.2. This proposed allocation methodology would provide a very straightforward definition of the Load Allocations, with no inherent error involved in the methodology, and no data gaps that would have to be filled. The Load Allocations would not change with changes in crops grown in the subwatersheds, and therefore load allocations would not need to be re-defined with each new growing season. Since the Load Allocations would be defined on an hourly and 4-day basis, seasonal variations are taken into account. For these reasons, there is minimal uncertainty associated with this method of defining the Load Allocations. Assessment of compliance for each subwatershed would be relatively straightforward; the flow monitoring and load calculations that would be needed in other scenarios would likely not be required to assess compliance under the proposed Load Allocations. The only data that would be necessary to assess compliance with the proposed Load Allocations would be diazinon and chlorpyrifos concentration data at the points of discharge to the SJR.

4.4.10 Margin of Safety and Seasonal Variations

The recommended alternative Load Allocations and Wasteload Allocations have an implicit margin of safety, as described below, and therefore no explicit margin of safety is required. Since the Load Allocation for each of the subwatersheds is set at the loading capacity, no dilution is assumed in the river - all tributaries are assumed to be discharging at concentrations approaching the loading capacity. However, since all subwatersheds are not expected to discharge diazinon and chlorpyrifos at concentrations approaching the Loading Capacity, there will be extra dilution in the SJR that provides a margin of safety.

The recommended methodology for allocating the Loading Capacity also assumes no significant reductions in diazinon or chlorpyrifos loading due to degradation or removal from the water column by adsorption to sediment particles and subsequent sediment deposition. Since there is likely some degradation and removal of these pesticides from the water column by adsorption to sediment particles, this assumption further contributes to the implicit margin of safety in the recommended allocation alternative. Since the Load Allocations and loading capacity are all defined using hourly and 4-day concentrations, all seasonal variations and critical conditions are explicitly considered in the recommended loading capacity and allocation determination method.

4.4.11 Comparison of Proposed Load Allocations to Current Pesticide Concentrations

As discussed in Section 4.4.12 and Reyes and Menconi (2002), there are a number of alternatives available to growers that would result in reduction in the amount of diazinon and chlorpyrifos present in the SJR and its tributaries. Information is available on trends in pesticide use through the pesticide use reporting system, but information on the extent of implementation of runoff mitigation practices is not currently available.

A review of recent diazinon and chlorpyrifos concentrations can give some indication of the additional effort that will be required to consistently meet the proposed Loading Capacity for the SJR and Load Allocations for its tributaries. The graphs and tables in Appendix C and Tables 1.5-1.8, 4.8 and 4.9, can be used to compare the current concentrations of diazinon and chlorpyrifos, based on data from recent years, to those that would be allowable under the proposed Loading Capacity and Load Allocations. In making these comparisons, it is important to consider both the declining use of these pesticides in recent years, which makes the concentrations in recent years more representative of current conditions, and the variability of precipitation and river flow patterns from year to year, which makes it necessary to consider multiple years to fully characterize current and potential near future conditions. For these reasons, the five years of data from 2000 through 2004 are used in Tables 4.8 and 4.9 in order to cover a wide range of hydrologic conditions, but still maintain a focus on more current pesticide use and land use patterns.

The recent diazinon and chlorpyrifos concentration data for the SJR (2000 through 2004) indicate that there are still occasions where the Loading Capacity of the river is exceeded, but these are fairly infrequent. The magnitude of exceedances seems to be less in the downstream reaches of the SJR, where flows are higher and more dilution is available. The limited number of exceedances indicates that in many cases excess loading capacity is available in the days immediately preceding the observed peak. There are no diazinon or chlorpyrifos concentration data for the SJR or its tributaries upstream of Sack Dam.

The recent (2000 through 2004) diazinon and chlorpyrifos concentration data for the tributaries draining directly into the SJR indicate that there are still occasions where the proposed Loading Allocations are exceeded, but these are fairly infrequent. The magnitude of and frequency of the exceedances are greater in smaller streams that are more dominated by agricultural runoff, such as Del Puerto and Orestimba creeks. Meeting the proposed load allocations in the smaller agriculturally dominated tributaries will likely require more effort than in areas where more dilution flows are present. The limited number of exceedances in these tributaries indicates that in many cases, especially in storm runoff events, excess loading capacity is available the days immediately preceding the observed peak concentration and the days following. There are no recent diazinon or chlorpyrifos concentration data for the Fresno or Chowchilla Rivers.

The recent loading data suggest that one or a combination of three general approaches could be used to address those days on which the loading capacity is exceeded: 1) reduce diazinon and chlorpyrifos use further; 2) reduce the runoff of diazinon and chlorpyrifos; 3) delay the runoff of diazinon and chlorpyrifos.

As discussed in Section 4.4.12 and Reyes and Menconi, (2002) viable pest control alternatives are available other than diazinon and chlorpyrifos. An approach focused solely on reduction of diazinon and chlorpyrifos use could be applied incrementally until the loading capacity was no longer exceeded. The amount of use reduction necessary would depend on the focus of the effort. If the effort was focused on areas that are likely to result in greater diazinon and/or chlorpyrifos runoff (e.g. based on slope, soil type, and proximity to waterways), diazinon and chlorpyrifos use could be maximized. Simple adjustments in timing of application (e.g. dormant spray application in December when soils are not saturated or avoiding applications before storms) may require little or no reduction in overall use in order to provide further reductions of diazinon and chlorpyrifos concentrations.

The reduction in the amount of diazinon and chlorpyrifos that runs off fields and orchards would also result in reductions in peak concentrations. As discussed in previous Regional Board reports (Reyes and Menconi, 2002; Karkoski, et al, 2002), substantial reductions in pesticide runoff can occur when buffer strips or cover crops are used. One other approach that has not been thoroughly evaluated is to delay diazinon and/or chlorpyrifos storm or irrigation runoff, so that peaks are attenuated. In many cases, if a portion of the diazinon and/or chlorpyrifos loading could be shifted to a day or two after the peak, the loading capacity would not be exceeded. Techniques used in rice farming and to flood irrigate orchards during the irrigation season could possibly be employed to temporarily retain some runoff during rainfall events and to allow that runoff to be discharged over a period of days. Irrigation and drainage management practices could also be employed to reduce or eliminate tail water runoff in the irrigation season.

The available information indicates that one or a combination of the three general approaches discussed above could be used to successfully reduce peak diazinon and chlorpyrifos concentrations and consistently meet the proposed loading capacity and load allocations.

Finally, the University of California Statewide Integrated Pest Management program has recently revised its recommendations for pest management in almonds. (UCIPM. 2005). If followed, these recommendations could substantially reduce almond growers' reliance on conventional pest management practices. Similar revisions are currently underway for pest management in stone fruits.

4.4.12 Available Practices and Technology

The information in this section is a brief summary of more detailed information provided in two previous reports (Agricultural Practices and Technologies Report. 2002. Reyes and Menconi. Draft Implementation Framework report for the Control of Diazinon and Chlorpyrifos in the San Joaquin River Basin. 2002. Azimi-Gaylon et al.). Many viable agricultural management practices exist that are likely to be effective in reducing offsite movement of diazinon and chlorpyrifos into surface water.

As described in Section 1.4, there are two seasons of OP pesticide use in the SJR Basin, dormant season (December through February), and irrigation season (March through September). Diazinon is primarily applied to stone fruit and nut orchards during the dormant season, with a lesser degree of use during the irrigation season. Chlorpyrifos is primarily applied to orchards and alfalfa fields during the irrigation season, with a lesser degree of use (on orchards) during the dormant season.

Stormwater runoff transports these pesticides during the dormant season, while both stormwater and irrigation runoff transport them during the irrigation season. Because there are two different transport mechanisms, the types of management measures appropriate for minimizing pesticide runoff are also different. The major types of management practices available for use in these two seasons are:

- Pest management practices;
- Pesticide application practices;
- Vegetation management practices;
- Field crop management practices; and
- Water management practices.

Pest management practices and pesticide application practices are applicable for use during both dormant and irrigation seasons. Vegetation management practices can be permanent installations, such as conservation buffers, designed to reduce pesticide runoff during both irrigation and dormant seasons. Vegetation management can also include annual use of cover crops or allowing natural vegetation to grow. Field crop management practices and water management practices are most applicable to irrigation season use, although some water management practices may also be used effectively in the dormant season.

A broad range of mitigation options is available to growers (Reyes and Menconi, 2002; Azimi-Gaylon et al. 2002). These options range from changes in application practices to adoption of vegetation management and water management practices that would prevent or reduce runoff. Changes in application practices could include: use of improved sprayer technologies; more frequent calibration of sprayer equipment; use of drift retardants; improving 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 possible to reduce runoff rates. In addition to reducing runoff, vegetative cover would also reduce sediment runoff and excess nutrients, as well as recharging groundwater through increased infiltration.

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

The appropriate actions for individual growers to take will vary, depending on the specific crops grown and the historic pest pressures. The Regional Board will not require implementation of specific practices or technology, but may review proposed actions based upon the likelihood that the growers' collective actions will be protective of water quality.

If growers switch to other pest control products, some of these products have the potential to result in the discharge of runoff that is harmful to water quality. Although the proposed Basin Plan Amendment is focused on control of diazinon and chlorpyrifos, Regional Board staff assessed strategies that should be viable for both pest management and water quality protection. A range of management scenarios was evaluated in Section 5 of this report.

In summary, growers have available a wide variety of management practices to control pests and to control diazinon and chlorpyrifos runoff. Some growers have already implemented these practices (e.g. irrigation runoff management; use of alternatives to diazinon and chlorpyrifos). Based on the wide variety of options available to growers to control or eliminate diazinon and chlorpyrifos runoff, it is technically and economically feasible to meet the proposed chlorpyrifos objectives and TMDL limits in the San Joaquin River.

4.4.13 Implementation Framework Alternatives

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 Water Code Section 13243);
2. Issuing Waste Discharge Requirements or WDRs (Water Code Section 13263);
3. Conditionally waiving WDRs (Water Code Section 13269); and
4. Issuing cleanup and abatement orders (Water Code Section 13304).

Cleanup and abatement orders are generally applied to localized pollution problems and not to watershed-wide issues addressed in the Basin Plan, so they are not reviewed any further.

Any alternative that is selected to implement this Basin Plan Amendment must clearly address the attainment of the water quality objectives or targets, and must provide reasonable assurance that the aquatic life beneficial use will be restored. Alternatives considered included: 1) no specific implementation framework or mechanism defined; 2) specific definition of the implementation framework or mechanism (e.g. waivers of waste discharge requirements; waste discharge requirements; or a prohibition of discharge); and 3) a flexible implementation framework with a clear backstop.

The primary factors considered in evaluating the alternatives include: 1) flexibility; 2) certainty in meeting water quality objectives; and 3) consistency with State and Federal laws and policies.

Alternative 1. No Specific Implementation Framework or Mechanism

The Regional Board could establish the program of implementation without defining the specific implementation framework or mechanism. As applicable waivers of waste discharge requirements or waste discharge requirements were renewed, it would be assumed that the provisions in the Amendment would be incorporated.

This alternative would provide flexibility, since no particular implementation mechanism would be defined. There would be less certainty that water quality objectives would be met, since there would be no description as to how the Regional Board planned to implement the provisions of the Amendment. This alternative would not be consistent with the Bay Protection Toxic Hot Spots program or the Nonpoint Source Implementation and Enforcement Policy. The Bay Protection Program clean up plan states that the implementation framework would be defined for this Amendment. The Nonpoint Source policy states that the Regional Board will address nonpoint source discharges through waivers of waste discharge requirements, waste discharge requirements, or prohibitions.

Alternative 2. Specific Definition of the Implementation Framework or Mechanism
The Amendment could define a specific implementation framework or mechanism. For point sources of diazinon and chlorpyrifos, the implementation mechanism is defined by federal law. Those sources are regulated through the NPDES permit program. For nonpoint source discharge of pesticides, a variety of approaches could be identified through the use of waivers of waste discharge requirements, waste discharge requirements or prohibitions of discharge (see Karkoski, et al, 2003 for a detailed description of these options).

This alternative would limit the flexibility of the Regional Board, since it would identify a specific regulatory mechanism for nonpoint source pesticide discharges. The degree of certainty in attaining water quality objectives would depend on which option was chosen. If the WDRs or waivers of WDRs depend to some extent on the actions of a third party not directly regulated by the Regional Board (e.g. another agency or association of dischargers), there would be less certainty that objectives would be met. Identifying a specific implementation framework would be consistent with both the Bay Protection Program Cleanup Plan and the Nonpoint Source Policy.

Alternative 3. Flexible Implementation Framework with a Clear Backstop
Either waivers of WDRs or WDRs could be effectively used to control these discharges. However, if neither are being used to address diazinon and chlorpyrifos discharges from nonpoint sources, then a prohibition would be in effect to ensure that objectives and allocations are met within the required time frame. The prohibition would not need to apply to those areas that are attaining the applicable objectives and allocations.

This alternative would provide the highest degree of flexibility to the Regional Board. The Regional Board could use waivers of WDRs, individual or general WDRs for different categories of nonpoint source dischargers. There would be a high degree of certainty of attaining the water quality objectives, since a prohibition would apply if the necessary waiver or WDR was not in place and objectives and allocation were not being attained. Identification of an implementation framework that includes all three Regional Board regulatory options would be consistent with both the Bay Protection Program Cleanup Plan and the Nonpoint Source Policy.

4.4.14 Recommended Alternative
Alternative 3 is recommended. At this time, it provides the greatest flexibility; the highest degree of certainty of attaining objectives and allocations; and is consistent with applicable laws and policies. The most effective regulatory alternative for management of diazinon and chlorpyrifos runoff cannot be determined until the Regional Board establishes its overall regulatory approach for agricultural discharges. Either WDRs or a conditional waiver of WDRs could be used to control diazinon and chlorpyrifos discharges. Any future implementation program that is developed to control agricultural discharges should provide the flexibility to take advantage of DPR, EPA or County Agricultural Commissioner (CAC) regulatory activities, and any efficiencies offered by coalition groups in representing the dischargers. If neither of these regulatory tools is

constructed to implement this basin plan amendment, then a default (i.e. prohibition of discharge) is needed to ensure that water quality objectives and load allocations are met in the required timeframe.

There are two recommended types of conditional prohibitions recommended for the two seasons of use.

Dormant Season Conditional Prohibition of Discharge
The recommended alternative is a conditional prohibition of discharge (Porter-Cologne Section 13243). The prohibition will take effect beginning December 1, 2010 if, during the previous year between 1 December and 1 March, the water quality objectives and the cumulative load allocations are not being met, and these discharges are not being controlled through waste discharge requirements, or a waiver of waste discharge requirements. The previous year provision is necessary to ensure that unregulated discharges are not impairing water quality.

Irrigation Season Conditional Prohibition of Discharge
The recommended alternative for the irrigation season is a conditional prohibition of discharge (Porter Cologne Section 13243). The prohibition will take effect beginning March 2, 2011 if, during the previous year between 2 March and 30 November, the water quality objectives and the cumulative load allocations are not being met, and these discharges are not being controlled through waste discharge requirements, or a waiver of waste discharge requirements. The previous year provision is necessary to ensure that unregulated discharges are not impairing water quality.

These prohibitions would only be applied to those dischargers from the subareas causing or contributing to the exceedance of the loading capacity or water quality objectives.

4.4.15 Other Implementation Provisions

Submission of Management Plans
The Nonpoint Source Implementation Policy requires nonpoint source dischargers to describe the management practices that will be implemented to attain water quality objectives. The Regional Board will require the submission of a management plan by a coalition of dischargers or by individual dischargers. By identifying the actions that the discharger will take to reduce diazinon and chlorpyrifos discharges, the Regional Board and the dischargers will be able to determine which practices are most effective at reducing pesticide runoff. The Regional Board will also be able to determine whether adequate effort is being made to reduce diazinon and chlorpyrifos discharges.

Time Schedule for Actions to be Taken
Porter-Cologne requires the Regional Board to include a time schedule for actions to be taken as part of the program of implementation. Timelines are identified for Regional Board issuance or revision of WDRs or waivers of WDRs to address diazinon and chlorpyrifos runoff. A timeline for the expected establishment of diazinon water quality

objectives is identified, as well as the frequency for review of the implementation program.

Time Schedule for Compliance

This section will discuss the alternative time schedules for compliance with water quality objectives and the TMDL. The primary considerations were feasibility of complying in the specified time frame; minimizing the time period in which potential beneficial use impacts could occur; and cost. Note that much of the discussion from the Sacramento and Feather River diazinon Staff Report (Karkoski, et al, 2003) is also applicable to this Amendment. A short term (2007), medium term (2008-2009), and long term (2010-2013) time frame for compliance were evaluated. It is assumed that establishing requirements shorter than two years would not be feasible, since approval of the water quality objectives and the Basin Plan Amendment may take 18 months or more after Regional Board action.

As described previously in Section 1, reported diazinon and chlorpyrifos use in the San Joaquin Valley has decreased significantly since the peak in the early 1990's. Median diazinon concentrations in the San Joaquin River have also decreased, as has the frequency of exceedance of the proposed diazinon water quality target. Recent data indicate that only incremental changes in management practices will be required to achieve full compliance in the San Joaquin River (see Figure 1.6). Compliance with the proposed chlorpyrifos water quality objectives will require more focused changes to current management practices.

Compliance with loading allocations in some tributaries may be more challenging, since the flow is primarily composed of agricultural discharge. Although the frequency of exceedance of proposed allocations has decreased, the magnitude of those exceedances can be significant (see Tables 4.8 and 4.9). Up to 80-90% reductions in peak concentrations will be needed to meet allocations on a consistent basis. The time schedule will focus on compliance with the loading capacity. Areas where the load allocations are not being met will be targeted for additional management efforts if the loading capacity is exceeded after the compliance date.

As discussed previously (see Section 4.4.12), a number of practices could be implemented in a short time frame (i.e. within the next two years) to produce the required changes. Since the potential practices generally do not require large capital investments, a long time frame should not be needed.

Factors that may make compliance more difficult and lead to a need for 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 applications were made, receiving water concentrations may increase even if total yearly use does not. Careful management of the timing of pesticide application (i.e. so that applications are not made immediately prior to storm or irrigation events) may be required to make significant reductions in peak concentrations.

Short Term (2007) Time Schedule for Compliance
Compliance with the proposed objectives and loading capacity is feasible to obtain in the short term. Only incremental reductions in diazinon and chlorpyrifos runoff are required and a variety of relatively low cost alternatives are available to achieve those reductions. A short-term compliance 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 the majority of growers time to implement improved practices, if weather conditions or pest pressure conditions prove unfavorable to reducing diazinon and chlorpyrifos runoff. In addition, compliance with allocations in the short term would be difficult without making significant changes in pesticide use and management practices. Growers who need to use diazinon and chlorpyrifos may require several seasons to fully implement practices that will reduce chlorpyrifos and diazinon runoff, such as establishing buffer strips or implementing improved application techniques or implementing improved irrigation practices.

A short-term compliance schedule may also be difficult for NPDES dischargers to attain. The ban on the sale of diazinon for non-agricultural outdoor uses was fully in effect in December 2004. It may take a few years for any existing stocks of such products to be used.

Medium Term (2008-2009) Time Schedule for Compliance
Compliance with the proposed objectives and loading capacity is feasible to obtain in the medium term (see Short Term discussion). A medium term time schedule would accommodate any additional time that might be needed to respond to changing pest pressures or economic conditions. The load allocations would be more difficult to achieve in all tributaries than the loading capacity. Growers would likely be able to implement an effective system to reduce pesticide runoff by 2008/ 2009 (see practices discussed in Section 4.4.12). Establishing buffer strips, improved application techniques, or improved water management could be feasibly accomplished in three to four years. If growers had an effective overall system 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 should be readily attained by NPDES dischargers. It is expected that the vast majority of diazinon and chlorpyrifos used by residents will have been applied. This should result in very few detections of diazinon or chlorpyrifos in NPDES effluent that originates within the jurisdiction of NPDES permittees.

A medium term compliance schedule would potentially result in aquatic life being exposed to elevated diazinon and chlorpyrifos levels for a longer period of time. If growers implement practices to reduce overall pesticide runoff, the exposure of aquatic life to all potentially toxic pesticides would be reduced.

Long Term (2010-2013) Time Schedule for Compliance

Compliance with the proposed objectives is feasible to obtain in the long term (see Short Term discussion). 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 more likely. A longer compliance schedule would provide growers with greater flexibility to adopt those management practices that are most cost effective at minimizing pesticide runoff. There are not likely to be any NPDES permitted sources of diazinon or chlorpyrifos, since the sale of non-agricultural diazinon products would have been banned for over five years and most non-agricultural chlorpyrifos products would have been banned for eight years.

Recommendation for Time Schedule for Compliance

A five-year time schedule, requiring compliance with diazinon and chlorpyrifos water quality objectives, allocations and loading capacity by 2010-2011 is recommended. A period of five years from Regional Board adoption of the Basin Plan Amendment should provide sufficient time to attain the objectives and allocations, 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 just result in use of alternatives that may also impact surface water. A five-year compliance time schedule provides the necessary time to implement a more comprehensive program focused on an overall reduction of pesticide runoff through implementation of appropriate management practices. A compliance time schedule greater than five years is not recommended, since there is no clear environmental or economic benefit to extending compliance beyond five years. A five-year compliance schedule should also result in diazinon and chlorpyrifos levels from NPDES discharges being reduced to negligible levels due to the ban on sale of non-agricultural uses of those products.

A five-year compliance schedule is consistent with the time frame for the Sacramento and Feather River Basin Plan Amendment (R5-2003-0148).

Compliance with numeric water quality objectives and loading capacity will be required no later than December 1, 2010 during the dormant season (December through February of the following year) and no later than March 2, 2011 for the irrigation season (March through November).

4.5 Need for New Policies

4.5.1 Compliance Policy

The proposed Basin Plan amendment identifies water quality objectives and TMDLs (with load allocations and waste load allocations) for diazinon and chlorpyrifos in the lower San Joaquin River. There is no existing policy that describes how the Regional Board would determine compliance when evaluating the combination of water column concentration data and pollutant loading information.

The Regional Board's compliance policy for control of diazinon and chlorpyrifos in the San Joaquin River will require compliance with the loading capacity and the water quality objectives by December 2010 (dormant season) and March 2011 (irrigation season). If the loading capacity in the San Joaquin River is not being met by these dates, subareas where load allocations are not being met will be identified and targeted for additional management efforts. The load allocations are established to assign responsibility for meeting the water quality objectives. If all allocations are met, the water quality objectives should be met.

4.5.2 Pesticide Runoff Management Policy

The Regional Board must follow federal, State and Regional Board anti-degradation policies when taking specific actions. In the case of the control of diazinon and chlorpyrifos, potential responses by growers could result in the use of other products that may runoff and degrade water quality. In addition, the Regional Board has an existing pesticide water quality objective that states, "pesticide concentrations shall not exceed the lowest levels technically and economically achievable."

Based on the existing anti-degradation policy and the current pesticide water quality objective, the Regional Board should encourage the adoption of practices to control pesticide runoff to surface waters. This policy should apply year-round, since diazinon and chlorpyrifos are used throughout the year, and alternative pesticides may be applied throughout the year as well.

In addition, the Regional Board recognizes that practices that retain surface runoff may in some instances increase infiltration. It is, therefore, important that the solution for one problem (surface water contamination) does not create another problem (ground water contamination). DPR and the County Agricultural Commissioners (CAC) currently have programs to address ground water contamination and are familiar with those pesticides that are most likely to cause ground water contamination problems.

It is ultimately the responsibility of the discharger to ensure that their pest control practices are not contaminating ground water and not causing violations of applicable Regional Board policies and water quality objectives. The proposed Basin Plan amendment includes policy language that requires dischargers to consider the potential impacts to ground or surface waters of alternatives to diazinon and chlorpyrifos.

4.5.3 Review and Planning Policies

The Regional Board will periodically review the provisions that have been included in this Basin Plan amendment. New scientific or technical information may be developed that could suggest revisions to the water quality objectives, TMDL, or implementation policies. The Regional Board will also determine whether the implementation framework established by this Basin Plan amendment is effective. The Regional Board may act on new information at any time, but a comprehensive, periodic review of the overall control program will help ensure that water quality objectives are being attained.

The proposed Basin Plan amendment includes a policy to periodically review the implementation program. The first review is proposed to take place prior to the compliance date to allow for potential adjustments to the implementation program.

4.6 Surveillance and Monitoring

Porter-Cologne requires that the Basin Plan amendment describe the type of surveillance and monitoring that will be required to determine compliance with the water quality objectives, loading capacity and load allocations. In general, responsibility for monitoring and surveillance will fall to three main groups: the Regional Board, the entity directly overseeing the implementation program (i.e. watershed coalition group), and those responsible for adopting new management practices.

Three main alternatives were considered: 1) Do not include a description of the type of monitoring and surveillance required; 2) Provide general direction on the required monitoring and surveillance; and 3) Identify specific monitoring requirements, including methods; sites; and constituents.

A description of the monitoring and surveillance to be conducted may not be required (Alternative 1), if the required monitoring were already being conducted as part of an existing Regional Board program. Although the Regional Board is currently conducting some monitoring of diazinon and chlorpyrifos, the funding is not certain for the long term and does not include tracking and evaluating management practices.

Alternative 2 would provide general requirements for the monitoring and surveillance to be conducted, but allow flexibility in terms of the precise requirements and who would conduct the monitoring. The general requirements would be structured to allow evaluation of compliance with this Basin Plan Amendment.

Alternative 3 would identify specific requirements for monitoring and surveillance. Specific sites to be monitored; the frequency of monitoring; and constituents to be monitored could be identified. This alternative would provide the greatest certainty as to expectations of the monitoring effort, but would provide the least flexibility.

Alternative 2 is recommended. Specific expectations with respect to the information to be collected are needed to ensure the Regional Board can determine progress in implementing this Amendment. 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. The use of monitoring and reporting programs (e.g. through a waiver of waste discharge requirements or waste discharge requirements) should provide the assurance that the necessary information is collected and submitted to the Regional Board. Alternative 2 would only apply to agricultural discharge, since diazinon and chlorpyrifos discharge from NPDES sources is not expected and any monitoring required as part of the NPDES permit process should be sufficient. The general monitoring and surveillance needs are described below.

The surveillance and monitoring program should be designed to collect the information necessary to:

- 1: Determine compliance with established water quality objectives and the loading capacity applicable to diazinon and chlorpyrifos in the San Joaquin River.
- 2: Determine compliance with established load allocations for diazinon and chlorpyrifos.
- 3: Determine the degree of implementation of management practices to reduce off-site movement of diazinon and chlorpyrifos
- 4: Determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon and chlorpyrifos
- 5: Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts
- 6: Determine whether the discharge causes or contributes to a toxicity impairment due to additive or synergistic effects of multiple pollutants
- 7: Demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable.

The types of activities required to meet the monitoring goals are described in more detail below.

<u>1: Determine compliance with established water quality objectives and the loading capacity applicable to diazinon and chlorpyrifos in the San Joaquin River.</u>
To determine compliance with water quality objectives and the loading capacity, monitoring will need to occur at a number of sites within the San Joaquin River. Six sites for determining compliance with the loading capacity are identified in the proposed Basin Plan Amendment. Monitoring of those six sites for diazinon and chlorpyrifos should allow compliance with water quality objectives and the loading capacity to be determined.

The frequency of monitoring should be based on the primary processes leading to diazinon and chlorpyrifos runoff. During the dormant season, storm water runoff will account for most diazinon and chlorpyrifos found in the San Joaquin River. Monitoring should, therefore, take place concurrent with and for a few days after storms of sufficient magnitude to produce runoff. Minimal or no monitoring in-between storm events or prior to the primary dormant spray application period should be necessary.
During the irrigation season, irrigation runoff will be the primary mechanism for transporting diazinon and chlorpyrifos, although any storm events during the "irrigation" season should also be monitored. Since irrigation will take place at different times, main stem monitoring can take place at a set frequency. The frequency of monitoring may vary depending on historic use patterns (e.g. once a month when diazinon/chlorpyrifos use is low; weekly or bi-weekly when use is high).

Laboratory detection limits must be low enough to detect exceedances of the water quality objectives or criteria.

2: Determine compliance with established load allocations[6] for diazinon and chlorpyrifos.
To determine compliance with load allocations, water quality monitoring will need to be conducted at sites that are representative of the subarea from which diazinon and chlorpyrifos runoff is occurring. Load allocations are assigned by subareas discharging into a given reach of the San Joaquin River.

Compliance with load allocations from the subareas can be determined by establishing monitoring stations as near the mouth of the representative tributaries as possible. In addition to monitoring diazinon and chlorpyrifos levels at these sites, diazinon and chlorpyrifos levels should be measured at a site in the tributary upstream of the diazinon and chlorpyrifos use areas. This will allow identification of any diazinon and chlorpyrifos runoff that would be due primarily to aerial drift and atmospheric deposition.

More intensive monitoring of all tributaries' inputs within a given reach may be required if discharges from a subarea are causing exceedances of objectives. Sampling frequency may need to be greater than once a day, since sites in the subareas may respond more quickly and show greater variation within a day then main stem sites.

3: 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 being used and how those practices are being applied, while considering the following factors.

- Minimize the paperwork burden on growers
- Use existing reporting systems
- 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
- 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 Regional Board to relate the implementation of specific diazinon and chlorpyrifos runoff mitigation approaches to changes in diazinon and chlorpyrifos loading.

[6] Note the term "load allocations" is from federal TMDL regulations. In this case, the "load" allocations are concentration based, so flow monitoring needed to calculate loads should not be necessary.

4: 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, field level evaluations will need to be conducted. The field 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 drift) that could be expected with implementation of a new management practice or strategy.

5: Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts.
Replacement of diazinon and chlorpyrifos with other OP insecticides, carbamate insecticides or pyrethroids 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 pose a threat to water quality. Monitoring of the water column and sediment would need to include analyses for these insecticides in order to ensure that aquatic toxicity does not continue, or does not simply move from the water column to sediment.

The monitoring locations should be the same as those used to monitor diazinon and chlorpyrifos levels and the monitoring could be done concurrently. Sediment sampling could be performed concurrently as well, but may not need to be performed as frequently (e.g. monthly during the dormant season rather then daily storm event sampling).

6: 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. The Amendment is based on the current understanding of the additive effects of diazinon and chlorpyrifos. Diazinon and chlorpyrifos may also have additive or synergistic effects in combination with other pollutants. To determine if such effects are occurring, monitoring for toxicity, and monitoring other 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: Demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable.
Goal 7 can be met by assessing the information collected to meet goals 3 and 4. Evaluation of the effectiveness of management practices should help identify which ones (or combinations) produce the lowest pesticide levels in discharge and are economically achievable. Tracking the degree of implementation of these practices should help the Regional Board determine whether the practices are wide spread enough to achieve the lowest pesticide levels possible in the San Joaquin River.

5 Economic Analysis, Estimated Costs, and Potential Sources of Financing

The Porter-Cologne Water Quality Control Act 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." It also requires a consideration of economics when water quality objectives are established. This section presents the information needed to meet these requirements.

5.1 Estimated Costs to Dischargers

There are two pesticides and two seasons of use that are addressed by this Basin Plan Amendment. Since stormwater runoff appears to be the primary pesticide transport mechanism during the dormant season, and irrigation runoff is the primary transport mechanism during the growing season, different practices to reduce pesticide runoff will be needed, depending on the season of use. It is assumed for purposes of this economic analysis that dormant season practices to reduce pesticide runoff will primarily be pest control practices and passive runoff control (e.g. buffer strips) since management of large volumes of stormwater runoff may be impractical. For the growing season, it is assumed that practices to reduce pesticides in irrigation runoff will include pest management practices and irrigation water management practices, since management of irrigation runoff is feasible for all growers. The following subsections describe the estimated costs for dormant season pest management and passive runoff management, irrigation season pest management, and irrigation season water management.

5.1.1 Dormant Season Pest Management Costs

Meeting the water quality objectives for diazinon and chlorpyrifos in the San Joaquin River system will require changes in pest management practices to reduce diazinon and chlorpyrifos in stormwater runoff. In the SJR watershed, approximately 85% of the diazinon and chlorpyrifos used during the dormant season (December through February) is applied to almond, peach, and apple orchards (CDPR Pesticide Use Report). Consequently, this section focuses on pest management and cultural practices considered to be effective in controlling target pests on these crops, and reducing diazinon and chlorpyrifos runoff from these crops. Costs are likely to be similar for other orchard crops where these pesticides are used to a lesser extent, such as prunes, apricots and walnuts.

Dormant Season Pest Management Scenarios

Economic analyses are provided for dormant season use of diazinon and chlorpyrifos on almonds, peaches and apples. For each crop, five scenarios are described, each comprised of a suite of possible pest management practices and cultural practices. Cultural practices are defined as including the costs of fertilizers, irrigation, and pesticides, plus harvesting costs, cash overhead, interest on capital, and advisory board assessments. Total costs per acre include fertilizers, irrigation, and pesticides, plus harvesting costs, cash overhead, interest on capital, and advisory board assessments (when applicable). Gross revenue per acre is the commodity price per ton multiplied by the tons produced per acre. Returns to Land, Management, and Overhead equal the gross revenue per acre, minus the total costs per acre. Data for all costs except dormant sprays are from University of California Cooperative Extension cost analyses (UCCE 1998; 2001; 2002a,b; 2003). Data for dormant spray costs are from Zalom et. al. (1999). The UCCE cost analysis for cling peaches was published in 1998 (UCCE, 1998), and cost data were adjusted for inflation by adding 3%. Revenue data are for 2003 (Ferriera, B. 2003. pers. comm.) and were not adjusted.

Costs for the dormant season alternate scenarios included hypothetical costs for in-season applications that could be needed to control pests during the growing season. The hypothetical likelihood of these in-season applications varies according to the crop and the scenario. For peaches and almonds, this likelihood is based on PUR data for diazinon and chlorpyrifos. It was assumed that the base case (dormant oil with OP pesticide) is the most effective approach, i.e. will effectively control pests during the dormant season, and if used then in-season sprays will be least likely to be necessary. All other approaches (except pyrethroids) will be less effective at controlling pests in the dormant season and will result in a higher likelihood of in-season sprays being needed. Ratios for all other alternate scenarios in peaches and almonds, except pyrethroids, were then set equal to or greater than this PUR ratio.

For pyrethroids on peaches and almonds, the probabilities of needing in-season applications were set higher than for diazinon and chlorpyrifos because pyrethroids persist longer and kill beneficial insects, which causes an upsurge in harmful insect and mite populations, necessitating in-season sprays. For all alternate dormant season scenarios in apples, the likelihood of in-season applications being necessary was set at 1.0 (100%) because of the need for in-season applications to control codling moth. These applications are independent of dormant season treatments.

The complete scenarios are provided in Appendix D.

One of these scenarios, the Base Case, has caused water quality impairment in the San Joaquin River system. The other four are alternate scenarios that offer varying levels of water quality protection. These four scenarios present options for the use of several low risk pesticides (Alternate Scenarios 1, 2, 3) and one option for all orchards using higher-risk pesticides along with runoff mitigation (Alternate Scenario 4). In reality, other variations and combinations of these practices are, or may be, used for effective pest management and water quality protection. Although it is not possible to present all of the possible variations, the scenarios present typical combinations of practices, and costs for alternate pesticides are presented in this text and in Appendix D. Because some growers are already implementing lower risk pest management practices, this analysis presents a worst-case economic scenario, because it assumes that all growers that currently use diazinon and chlorpyrifos would have to switch to lower risk practices.

The pest management and cultural practices discussed here are all considered "viable", that is, they offer favorable levels of pest control efficacy when compared to the base case. (Zalom et al, 1999) Most of these pest management and cultural practices have been recommended, or studied, by the University of California Integrated Pest Management Program (UCIPM), and are considered to be effective both for controlling pest damage and for reducing diazinon and chlorpyrifos runoff from orchards. The individual pest management practices and their costs are from a study conducted by the Statewide UCIPM Project, the Water Resources Center, and the Ecotoxicology Program at UC Davis (Zalom, et al. 1999), funded by the California State Water Resources Control Board (SWRCB). Each scenario is comprised of several specific practices. Specific practices for each scenario, such as choice of pesticide used, may vary depending on pest pressure and cultural and pest management practices used previously. Practices can also vary by crop and by year.

The cost of the pesticides typically applied with dormant oil represents less than 1% of the total production costs, so substitution of one pesticide for another has little effect on costs overall. However if multiple applications are required costs will increase because each additional pass over the field generates new costs. For example B*t*, requires multiple applications, and pyrethroids persist longer and kill beneficial insects, which causes an upsurge in harmful insect and mite populations, necessitating in-season sprays.

This economic analysis identifies the total costs of the base case and the alternate scenarios. The total cost of the base case is compared to the total cost of the alternate scenarios. Costs are compared for each crop and are expressed as an absolute change and a percent change in total costs, relative to the base case.

Economic Analysis of Base Case: All Growers Use Dormant Oil with Diazinon or Chlorpyrifos

The current pest management practice of treating orchards with dormant oil (DO) and diazinon or chlorpyrifos is generally very effective in controlling peach twig borer (PTB), San Jose scale (SJS), aphids, and mites.

Total annual costs per acre for the base case for almonds, peaches and apples are $2,749, $3,951, and $11,692, respectively when diazinon is used, and $2,735, $3,932, $11,688, respectively when chlorpyrifos is used (see Appendix D). These costs assume that either diazinon or chlorpyrifos is used for the dormant season application. The probability of needing an in-season application was based upon CDPR Pesticide Use Report data (2000-2002) when possible. Probabilities for dormant oil alone, dormant oil plus *Bt* and dormant oil plus spinosad on almond and peach could not be obtained from PUR data. No probabilities could be obtained for apple from PUR data. Probabilities for these scenarios were estimated. Other commonly-used organophosphates (OP) such as Guthion® (azinphos-methyl) and Supracide® (methidathion) are more expensive than diazinon or chlorpyrifos, but would probably be used only if the orchard had a history of scale problems.

Costs would be higher if in-season pesticide applications were needed to control aphids, mites, scale, or other pest problems. In-season applications are generally not necessary in almonds if an OP insecticide is applied during the dormant season, but are somewhat more likely to be needed in peaches.

Base case Total Costs as a Percent of Gross Revenue for almonds, peaches and apples are 110%, 84%, and 76 %, respectively when diazinon is used, and 109%, 84% and 76%, respectively when chlorpyrifos is used. This percentage does vary, depending primarily on crop price. Increased interest rates, advisory board assessments, harvest costs, and other factors would also cause these percentages to change.

Economic Analysis of Alternate Scenario 1: All Growers Use Pest Management Materials that Pose Little or No Risk to Water Quality – Dormant Oil Only
In Scenario 1 all growers use dormant oils without OPs, pyrethroids, or carbamates in the winter.

Total costs per acre for this scenario for almonds, peaches and apples are $2,750, $3,937, and $11,673, respectively (Appendix D). Costs vary because of different susceptibilities to pests not controlled by dormant oil alone. This analysis has used an estimated probability of 1 for almonds, peaches and apples, respectively, to describe the potential need to make in-season applications of Imidan. These probabilities represent relative risks for each crop, and would vary greatly depending on orchard location, weather, variety grown, and many other factors. The cost of the Imidan applications has been multiplied by the specific probability for the crop and added to the cultural cost. No other costs have been added to account for any potential need for any other in-season applications. These cultural costs do not account for the potential risk of pest damage that would lower crop yield or price. These considerations also apply to Scenarios 2 and 3.

Percent change in cost from the Base Case for Scenario 1 for almonds, peaches and apples are 1%, 0%, and 0%, respectively. This percentage would vary according to the factors described above for the Base Case.

Economic Analysis of Alternate Scenario 2: All Growers Use Pest Management Materials that Pose Little or No Risk to Water Quality – Dormant Oil + Bt at Bloom
In Scenario 2, all growers use dormant oils without OPs, pyrethroids, or carbamates in the winter, with two bloom time applications of *Bt* for PTB. Scale, aphids, mites, and other pests would be controlled with in-season applications of pesticides such as Imidan, as needed.

Total costs per acre for Scenario 2 for almonds, peaches and apples are $2,778, $4,000, and $11,741, respectively (Appendix D). Estimated probabilities of 0.60, 0.9, and 1.0 for almonds, peaches and apples, respectively, were assigned to describe the potential need to make in-season applications of Imidan.

Percent change in cost from the Base Case for Scenario 2 for almonds, peaches, and apples are 2%, 1% and 0%, respectively. This percentage would vary according to the factors described for the Base Case.

Economic Analysis of Alternate Scenario 3: All Growers Use Pest Management Materials that Pose Little or No Risk to Water Quality – Dormant Oil + Spinosad (Success®)
In Scenario 3, all growers use dormant oils without OPs, pyrethroids, or carbamates in the winter, with spinosad (Success®) added to dormant oil for control of PTB.

Total costs per acre for Scenario 3 in almonds, peaches and apples are $2,760, $3,962, and $11,703, respectively, and probabilities of needing in-season treatments are 0.60, 0.9, and 1.0 (Appendix D). Percent change in cost from the Base Case for Scenario 3 for almonds, peaches and apples are 1%, 1%, and 0%, respectively.

Economic Analysis of Alternate Scenario 4: No Growers Use Pest Management Materials that Pose Little or No Risk to Water Quality. All Growers Use Dormant Oil + Pyrethroid. Use In Season Treatment As Needed. Use Cover Crops as Runoff Mitigation.
In Scenario 4, growers would use DO with pyrethroids plus in-season pesticides, as needed, and would establish cover crops to reduce runoff. Because pyrethroids are more persistent than OPs, and have more impacts on predators that help control pest populations, in-season applications may be necessary. Since the use of pyrethroids is likely to greatly reduce populations of beneficial insects, cover crops would be used to intercept runoff rather than harbor beneficial insects.

Total Costs per acre for Scenario 4 for almonds range from $2,898 to $2,909, depending on the in-season treatment used. These costs for peaches and apples are $4,078 and $11,832 respectively (Appendix D). Percent change in cost from the Base Case for Scenario 4 for almonds, peaches and apples are 6%, 3%, and 1%, respectively.

A summary of the information described above is provided in Table 5.1.

5.1.2 Economic Analysis Performed by US EPA
US EPA performed an economic analysis of alternatives to annual dormant season use of diazinon on almonds in California (US EPA. 2002.). The alternatives used in their analysis were: substitution with another OP pesticide (chlorpyrifos); alternate year application of diazinon; and use of a non-OP pesticide such as *Bacillus thurengensis*. The estimated cost increases for these alternatives were less than 1% (for substitution with chlorpyrifos), and from 2-6% for alternate year diazinon application or use of a non-OP alternative, depending on the level of pest pressure. This range of cost increases is similar to that estimated in this economic analysis for almonds.

5.1.3 Irrigation Season Pest Management Practices
Meeting the water quality objectives for diazinon and chlorpyrifos in the SJR during the irrigation season may require changes to pest management practices. Such changes may promote the reduced use of OP pesticides, or alternative pesticides that have a high likelihood of causing aquatic toxicity. These changes should reduce or eliminate the movement of pesticides from irrigated farmland to surface water.

For at least the last ten years, the use of diazinon (in pounds a. i.) during the irrigation season has been much less than the use of chlorpyrifos. For example, in 2002, 9,416 pounds of diazinon (a.i.) were used, compared to 121,984 pounds of chlorpyrifos (a.i.). The use of both diazinon and chlorpyrifos has been declining for the last ten years (see Tables 1.1-1.4). Recent irrigation season use of chlorpyrifos has been primarily on alfalfa, almond, and walnut crops. These crops accounted for approximately 80% of the irrigation season use of chlorpyrifos in 2002, with alfalfa alone accounting for approximately one-half of the use. Diazinon was used primarily on cantaloupe, melon and prune crops during the 2002 irrigation season.

Alfalfa
Alfalfa is a perennial crop, and stands generally last from four to five years. Alfalfa weevil and the Egyptian weevil are the major economic insect pests of alfalfa. Other pests include aphids, army worms, cutworms and mites. Beneficial insects can be successful in controlling most of these pests, but they are not generally effective in controlling the Egyptian alfalfa weevil. Chlopyrifos has been used to control the Egyptian weevil.

Phosmet, malathion, dimethoate, carbofuran and pyrethroids are also used instead of chlorpyrifos. Pyrethroids in particular are increasingly being substituted for chlorpyrifos. Pyrethroids have been suggested as a potential alternative to chlorpyrifos because they have been promoted as less likely to cause water quality impacts (Long et. al. 2002), and because pyrethroids appear to be more effective than chlorpyrifos in controlling Egyptian weevils (Putnam. 2004. pers. comm.). Pyrethroids are highly toxic to fish and they can also reduce populations of beneficial insects.

Long et al. (2002) suggested that the use of the pyrethroids lambda-cyhalothrin and cyfluthrin instead of chlorpyrifos may be a viable option for protecting water quality from runoff from alfalfa fields. The authors stated that the following factors appear to be responsible for this protection:

- Pyrethroids are highly hydrophobic and they also bind tightly to sediment and other organic material
- Alfalfa traps sediment due to its deep roots and vigorous canopy. It reduces soil movement during irrigation.

In this study, there was near zero mortality to *Ceriodaphnia dubia* in a 24-hour toxicity test. Alfalfa did appear to reduce the movement of sediment off the field. This study was based upon the state of knowledge available at the time, but based upon current knowledge, additional information would be helpful. The pyrethroids used in this study (lambda-cyhalothrin and cyfluthrin) are also highly toxic to fish, and fish toxicity tests were not performed in this study. Pyrethroids in runoff samples were not detected at concentrations greater than the 0.05 parts per billion (ppb) detection limit; however, these pyrethroids are toxic (based on data from both invertebrates and fish) at concentrations of 0.002 ppb for cyfluthrin and 0.010 ppb for lambda-cyhalothrin (Solomon et. al. 2001). Lower detection limits may not have been available at the time of the Long study. Since pyrethroids bind tightly to sediment, it is more likely to detect them in sediment samples than in water samples.

Another pyrethroid study (Weston et. al. 2004) tested sediment samples collected from 42 locations throughout the Central Valley, with about 20 sites in this TMDL project area. Pyrethroids were detected in 75% of the samples, at a detection limit of 0.001 ppb. This study found that pyrethroid concentrations in samples collected from creeks, rivers and irrigation canals were high enough to have contributed to the observed toxicity in 40% of the samples that were toxic to *Chironomus tentans* and nearly 70% of the samples that were toxic to *Hyalella azteca.* Weston et. al. also noted information on pyrethroid toxicity from the previously cited study (Solomon et. al. 2001). This study plotted all water toxicity data for a wide variety of pesticides and concluded that the 10^{th} percentile of the toxicity distribution would be a convenient toxicity criterion. The 10th percentiles of the LC_{50}'s for pyrethroids in Weston et. al. ranged from 0.010 to 0.180 ppb. Pistachios, almonds, peaches, alfalfa, lettuce and cotton were the major crops on which pyrethroids were used (from PUR 2000) that are grown in the vicinity of the Weston sampling sites.

The results of these two studies indicate that although alfalfa appears to trap sediment, and may possibly also trap the pyrethroids that are bound to the sediment, pyrethroids are still moving off areas where they are used, whether on alfalfa or on other crops. Additional management measures, primarily improved water management, will be needed to prevent aquatic toxicity due to pyrethroids.

5.1.4 Irrigation Season Water Management Costs

Meeting the water quality objectives for diazinon and chlorpyrifos in the SJR during the irrigation season may require changes to water management practices. These changes will need to limit the amount of water that leaves the orchard or field, thereby reducing or eliminating the movement of pesticides from irrigated farmland to surface water.

Irrigation is a vital component of SJR agriculture. With little to no rainfall during the spring and summer months, the application of irrigation water is necessary to grow crops. During the irrigation season, pesticides are discharged to the SJR from agricultural drainage as a result of irrigation. Because irrigation practices are the primary means for pesticide movement into the SJR during the growing season, proper irrigation and drainage methods must be used. These methods focus on increasing irrigation efficiency to reduce excessive irrigation water volumes entering a field, thereby reducing the volume of pesticide-laden drainage water leaving the field. They also focus on managing drainage water to prevent pesticides from reaching the river.

This section of the economic analysis will focus on the costs to dischargers of irrigation practices that improve irrigation efficiency, as well as drainage practices that manage drainage water to prevent pesticides from reaching surface waters.

<u>Irrigation Practices</u>
Irrigation practices control the amount of water applied to a field. Efficient irrigation practices can help to reduce or eliminate the discharge of pesticides through irrigation water to surface waters. Irrigation practices can be broken down into three major categories: surface, sprinkler, and micro-irrigation. These practices are briefly described in the following sections. Additional information about their capabilities and limitations can be found in Burt (2000). Soil moisture monitoring is also discussed as a practice that can improve the efficiency of all types of irrigation methods.

Surface Irrigation
Once initial land grading is completed, surface irrigation is a simple and cheap method for irrigating crops. There is minimal energy cost to operate this type of system. (Table 5.1) This method takes advantage of field slope and gravity to move water across a field, either along strips covering the entire field, or basins that fill the field with water, allowing it to seep into the soil. Surface irrigation alone, without additional runoff control, creates movement of pesticides offsite, and additional costs for some type of runoff control system are necessary. Tail-water return systems are a recommended component of surface irrigation (Burt et. al. 2000) and would reduce the likelihood of pesticide movement offsite. These additional costs are discussed further in the Drainage Control section below.

Sprinkler Irrigation
Sprinkler irrigation is more complex and expensive to operate than surface irrigation, but provides for more efficient water use. The major cost involved is the initial capital cost of establishing a basic system composed of a water source, pump, pipe network, sprinklers, and valves. In some systems, labor costs can be high but maintenance costs are relatively low.

Micro-irrigation
Micro-irrigation is a broad term covering a number of different systems. The major cost of this method is the initial capital cost of establishing the system. Labor and energy costs are low as the system can be easily operated manually or largely automated.

<u>Sample Cost Comparison of Flood versus Sprinkler Irrigation Systems in Almonds</u>
The University of California Cooperative Extension (UCCE) produces sample cost information for establishment and production of many crops. Cost information is available for almonds grown in the northern San Joaquin Valley, using either flood or sprinkler irrigation. The net cost difference is estimated at $196/acre/year more for sprinkler irrigation than for flood irrigation. This does not account for any cost savings realized by increased irrigation efficiency.

Combining this information with the total number of acres of almonds grown in the project area, the estimated percentage that currently use flood irrigation, and the estimated percentage that use diazinon or chlorpyrifos allows an estimate to be made of the potential cost for conversion of all almond orchards in the project area to sprinkler irrigation. A similar calculation was made for walnuts, using the irrigation costs for almonds as an estimate. The results are provided in Table 5.5.

Irrigation Practices for Alfalfa
The irrigation and water management practices that are used on alfalfa will be critical for improving water quality for two reasons. Alfalfa accounts for approximately half of the chlorpyrifos used during the irrigation season, and alfalfa consumes more agricultural water (19% DWR estimate) than any other single crop (Putnam. 2003).

Sprinklers are used for initial establishment of alfalfa fields because the seeds are small and would be washed away by flood irrigation. After establishment, irrigation is usually switched to a flood system when alfalfa is grown on heavy soils, such as in the San Joaquin Valley. Soil type is the most important consideration in determining the best irrigation system to use. The heavy soils, combined with high summertime evapotranspiration rates, necessitate the use of flood irrigation. Sprinklers cannot provide an output high enough to keep up with evapotranspiration. Additionally, because infiltration of water into heavy soils is very slow, once sprinklers have applied the maximum output (2”-3”) it becomes a de facto flood application due to sheeting of water on the surface of the heavy soil. For these reasons, flood irrigation is the predominant method used in the San Joaquin Valley (80 – 90%), and it is unlikely that most growers will switch to another irrigation method. Flood irrigation, if properly managed, can be fairly efficient. One way of improving irrigation management and efficiency is to irrigate based upon the results of soil moisture monitoring. Soil moisture sensors and digital meters are relatively inexpensive (approximately $300), and their use is recommended by UCCE. It is also important for growers to manage their irrigation water efficiently, and not allow unnecessary excess drainage. (Putnam, pers. comm.)

Since options for switching irrigation systems on alfalfa are limited by soil type, other means of controlling runoff will likely be necessary. Some options for controlling runoff include installing tail-water return systems and/or end of field vegetated areas. Costs for these options are explored in the following sections.

Drainage Practices
Proper drainage management can reduce or even eliminate the discharge of pesticides to surface water. Drainage management can be categorized into methods that recirculate surface drainage water and methods that temporarily hold water. These methods include a combination of practices to reuse drainage water (tail-water recovery systems), hold drainage water (berms, water and sediment control basins), and filter drainage water (vegetated drainage ditches, grassed waterways, constructed wetlands).

Surface Drainage Recirculation
Surface drainage recirculation is the recovery of surface drainage water for reuse on irrigated lands. Irrigation systems generate surface runoff to varying degrees depending on application rate, soil type, and other conditions. This method can successfully recover 100% of all surface drainage water for use on the same field or on other fields. Capital

costs include earthwork and pumping equipment. Operation and maintenance costs include energy use and labor. (see Table 5.6, information from Smith, 2002).

Temporary Retention Ponds
Temporary retention ponds allow for holding of drainage water. Holding drainage water is important to allow sufficient pesticide breakdown prior to release to surface waters. Capital costs include land acquisition, earthwork, and fencing. Other costs can include improved liners and bird netting. Operation and maintenance costs include energy use for pumping and monitoring. (see Table 5.6, information from Smith, 2002).

Vegetated Buffers
In general terms, vegetated buffers are areas of land located along field edges that are maintained in permanent vegetation. A wide variety of types of vegetated buffers are available, including filter strips, hedgerows, riparian buffers, grassy waterways and constructed wetlands. The vegetation and the soil buildup in the buffers slow water movement and increase water infiltration. By slowing its movement, excess irrigation water is more likely to infiltrate into the soil, carrying dissolved pesticides with it. Buffers also reduce the movement of sediment, along with sediment-bound pesticides. Pesticides that infiltrate into the upper soil layer, or that are trapped by vegetation, can be degraded by soil microfauna.

One possible drawback of vegetative buffers is that they may necessitate taking land out of production. Buffers require maintenance to prevent channelization and accelerated runoff. Concentrated flow of runoff must be prevented, and shallow sheet flow encouraged, so that residence time in the buffer is adequate for pesticide removal. Studies summarized in NRCS (2000) have demonstrated trapping efficiencies of 50 percent or more with properly constructed and maintained buffers.

Costs for vegetated buffers can vary widely, depending on the size of the buffer and the types of vegetation planted. The installation cost of a typical riparian forest buffer with mixed hardwood seedlings and a grass strip is approximately $400 per acre. (NRCS. 2000). Costs for vegetated buffers using only grasses and/or shrubs would be significantly less. Estimated cost of a grassy vegetated buffer is $60/acre (Thomas, F. pers. comm.). Cost-share programs are available through NRCS that can contribute 50 to 75% of the cost of buffer installation.

Setbacks or No Spray Zones
Areas of a field adjacent to aquatic sites may be designated as no spray zones. The cost of this type of practice would be primarily the cost of any lost crop production.

Irrigation Season Pest Management Cost Scenarios

Several scenarios were developed for irrigation season pest management practices, similar to those described in the previous section on dormant season pest management practices. Economic analyses are provided for irrigation season use of chlorpyrifos on almonds and alfalfa. Very little irrigation season use of diazinon occurs. For almonds, three scenarios are described, and two scenarios are described for alfalfa, along with the base case for each crop. Each scenario is comprised of a suite of possible pest management practices and cultural practices.

Almonds

The Base Case described for almonds reflects the irrigation regimes currently in use. These regimes are 60% of growers using basin flood irrigation with berms, and 40% of growers using drip irrigation or microsprinklers. The base case assumes one application of chlorpyrifos. No cover crops are used to reduce runoff.

In Scenario 1, orchard sanitation is used, along with Bt application at hull split, instead of chlorpyrifos application. The irrigation regime is the same as in the Base Case.

In Scenario 2, Guthion is used instead of chlorpyrifos because it is the first on the list of chlorpyrifos alternatives listed in the UCIPM guidelines. The irrigation regime is the same as the Base Case. Cover crops are used to reduce runoff.

In Scenario 3, chlorpyrifos is used, but 100% of growers use drip irrigation or microsprinklers to reduce runoff.

Alfalfa

The Base Case described for alfalfa reflects the predominant irrigation regime currently in use. Irrigation is primarily by flooding, without tailwater control or vegetated buffers to reduce runoff. Tailwater control through surface drainage recirculation, and vegetated buffers are both recommended by UCCE for alfalfa, however these practices are not currently in widespread use. The base case assumes one application of chlorpyrifos.

In Scenario 1, chlorpyrifos is used and the irrigation regime is flood irrigation as in the Base Case, however tailwater control is used to reduce runoff.

In Scenario 2, chlorpyrifos is used and the irrigation regime is flood irrigation as in the Base Case, however a vegetated buffer is used to reduce runoff.

A summary of the results of the economic analyses for almonds and alfalfa is provided in Table 5.7. Detailed cost information is provided in Appendix D.

5.1.5 Estimated Monitoring, Planning, and Evaluation Costs

Monitoring and planning costs were estimated for two different approaches that orchard growers could take in responding to this Basin Plan Amendment (BPA). Orchard growers could participate in a watershed group to meet the BPA requirements, or orchard growers could work individually with the Regional Board to meet the BPA requirements.

Approximately 1000 growers reported diazinon or chlorpyrifos use annually in the lower San Joaquin River watershed in 2002 and 2003. For purposes of this analysis, it is assumed that all of those growers would need to respond to this BPA. The total cost for monitoring, planning, and evaluation would be approximately \$600,000 to \$3,100,000 for a waiver-based program, depending on whether growers used a watershed approach or an individual approach, respectively.

Watershed Approach

For a watershed group, the estimated monitoring, planning, and evaluation cost is approximately $600,000 per year, or $600 per grower. It is assumed that water quality monitoring would need to be conducted at six sites in the watershed, corresponding to the six compliance sites. Each site would be monitored twelve times during the dormant season and twelve times during the irrigation season. The total monitoring cost would be approximately $76,000 annually. These costs may be lower if a portion of the monitoring is already being performed under the Agricultural Waiver Monitoring Program. The monitoring cost could be substantially greater if the sample collection were contracted out. The monitoring costs are associated with determining compliance with water quality objectives and load allocations.

The cost for planning and implementation by the watershed group includes development of an annual monitoring and implementation plan, annual reporting of monitoring and implementation results, and coordination of implementation activities. The total cost for these activities is approximately $280,000 annually. The planning and implementation 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.

There is also an assumed cost associated with evaluating effectiveness of management practices. For purposes of this estimate, it is assumed that every farm need not be evaluated, but different practices will need to be evaluated over time. The cost for a project that evaluates the effectiveness of management practices is assumed to be $400,000. It is assumed that one evaluation project would take place every two years. Additionally, it is assumed that annual grower surveys of management practices implemented would be conducted at a cost of $25,000 per year. The total annual cost for effectiveness evaluation is approximately $225,000 per year.

Individual Grower Approach

If growers report directly to the Regional Board, the estimated monitoring, planning, and evaluation cost is about $3,100,000 or $3,100 per grower.

It is assumed that monitoring (flow and water quality) would need to take place at 1000 discharge points, one for each grower. Each site would be monitored up to 2 times during the season(s) during which the pesticides are applied or runoff is expected to occur. The total monitoring cost would be approximately $690,000 annually. These costs may be lower if a portion of the monitoring is already being performed under the Agricultural Waiver Monitoring Program. The monitoring cost could be substantially greater if the sample collection and flow monitoring were contracted out instead of conducted by the grower. The monitoring costs are associated with determining compliance with load allocations.

The cost for planning and reporting by the grower would primarily consist of filling out standard forms developed by Regional Board staff for reporting and monitoring purposes. The cost to the grower for his/her time is estimated to be $400 annually.

In addition, a cost is assumed for evaluating the effectives of management practices. It is assumed that such an assessment would be required annually and would cost approximately $2,000 per grower.

5.1.6 Summary of Potential Grower Cost

The cost of the pesticides typically applied with dormant oil represents a small fraction of total production costs, so substitution of one pesticide for another has little effect on overall costs. If the use of an alternative pesticide increases the likelihood of the need for additional applications of pesticides in the future, then costs increase accordingly because each additional pass over the field generates new costs.

The primary irrigation method used on the major crops to which chlorpyrifos is applied (almonds and alfalfa) is basin flood irrigation. Sprinkler irrigation is also used, although to a lesser degree. If chlorpyrifos continues to be used, or if it is replaced by other pesticides that have a high potential to impair water quality, then irrigation management will be a critical tool to keep pesticide runoff from entering the San Joaquin River at problematic concentrations. Use of more efficient irrigation practices, or installation of drainage controls such as tailwater return systems or vegetated buffers will also be important to the restoration of the beneficial uses of the San Joaquin River. Costs of improved irrigation and drainage practices are relatively greater than the costs of alternative pest management practices.

The cost of monitoring and compliance activities can vary greatly, depending on the approach taken. A watershed group approach would be significantly less costly on a per capita basis, than an individual approach.

The estimated cost of dormant season alternative pest management practices ranges from a minimum cost of approximately -$56,000 to a maximum cost of approximately $2.5 million. The estimated cost of irrigation season alternative pest and water management costs range from $3.9 million to $5.3 million. The basinwide combined costs of alternative pest management practices, alternative water management practices, and monitoring and compliance activities for the major crops that use diazinon and chlorpyrifos are estimated to range from $4.4 million to $10.9 million. 2004 dollars were used and no adjustments were made for inflation. (Appendix D)

The estimated costs for dormant season and irrigation season practices present a high-end estimate of cost. The dormant season cost estimates did not account for changes in the federal label for diazinon dormant season applications (CVRWQCB-CVR, 2004b) or the Department of Pesticide Regulations pending dormant spray regulations (CDPR, 2003b). It is likely that by meeting the existing federal requirements for diazinon dormant season application and the pending CDPR regulations that growers will not need to implement additional management practices in the dormant season to meet the requirements of this proposed Amendment (i.e. there should be little or no additional increase in cost).

The irrigation season cost estimates also provide a high-end estimate since the cost estimates assume that all growers currently using diazinon or chlorpyrifos in the irrigation season would need to change management practices. Recent data indicates a decrease in the levels of diazinon and chlorpyrifos (see Figure 1.8 for example), which suggests that incremental changes in management practices may be sufficient to meet water quality objectives on a consistent basis.

5.2 Estimated Regulatory Costs to NPDES Permittees

Retail sales of chlorpyrifos for consumer use ended on December 31, 2001. Retail sales of diazinon for consumer use ended December 31, 2004. It is therefore anticipated that NPDES permittees will not be required to implement additional management measures or treatment technologies to control diazinon or chlorpyrifos in municipal wastewater treatment plan discharges or in municipal storm water discharge.

Additionally, any diazinon and chlorpyrifos monitoring that is currently part of an NPDES permit is not expected to increase or change as a result of adoption of this BPA. Therefore, no change in control costs or monitoring costs is projected to occur for NPDES permit holders with adoption of this BPA.

5.3 Potential Sources of Financing

In general, the potential sources of funding for agricultural water quality programs do not change significantly by crop type. 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 drainage problem.
4. Ad Valorem tax on lands contributing to the drainage 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. Consolidated grant program administered by the State Water Resources Control Board, including Proposition 40 grants, 319 NPS Implementation Program grants, and Proposition 50 CalFed Watershed Program
3. State Revolving Fund Loan program for NPS pollution

5.4 Economic Analysis Summary

In summary, dischargers of diazinon and chlorpyrifos may incur costs in the implementation of new management practices, and in reporting on compliance with the provisions of the Basin Plan. The actual costs incurred by dischargers will depend on how cost effectively they can minimize or eliminate diazinon and chlorpyrifos runoff. Implementation of new management practices (pest control alternatives to diazinon and chlorpyrifos, and runoff mitigation practices) could result in an aggregate increase in production cost of $27,000 to $17 million, depending on the pest control and mitigation approaches pursued by growers.

Actual costs will also depend on whether growers report as a group to the Regional Board, which would be the least-cost alternative, or report individually. The costs to dischargers for monitoring, planning, and evaluation are estimated to range from $600,000 total ($600 per discharger), for a watershed approach, to $3.1 million ($3,100 per discharger) per year for an individual approach.

Total costs to dischargers for both implementation and reporting could range from $4.6 million to $20 million per year. Details of these costs are provided in Appendix D.

6 California Environmental Quality Act (CEQA) Review

This proposed Basin Plan amendment does not prescribe specific changes in land use or pesticide use practices. Therefore, this analysis of potential environmental impacts is based upon an evaluation of the range of possible changes in pest management methods or possible approaches to controlling runoff containing diazinon and chlorpyrifos that could result in response to adoption of this Basin Plan amendment. This CEQA review is based upon the potential alternative strategies that agricultural users of these pesticides could employ in response to the proposed Basin Plan amendment. Urban uses of diazinon and chlorpyrifos are not considered in detail, since most urban uses of diazinon are being phased out within the time frame for compliance with the proposed Basin Plan amendment, and sales of chlorpyrifos for most urban uses ended in 2000.

6.1 Environmental Checklist Form

6.1.1 Project Title

Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Runoff into the Lower San Joaquin River

6.1.2 Lead Agency Name and Address

California Regional Water Quality Control Board, Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114

6.1.3 Contact Person and Phone Number

Joe Karkoski, Senior Water Resources Control Engineer
(916) 464- 4668

6.1.4 Project Location

Lower San Joaquin River from the Airport Way Bridge near Vernalis to the Mendota Dam

6.1.5 Project Sponsor's Name and Address

California Regional Water Quality Control Board, Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114

6.1.6 General Plan Designation

Not applicable

6.1.7 Zoning

Not applicable

6.1.8 Description of Project
The Regional Board is proposing to amend the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins. The purposes of the proposed amendment are to:

- adopt numeric water quality objectives for diazinon and chlorpyrifos in the SJR from the Airport Way Bridge near Vernalis to the Mendota Dam
- establish maximum loading capacities, load allocations and wasteload allocations for diazinon and chlorpyrifos
- adopt an implementation strategy to bring dischargers of these pesticides into compliance with the new water quality objectives, load allocations and wasteload allocations.

6.1.9 Surrounding Land Uses and Setting
The area impacted by this basin plan amendment is land area that drains into the SJR from the Airport Way Bridge near Vernalis to the Mendota Dam. The land uses in the area include agriculture, urban residential, urban non-residential, open space, and wildlife habitat. Other public agencies whose approval is required include the State Board, OAL, and US EPA.

6.2 Environmental Factors Potentially Affected
Findings: No potentially significant impacts from this proposed action were identified.

____________________	____________________
Signature	Date
Jerrold A. Bruns, Environmental Program Mgr.	Cal. Regional Water Quality Control Board
Printed Name	Central Valley Region

The environmental resource categories identified below are analyzed herein to determine whether the Proposed Project would result in adverse impacts to any of these resources. None of the categories below are checked because the Proposed Project is not expected to result in "significant or potentially significant impacts" to any of these resources.

- Aesthetics
- Hazards & Hazardous Materials
- Public Services
- Agriculture Resources
- Hydrology/Water Quality
- Recreation
- Air Quality
- Land Use Planning
- Biological Resources
- Mineral Resources
- Utilities/Service Systems
- Cultural Resources
- Noise
- Mandatory Findings of Significance
- Geology/Soils
- Transportation/Traffic

On the basis of this initial evaluation:

☒ I find that the Proposed Project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the Proposed Project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the Project have been made by or agreed to by the Project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the Proposed Project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the Proposed Project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect: 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the Proposed Project could have a significant effect on the environment because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the Proposed Project, nothing further is required.

No potentially significant impacts from this proposed action were identified.

______________________________	______________________
Signature	Date
<u>Jerrold A. Bruns, Environmental Program Mgr.</u>	<u>Cal. Regional Water Quality Control Board</u>
Printed Name	Central Valley Region

6.3 Evaluation of Environmental Impacts

This Environmental Checklist has been prepared in compliance with the requirements of CEQA relating to certified regulatory programs.

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	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 which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒
II. AGRICULTURE RESOURCES – In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. 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) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☐	☒
III. AIR QUALITY – Where available, the significance criteria established by the applicable air quality management or air pollution control the District may be relied upon to make the following determinations. 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 which exceed quantitative thresholds for ozone	☐	☐	☐	☒

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
precursors)?				
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒
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 regulators, 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, regulations or by the California Department of Fish and Game or US 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?	☐	☐	☐	☒
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 of site or unique geological feature?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	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?	☐	☐	☐	☒
VII. 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 which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 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?	☐	☐	☐	☒

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
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?	☐	☐	☐	☒
VIII. 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 which 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 which results in flooding on- or off-site?	☐	☐	☐	☒
e) Create or contribute runoff water which exceed the capacity of existing or planned stormwater 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 which would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding,	☐	☐	☐	☒

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
including flooding as a result of the failure of a levee or dam?				
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒
IX. 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?	☐	☐	☐	☒
X. MINERAL RESOURCES – Would the Project:				
a) Result in the loss of availability of a known mineral 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?	☐	☐	☐	☒
XI. 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?	☐	☐	☐	☒
XII. POPULATION AND HOUSING – Would the Project:				
a) Induce substantial population growth in an	☐	☐	☐	☒

Impact	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporation	Less Than Significant Impact	No Impact
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?	☐	☐	☐	☒
XIII. PUBLIC SERVICES				
a) Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, 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?	☐	☐	☐	☒
XIV. 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 which might have an adverse physical effect on the environment?	☐	☐	☐	☒
XV. 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,	☐	☐	☐	☒

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
including either an increase in traffic levels or a change in location that results 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)?	☐	☐	☐	☒
XVI. 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?	☐	☐	☐	☒
XVII. 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 of restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒

Impact	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporation	Less Than Significant Impact	No Impact
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 probably future projects)?	☐	☐	☐	☒
c) Does the Project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

6.3.1 Thresholds of Significance

For the purpose of making impact determinations, potential impacts were determined to be significant if the proposed Basin Plan amendment or its alternatives would result in changes in environmental condition that would, either directly or indirectly, cause a substantial loss of habitat or substantial degradation of water quality or other resources.

6.4 Discussion of Environmental Impacts

The analysis of potential environmental impacts is based upon the possible changes in pest management methods or possible approaches to controlling runoff of diazinon and chlorpyrifos in response to the proposed Basin Plan amendment. The evaluation is based on the alternative strategies described in Section 5 of this report.

6.4.1 Aesthetics

The proposed Basin Plan amendment will likely result in changes in pest management practices on orchard crops and certain field crops. Potential practices are described in Section 5 and Appendix D. None of those practices would alter any scenic vistas, damage scenic resources, degrade the visual character of any site, or adversely affect day or nighttime views.

6.4.2 Agricultural Resources

The practices discussed in Section 5 and Appendix D, or other potential strategies that could be pursued by growers, are unlikely to lead to a conversion of agricultural land to other uses. Conservation buffers, which may be installed to reduce runoff containing pesticides, are considered to be agricultural land.

Regional Board staff has reviewed the potential range of costs of the proposed implementation program, as well as the potential range of costs of alternative pest management strategies and water management practices that might be employed by growers. This review has shown that growers have a wide range of alternatives to diazinon and chlorpyrifos available to both maintain control of pests and to minimize or eliminate water quality impacts. Based on the wide range of options available, growers should be able to choose an approach appropriate to their crop and field that will minimize costs, allow them to continue farming and meet water quality objectives and load allocations.

The review has also shown the availability of alternative irrigation methods that could be implemented to reduce diazinon and chlorpyrifos in irrigation runoff. As with alternative pest control methods, there is a range of irrigation options available, and growers should be able to choose an approach appropriate to their crop and field that will minimize costs, allow them to continue farming and meet water quality objectives.

The availability of federal and state government funds for environmental conservation (e.g. EQIP, Proposition 13 and other funds) should allow growers to offset some of their costs, if they choose an approach that requires a large capital investment.

6.4.3 Air Quality

Implementation of some of the alternative pest management strategies and pesticide application technologies, especially those that result in a reduction in diazinon and chlorpyrifos use rates, could lead to a reduction in aerial drift, and therefore an improvement in air quality.

Some of the alternative pest management practices could lead growers to switch from diazinon and chlorpyrifos to other pesticides. In response to a Regional Board request, the DPR has evaluated those alternative pesticides to determine whether air quality could be impacted by use of the alternatives. It is DPR's opinion that a reduction in the use of diazinon and chlorpyrifos in the San Joaquin Valley would result in an improvement in air quality, even if an increase in the use of alternative pesticides, such as carbaryl or pyrethroids, occurs (R. Segawa. 2004.pers. comm.).

Under the Toxic Air Contaminant Program, DPR prioritizes pesticides for air monitoring based on human toxicity, use patterns, and volatility. The DPR and the California Air Resources Board (ARB) monitor for a number of pesticides in the San Joaquin Valley.
In addition to the Toxic Air Contaminant Program, DPR tracks emissions of volatile organic compounds (VOCs) from pesticide products because they are precursors to ozone. It is unlikely that changes in use patterns due to regulatory action on diazinon and chlorpyrifos will cause DPR's goals for reduction of VOC emissions from pesticides to be exceeded (R. Segawa. 2004. pers. comm.).

Changes to water management practices should result in improved water conservation. This will not have any affect on air quality.

6.4.4 Biological Resources

The proposed Basin Plan amendment is designed to reduce diazinon and chlorpyrifos in runoff to levels that are not toxic to organisms in the SJR. Therefore, effects of this amendment on biological communities should be positive. As described in Section 5 and Appendix D, growers also currently use other pesticides, including pyrethroid and carbamate insecticides that, when present in runoff or in aquatic sediments, could have an effect on biological resources. These insecticides are commonly used on a variety of crops and under a wide range of conditions. Growers who currently use diazinon and chlorpyrifos may choose to switch to these or to other products to control pests in response to this Basin Plan amendment, causing a further increase in their use.

In order to prevent the substitution of other potential biologically damaging pesticides for diazinon and chlorpyrifos, this amendment includes monitoring requirements that will allow the Regional Board to identify potential impacts of pesticides in orchard runoff. The amendment also requires agricultural pesticide dischargers to implement control measures to insure compliance with water quality objectives, when alternatives to diazinon and chlorpyrifos have the potential to contaminate surface water or groundwater. The Basin Plan currently contains water quality objectives that do not allow pesticides to impact beneficial uses, including aquatic life use. This amendment does not change in any way, the applicability of these objectives. This amendment also reinforces existing Central Valley Water Board policies regarding additive toxicity by explicitly addressing the additivity of diazinon and chlorpyrifos and alternatives to diazinon and chlorpyrifos.

Changes to water management practices should result in improved water conservation. Conserved water is potentially available to enhance in-stream flows and for other uses. This should not have any negative effect on biological resources.

6.4.5 Cultural Resources

Implementation of the proposed Basin Plan amendment is unlikely to affect cultural resources. None of the potential practices that growers might implement are likely to change the significance of any historical or archaeological resource, destroy a unique paleontological resource or geologic feature, or disturb any human remains.

6.4.6 Geology and Soils

Implementation of the Basin Plan amendment will not affect the geology of the region and will not expose people to additional geologic hazards. As discussed in Appendix D, growers may plant cover crops or buffer strips to increase soil infiltration and reduce runoff, which will likely reduce soil erosion. Changes to water management practices should result in improved water conservation, and will not result in increased erosion or siltation.

6.4.7 Hazards and Hazardous Materials

The DPR examines hazards posed by pesticides to workers and the public during its regulatory process. Each product is evaluated for potential hazards, and any conditions necessary for the safe use of the material are required on the label or in specific regulations. Some of these requirements include use of protective clothing and respirators, use of a closed system for mixing and loading, or special training requirements for workers applying the pesticide.

Some of the pesticides that growers may use as alternatives to diazinon and 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. Propargite is on DPR's Minimal Exposure Pesticide list, and requires special protection for workers due to its toxicity. Implementation of this Basin Plan amendment should not result in any increased exposure to hazards or hazardous material.

6.4.8 Hydrology and Water Quality

None of the potential options 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 stormwater drainage systems, or increase the chance of inundation by seiche, tsunami, or mudflow.

One of the approaches to reducing diazinon and chlorpyrifos in runoff discussed in Section 5 and Appendix D is to increase the infiltration of stormwater into soil, rather than allowing it to run off the end of the orchard or field. Increasing infiltration is not likely to result in groundwater contamination with pesticides, especially in soils with moderate to high clay and organic matter content. Pyrethroids, and some of the other pesticides discussed in Appendix D, have very high soil adsorption coefficients that cause them to bind tightly to soils, and therefore these pesticides would not be carried more than a few inches below the soil surface. Other pesticides breakdown quickly through microbial decomposition and therefore do not persist long enough to be carried to groundwater.

The amendment includes a policy that requires growers to evaluate whether an alternative pesticide could potentially result in ground water contamination or violation of surface water quality objectives. The policy states that growers should use an alternative that will not result in groundwater contamination or violation of surface water quality objectives.

Changes to water management practices should result in improved water conservation. Conserved water is potentially available to enhance in-stream flows and for other uses. Reducing runoff of diazinon and chlorpyrifos may also result in the reduction of other contaminants (e.g. nutrients and sediment), which would enhance water quality. This Amendment is not expected to have any negative effect on hydrology and water quality.

6.4.9 Land Use and Planning

Implementation of the proposed Basin Plan amendment should not result in any changes in land use or planning. See discussion of Agricultural Resources above.

6.4.10 Mineral Resources

The effect of the proposed Basin Plan amendment should be limited to land currently under agricultural production, and there should be no impact to mineral resources.

6.4.11 Noise

The proposed Basin Plan amendment could lead to changes in the way in which diazinon and chlorpyrifos are applied. The alternative practices (see Section 5 and Appendix D) should not lead to any increase in exposure to noise. The proposed Basin Plan amendment should have no impact on noise in the project area.

6.4.12 Population and Housing

The proposed Basin Plan amendment will likely result in changes in pest management practices on orchards and certain field crops. Those changes in pest management practices would not directly or indirectly induce population growth in the area, displace existing housing, or displace people. The proposed Basin Plan amendment should not have an impact on population and housing.

6.4.13 Public Services

The proposed Basin Plan amendment will not have an impact on public services. If the implementation program for the Basin Plan amendment is administered at the county level, CACs may need to add as many as two additional staff, depending on the county. These potential staff increases should not require new or altered government facilities.

6.4.14 Recreation

There should be no increase in use of parks or recreational facilities or the need for new or expanded recreational facilities as a result of this proposed Basin Plan amendment.

6.4.15 Transportation/Traffic

The proposed Basin Plan amendment will not have an impact on transportation/traffic. None of the potential alternative practices (see Section 5and Appendix D) should result in changes in traffic or require changes in traffic infrastructure.

6.4.16 Utilities and Service Systems

The proposed Basin Plan amendment will likely result in changes in pest management practices on orchards and some field crops. No wastewater treatment requirements for diazinon and chlorpyrifos in agricultural runoff have been established by the Regional Boards. No wastewater treatment requirements have been established for diazinon and chlorpyrifos from other potential sources, such as urban runoff or municipal treatment plants in the project area, due to the phase out of the use of these pesticides in urban settings. The proposed Basin Plan amendment should not result in changes in wastewater treatment requirements.

None of the potential alternative practices (Section 5 and Appendix D) would cause the construction of new water or wastewater treatment plants or the expansion of existing plants for control of diazinon and chlorpyrifos in runoff from agricultural fields. The phase-out of the residential use of diazinon and chlorpyrifos makes it highly unlikely that these pesticides would be present in the effluent of municipal wastewater treatment plants at levels requiring additional wastewater treatment controls.

The proposed Basin Plan amendment does not require and should not result in the construction or expansion of new storm water drainage facilities. The most feasible practices for the control of diazinon and chlorpyrifos in agricultural runoff are changes in on-field practices, including changes in pest management and water management practices. It is unlikely that alterations in storm drainage facilities would be an effective means of reducing diazinon and chlorpyrifos in runoff from agricultural areas.

The proposed Basin Plan amendment should not result in significant changes in water supply. One of the potential alternative practices that could be used by growers would be the use of cover crops to increase infiltration and reduce surface runoff of water, which may contain diazinon, chlorpyrifos and other contaminants. The use of cover crops may or may not require additional irrigation water, but it should also result in reduced evaporation from soil surfaces, with little net change in irrigation water needs. Changes to water management practices should result in improved water conservation.

The proposed Basin Plan amendment should not require any changes in wastewater treatment services. The potential practices that could be applied by growers (see Section 5 and Appendix D) should not result in any changes in the generation of solid waste and therefore should not impact landfill capacity. The potential practices that could be applied by growers (see Section 5 and Appendix D) should not result in any changes in the generation of solid waste and therefore should not affect compliance with federal, state, or local statutes and regulations related to solid waste.

6.4.17 Mandatory Findings of Significance

The Basin Plan amendment is designed to reduce diazinon and chlorpyrifos concentrations in the lower SJR, and to ensure that increased use of the alternatives to these pesticides will not degrade water quality. The water quality objectives and allocations established by this amendment are designed to eliminate the impacts of diazinon and chlorpyrifos to aquatic life in the lower SJR. This Basin Plan amendment does not require or allow any changes in pesticide application practices that could degrade the quality of the environment or have environmental effects that could cause substantial indirect or direct adverse effects on human beings.

The proposed Basin Plan amendment will likely result in changes in pest management and water management practices on orchards and on some field crops. Growers may use other pesticides instead of diazinon and chlorpyrifos, and they may apply pesticides less frequently. The Regional Board's Basin Plan amendment, therefore, addresses the identified water quality impacts from diazinon and chlorpyrifos in runoff, as well as the potential impact of other pesticides applied to orchards and fields.

There are no probable future changes in Regional Board programs that would lead to cumulatively significant impacts when combined with likely impacts from the proposed Basin Plan amendment.

7 Public Participation and Agency Consultation

Regional Board staff held public workshops to inform the public and interested parties of the status and staff progress on the diazinon and chlorpyrifos TMDL. The workshops included the initial outreach to inform the stakeholders that this TMDL was beginning, and continuous updates were conducted when each draft component of the SJR Chlorpyrifos and Diazinon TMDL Report was completed. These workshops were held to seek public input during TMDL development (Table 7.1). Additional outreach presentations were made to San Joaquin River Agricultural Implementation Group (AIG), and to the Merced and Stanislaus county pest control advisors and pest control applicators. Staff workshops were held on 23 July and 10 September 2002 where members of the public were given the opportunity to discuss the draft TMDL report and the Implementation Framework with Regional Board staff.

During the Basin Planning phase, several additional public meetings were held. On 19 January 2005 a CEQA Scoping meeting and public workshop was held. An additional public workshop was held on 21 September 2005. Finally, a Regional Board public hearing was held on 21 October 2005, and this Basin Plan Amendment was adopted at this hearing.

The following agencies participated in the development of this amendment, through receipt of mailings pertaining to development of the amendment, attendance at public workshops, and submission of comments on the amendment: California Department of Pesticide Regulation; California Department of Fish and Game; National Oceanic and Atmospheric Administration – Fisheries; U.S. Fish and Wildlife Service; and U.S. Environmental Protection Agency.

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