CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

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

FOR

THE CONTROL OF ORCHARD PESTICIDE RUNOFF AND DIAZINON RUNOFF INTO THE SACRAMENTO AND FEATHER RIVERS

FINAL STAFF REPORT

16 October 2003

State of California

California Environmental Protection Agency

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CENTRAL VALLEY REGION

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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. R5-2003-0148). Mention of specific products does not represent endorsement of those products by the Regional Board.

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FINAL STAFF REPORT

Basin Plan Amendment Staff Report
Sacramento and Feather Rivers Diazinon Water Quality Objectives and Program of Implementation

FINAL STAFF REPORT

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List of Acronyms and Abbreviations

§	Section (as in a law or regulation)
Σ	Sum
µg/L	Micrograms/liter (equivalent to parts per billion or ppb)
a.i.	Active ingredient of a pesticide
ACR	Acute to chronic ratio
art.	Article (as in a law or regulation)
Basin Plan	Water Quality Control Plan (Basin Plan) Central Valley Region; Sacramento River and San Joaquin River Basins
B*t*	Bacillus *thuringiensis*
C.F.R. or CFR	Code of Federal Regulations
CAC	County Agricultural Commissioners
Cal EPA	California Environmental Protection Agency
Cal. Code Regs.	California Code of Regulations
CALFED	CALFED Bay-Delta Program
CCC	Criterion Continuous Concentration
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDPR or DPR	California Department of Pesticide Regulation
CEQA	California Environmental Quality Act
ch.	Chapter (as in a law or regulation)
CMC	Criterion Maximum Concentration
CVRWQCB	California Regional Water Quality Control Board, Central Valley Region
CWA	Federal Clean Water Act
CWC	California Water Code
Delta	Sacramento-San Joaquin Delta
DFA	California Department of Food and Agriculture
div.	Division (as in a law or regulation)
DO	Dormant oil
DWR	California Department of Water Resources
EC50	Concentration that is expected to have an effect on 50% of a group of organisms tested
ELISA	Enzyme-linked immunosorbent assays
et seq.	“and following” (references a series of related sections of law)
Exceedance or Excursion	In this report, used to refer to a data point above a criteria value
FAC, Food & Agr. Code	California Food and Agricultural Code
FACR	Final acute to chronic ratio
FAV	Final acute value
FCV	Final chronic value

List of Acronyms and Abbreviations

FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FPV	Final plant value
FRV	Final residue value
g/day	Grams/day
GMAV	Genus mean acute value
IPM	Integrated Pest Management
JPA	Joint Powers Authority
LA	Load allocation
Lbs	pounds
LC	Loading capacity
LC50	Concentration that is expected to be lethal to 50% of a group of organisms tested.
LOEC	Lowest observed effects concentration
LOQ	Limit of quantification
MAA	Management Agency Agreement
MOS	Margin of safety
ng/L	Nanograms/liter
NHI	Natural Heritage Institute
No.	number
NOEC	No observed effects concentration
NPDES	National Pollutant Discharge Elimination System
NPS	Non-point Source
NWIS	National Water Information System
OEHHA	Office of Environmental Health Hazard Assessment
OP	Organo-phosphorus or Organo-phosphorus Pesticide
Ops. Cal. Atty. Gen.	Opinions of the California Attorney General
p./ pp.	Page/ pages
PCO	Pest control operator
pers. comm.	personal communication (either written or oral)
PERA	Probabilistic Ecological Risk Assessment
Plums	Refers to both dried and fresh fruit
Porter-Cologne	Porter-Cologne Water Quality Control Act as amended
ppm	Parts per million
PRMP	Pesticide Runoff Minimization Plan
PTB	Peach twig borer
Pub. Resources Code	California Public Resources Code
PUR	Pesticide Use Report
Regional Board	California Regional Water Quality Control Board, Central Valley Region
ROWD	Report of Waste Discharge
RWQCB	Regional Water Quality Control Board
SJS	San Jose scale
State Board or SWRCB	California State Water Resources Control Board

List of Acronyms and Abbreviations

Subd.	Subdivision (as in a law or regulation)
Super. Ct.	Superior Court
SWDB	Surface Water Database
TIE	Toxicity Identification Evaluation
tit.	Title (as in a law or regulation)
TMDL	Total Maximum Daily Load
U.S.C.	United States Code
UCIPM	University of California Statewide Integrated Pest Management Project
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Wat. Code	California Water Code
WDRs	Waste Discharge Requirements
WLA	Waste Load Allocation
WQC	Water Quality Criteria

1 Executive Summary and Background

1.1 Executive Summary

This staff report addresses a proposed amendment to the water quality control plan for the Sacramento and San Joaquin River Basins (Basin Plan). The amendment primarily addresses the regulation of discharges of diazinon and other pesticides from orchards in the Sacramento River watershed.

Diazinon is identified on the State's Clean Water Act Section 303(d) list as impairing both the Sacramento and Feather rivers. Elevated concentrations of diazinon are observed in January and February, which corresponds to the dormant spray application period for orchard crops. Approximately 99% of the agricultural use of diazinon in January and February is on almond, peach, and dried plum (prune) orchards.

California Water Code Section 13240 requires the preparation and adoption of a Basin Plan. The Basin Plan must include: beneficial uses to be protected; water quality objectives; and a program of implementation needed for achieving water quality objectives. The Basin Plan provides the regulatory basis for actions taken by the California Regional Water Quality Control Board, Central Valley Region (Regional Board) to control water quality. The Basin Plan is also used to satisfy water quality standards requirements under Section 303 (c) of the federal Clean Water Act.

The Regional Board initially adopted the Basin Plan in 1975. The Basin Plan has been amended several times since 1975. Those amendments have included general policies and water quality objectives for pesticide discharges.

Basin Plans are adopted and amended by the Regional Board under a structured process that includes opportunities for full public participation and state environmental review. Amendments to the Basin Plan (Basin Plan Amendments) do not become effective until approved by the Regional Board, State Water Resources Control Board (State Water Board), and Office of Administrative Law (OAL). Certain provisions of a Basin Plan Amendment (e.g. water quality standards) do not become effective until approved by the United States Environmental Protection Agency (USEPA).

Three other staff reports have been prepared, which provide much of the technical basis for the proposed Basin Plan Amendment. Those staff reports addressed: 1) potential numeric targets for diazinon (Azimi-Gaylon, et al., 2001); 2) the analytical approach for developing Total Maximum Daily Loads (TMDLs) for diazinon in the Sacramento and Feather Rivers (McClure, et al., 2002); and 3) alternatives for the program of implementation (Karkoski, et al., 2002). Those staff reports have been the subject of public workshops. This Basin Plan Amendment report is based on the staff reports, comments received at the workshops, written comments received on the staff reports, and discussions with various interested parties.

If adopted, the Basin Plan Amendment proposed as part of this report would result in: 1) numeric acute and chronic water quality objectives for diazinon in portions of the Sacramento and Feather Rivers; 2) the use of a prohibition of discharge, unless diazinon objectives are met or waste discharge requirements or a waiver of waste discharge requirements are in place to regulate

diazinon runoff from orchards in the Sacramento River watershed; 3) the establishment of diazinon TMDLs and allocations for the Sacramento and Feather rivers; 4) new policies governing the discharge of pesticides from orchards; and 5) specific monitoring requirements for evaluating compliance with the proposed amendments. The recommendations are summarized in Table 1.1.

The purpose of this staff report is to present the proposed Basin Plan Amendment and to provide the rationale behind each part of the amendment. Section 1 is the introduction and provides historical background information relevant to the process. Section 2 presents the proposed Basin Plan Amendment, which includes changes to the water quality objectives, implementation, and surveillance and monitoring chapters of the Basin Plan. Section 3 discusses consideration of changes to designated beneficial uses. Section 4 evaluates alternative diazinon water quality objectives and provides the basis for the recommended objective. Section 5 provides an evaluation of a number of implementation issues, including: practices available to reduce diazinon runoff, alternative frameworks for the program of implementation, the loading capacity and allocations, and the compliance time frame. Section 6 provides an evaluation of existing policies and the need for new policies. Section 7 addresses monitoring and surveillance issues. Section 8 provides an evaluation of potential cost of the proposed Basin Plan Amendment. Section 9 includes a discussion of California Environmental Quality Act (CEQA) issues. Section 10 discusses the public participation and agency consultation process. Appendix A provides a detailed discussion of the TMDL analysis and Appendix B provides the comments received during the peer review process and the response to those comments. Appendix C provides a suggested format for submitting comments. Appendix D summarizes the available studies on diazinon levels in the Sacramento Valley. Appendix E includes a response to comments from the public that were received on the 5 May 2003 Staff Report. Appendix F provides additional details on the cost analysis. Appendix G provides a review of the toxicity studies found in the USEPA's AQUIRE database that were used by Novartis in their probabilistic ecological risk assessment.

A staff workshop and CEQA scoping meeting was held on the peer review draft version of this staff report on March 26, 2003. No comments on changing the scope of this proposed Basin Plan Amendment were received at that meeting. A public workshop before the Regional Board was held during the June 6, 2003, regular meeting of the Board.

This Staff Report includes revisions based on comments received during that meeting and written comments received by June 23, 2003. This Staff Report and proposed Basin Plan Amendment (found in Section 2) are being circulated for public comment. The proposed Basin Plan Amendment will be the subject of a public hearing before the Regional Board, which is scheduled for either October 16 or 17, 2003, at a regular meeting of the Board. After the public hearing is closed, the Regional Board may adopt the amendment as proposed or make modifications to the proposed amendment (significant modifications would require another 45-day comment period and new hearing notice).

Written comments on this Staff Report and proposed Basin Plan Amendment should be submitted by October 1, 2003. To assist staff in identifying and responding to comments, comments should be submitted (hard copy and electronic) in the format suggested in Appendix C. The suggested format is to number the comment, state in one sentence the topic of the comment, followed by supporting discussion, and a specific recommendation. If you have any questions concerning this amendment, please contact Joe Karkoski at (916) 255-3368.

Table 1.1 Summary of Proposed Amendments to the Water Quality Control Plan for the Sacramento and San Joaquin River Basins

Water quality objectives	**0.050 µg/L diazinon** measured as a 4-day average and **0.080 µg/L diazinon** measured as a 1-hour average; neither objective to be exceeded more than once every three years on the average. The objectives would apply to the Sacramento and Feather Rivers. The proposed objectives were developed by the California Department of Fish and Game using USEPA-approved methods for deriving aquatic life criteria.
Total Maximum Daily Load (TMDL) Elements	**Loading Capacity** (LC) = Flow X Water Quality Objective (maximum diazinon mass or "load" that the rivers can safely assimilate and still meet water quality objectives). **Load Allocations** for areas above the Sacramento River at Verona are expressed as a percentage of the Loading Capacity (LC) and divided by subwatershed based on the relative acreage of almond, peach, and prune orchards. The load allocations apply to the non-point (non-NPDES permitted) sources of diazinon. Colusa Basin Drain: 17% of the LC Feather River: 12% of the LC Sacramento River above Colusa: 27% of the LC Sutter/Butte Basin: 33% of the LC The **Load Allocation** for discharge into the Sacramento River between Verona and I Street is 70% of the difference between the loading capacity calculated at I Street minus the loading capacity calculated at Verona. **Waste Load Allocations** are set equal to the water quality objectives. Waste load allocations apply to NPDES sources of pollution (e.g. municipal storm water permits and publicly owned treatment works). Sale of diazinon products for urban use are being phased out and will no longer be available by 2004, so urban sources are expected to rapidly decline. The **Margin of Safety** is set at 11% of the Loading Capacity for the Sacramento River at Verona and 30% for discharge into the Sacramento River between Verona and I Street. Conservative assumptions are also used in allocating the loads – no degradation of diazinon from the subwatersheds to the Sacramento River at Verona compliance point is assumed.
Implementation Provisions	• **Compliance** with allocations and water quality objectives are required by June 30, 2008. • A **conditional prohibition of discharge** is the proposed implementation framework for non-point source dischargers. The prohibition **only** applies if water quality objectives are not met or waste discharge requirements or a waiver of waste discharge requirements are not in place to regulate the discharge. • **Orchard dischargers** must consider whether an alternative to diazinon could contaminate ground or surface water. • The control program is **adaptive** in that the objectives, allocations, and implementation provisions will be reviewed at least once every five years. • Diazinon dischargers must submit a **management plan** by June 30, 2005 that describes actions to be taken to comply with allocations. • The estimated **cost to dischargers** to adopt new management practices is $(0.3) to $3.8 million/year and the monitoring, planning, and evaluation costs are $0.5 to $9.3 million/year. • The estimated **costs to the Regional Board** are $0.2 to $0.7 million/year. • **Potential funding sources** for dischargers include private financing, grants or low-interest loans from the State and federal governments, and fees levied by districts with authority over drainage management.
Monitoring	Surveillance and monitoring activities should be structured to allow the Regional Board to determine: **1)** compliance with water quality objectives; **2)** compliance with established waste load and load allocations; **3)** the degree of implementation of management practices to reduce off-site migration of diazinon; **4)** the effectiveness of management practices; **5)** whether alternatives to diazinon are causing surface water impacts; **6)** whether the discharge is resulting in toxicity from multiple pollutants; and **7)** that management practices are achieving the lowest pesticide levels in surface waters technically and economically achievable.

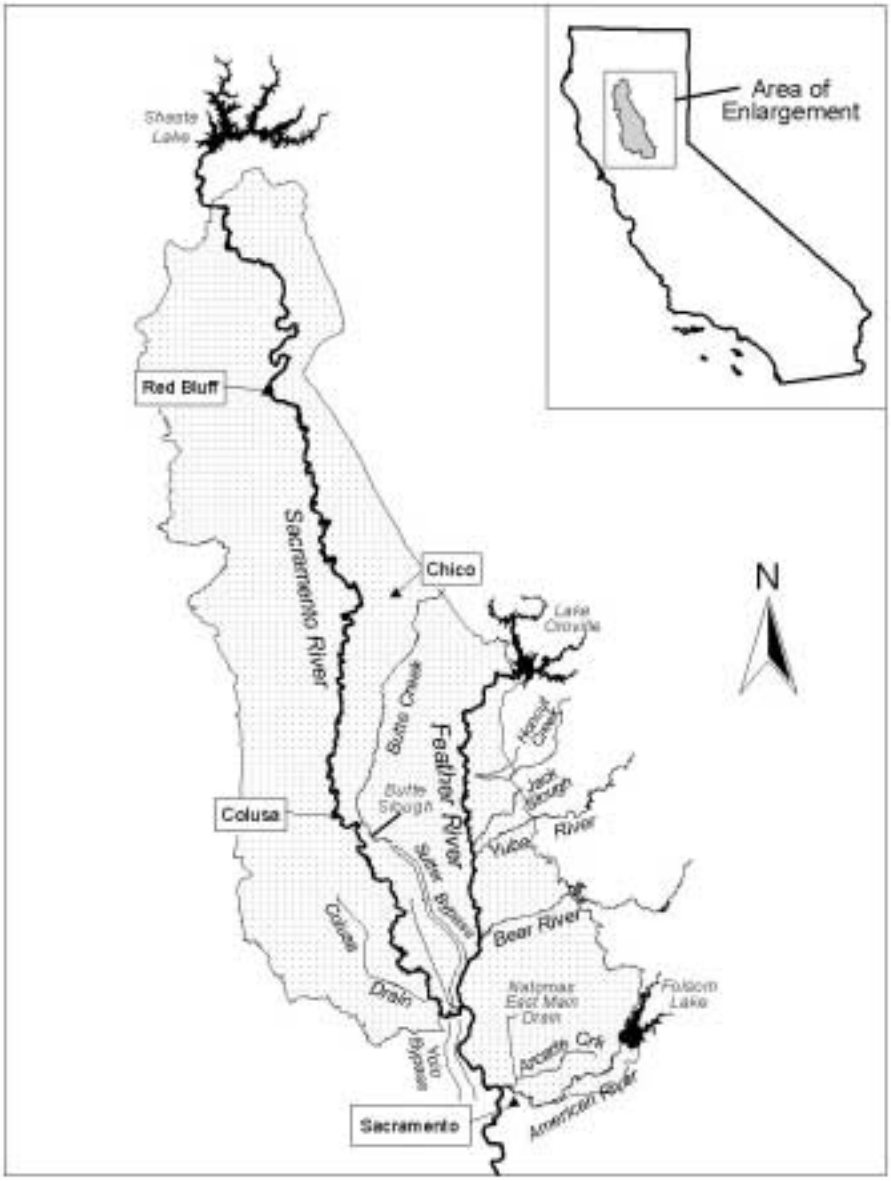
1.2 Watershed Areas to Be Considered

The amendment addresses the main stems of the Sacramento and Feather Rivers below the major reservoirs. The Sacramento Valley (the land area below the major reservoirs-Figure 1.1) covers approximately 5,200 square miles. About 3,400 square miles are irrigated to grow crops and approximately 290 square miles of those crops are devoted to stone fruit and almonds.

Flow in the Sacramento Valley is highly managed. Reservoirs are used to capture runoff for flood control and water supply. Water is diverted from the rivers for municipal and agricultural uses. Levies and bypasses are used to prevent flooding. Both the Sutter and Yolo Bypasses can convey excess flow from the main channel of the Sacramento River.

Both the Sacramento and Feather Rivers receive runoff from agricultural and urban land. The runoff from the agricultural land is often conveyed in a series of ditches before finally discharging to a river or stream. In some cases, the discharge may collect in a common conveyance maintained by a water district. In other instances, the conveyances to a river or stream may be farmer operated.

Figure 1.1. The Sacramento Valley.



1.3 Background

1.3.1Regulatory

Beginning in 1991, the U.S. Geological Survey (USGS) (MacCoy, et al., 1995) began analyzing pesticide levels in the Sacramento River near Sacramento. Elevated diazinon levels were not detected until January and February 1992. Subsequent sampling conducted by USGS, the Regional Board, and California Department of Pesticide Regulation (CDPR) (see Appendix D for a list of all monitoring studies used) continued to show a pattern of elevated diazinon concentrations during January and February in the Sacramento River, Feather River, and their tributaries (see Figure 1.2 below).

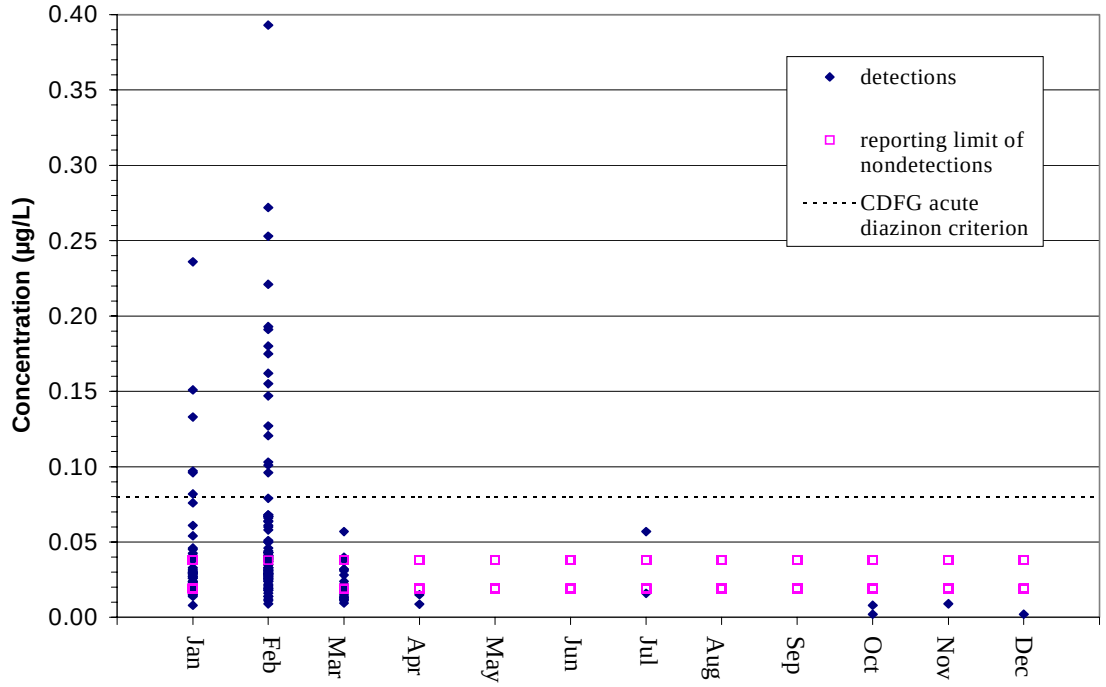


Figure 1.2. Concentration of diazinon in the Sacramento River at Sacramento from 1991-2001

Data are from MacCoy et al., 1995; Kuivila and Foe, 1995; Holmes et al., 2000; Domagalski, 1996; Dileanis et al. 2002; Dileanis, 2002.

In 1994, the California Department of Fish and Game (CDFG) published hazard assessment criteria for diazinon based on USEPA methods (Menconi and Cox, 1994, USEPA 1985a). The chronic criterion was 0.04 µg/L, as a 4-day average, and the acute criterion was 0.08 µg/L, as a 1-hour average. These criteria were updated by CDFG in 2000 (Siepmann and Finlayson, 2000). The chronic criterion was adjusted and is now 0.05 µg/L, as a 4-day average. The diazinon levels in the Sacramento and Feather Rivers were often above those criteria during January and February.

Based on the available data and information on diazinon, the Regional Board added the Sacramento and Feather Rivers to the Clean Water Act Section 303(d) list in 1994 due to toxicity caused by diazinon. The Feather River was listed for sixty miles – the approximate distance

from the fish barrier dam to the mouth. The Sacramento River was listed for thirty miles – the approximate distance from the Colusa Basin Drain to the Sacramento River at "I" Street. Section 303(d)(1)(C) of the Clean Water Act requires the establishment of the total maximum daily load (TMDL) for pollutants on the 303(d) list. Both the Sacramento and Feather Rivers have been designated as having a "high" priority for TMDL development for diazinon.

The Regional Board has an established policy in its Basin Plan to address the control of pesticide discharges from nonpoint sources. The policy outlines the process the Regional Board will use to identify and address pesticide related water quality problems. The process includes: a review of monitoring results and identification of pesticides of greatest concern; consideration of approval of management practices to control discharge; establishing a schedule to review management practices; and consideration of enforcement action. The policy includes provisions for DPR to act to correct the identified problem, for dischargers to correct the problem while reporting to the Regional Board, or for the Regional Board to prohibit discharges or issue waste discharge requirements. The policy waives waste discharge requirements for irrigation return flows (per Resolution No. 82-036), if the Regional Board determines that management practices are adequate to meet water quality objectives.[1]

In February 1996, a lawsuit was settled between the Regional Board, State Board, and Department of Pesticide Regulation and the Sacramento Valley Toxics Campaign and the Environmental Council of Sacramento. The Sacramento Valley Toxics Campaign and the Environmental Council of Sacramento challenged the adoption of an amendment to the Basin Plan, which addressed pesticide objectives (*Sacramento Valley Toxics Campaign, et al. v. State Water Resources Control Board of the State of California, et al.* (Super. Ct. Sacramento County, 1996, No. 363701/703)).

The settlement agreement focused on the presence of dormant sprays in surface waters and in particular diazinon and chlorpyrifos. The settlement agreement included provisions for local sponsors to direct voluntary adoption of management practices to reduce discharges of dormant sprays. DPR was to obtain a commitment from local sponsors by June 1996. The local sponsors were to submit an implementation plan within nine months. DPR was to begin regulating the sale and/or use of dormant sprays if: 1) no sponsor was found; 2) the sponsor did not make satisfactory progress in submitting reports or implementing management practices; or 3) DPR found that unsatisfactory performance of management practices resulted in failure to meet measures of success.

DPR and the Regional Board were to hold a workshop to determine measures of success for diazinon and chlorpyrifos. The DFG hazard assessments for diazinon and chlorpyrifos were to be used as measures of success of implementation practices, "absent the receipt of substantial credible scientific evidence to the contrary during the workshop process."

DPR was to submit two triennial reports to the Regional Board describing control efforts and monitoring. After DPR submitted the second triennial report, the Regional Board was to consider development of numeric water quality objectives or other regulatory options to address dormant sprays. The settlement agreement allowed for the Regional Board or DPR to use their regulatory authorities at any point in the process.

[1] The waiver referenced in the pesticide policy is no longer in effect. The Regional Board has adopted a new waiver of waste discharge requirements for discharges from irrigated lands (Resolution No. R5-2003-0105).

A year after the settlement agreement, DPR and the State Board entered into a management agency agreement (MAA) to address the protection of water quality from adverse effects of pesticides (SWRCB and DPR, 1997a). DPR and the State Board developed an implementation plan for the MAA (SWRCB and DPR, 1997b). The implementation plan had many of the features of the settlement agreement.

A four-stage process was established. 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.

Stage two and stage three includes 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 in the Sacramento and Feather Rivers. A QRL or QRLs for diazinon 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. DPR has also indicated that it will go through a rule-making process to establish use restrictions for dormant sprays (CDPR, 2003b). Diazinon registrants have formed a task force and are proposing supplemental label provisions for diazinon that would require additional management practices (Weinberg, 2003).

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 USEPA has cancelled the use of diazinon for commercial and residential outdoor and indoor applications (USEPA, 2001). The sale of diazinon for these uses will be phased out and prohibited after 2004. The USEPA has also proposed additional restrictions on the use of diazinon for agricultural purposes (USEPA, 2002a), which are currently undergoing public review.

1.3.2 Pesticide Use and Water Quality

Since January and February were the months when elevated diazinon levels were most frequently found, diazinon use patterns during those months were evaluated. The median monthly reported diazinon use in January and February in the Sacramento River watershed was greatest for almond, peach, and plum (dried and fresh) orchards[2]. For reported agricultural use, these crops accounted for approximately 99% of the diazinon applied in January and February. When all reported uses are considered (e.g. including structural pest control and landscape maintenance), the use of diazinon on almond, peach, and plum orchards accounts for 95% of the

[2] The diazinon use on plum orchards is almost exclusively on prune (dried plum) orchards. Use on fresh plums has been about 0.2% of the use on dried plums.

diazinon use during January and February. The total number of almond, peach, and prune growers using diazinon has been about 300 annually from 1999-2001 (CDPR, 2002).

Figure 1.3 plots crop value and dormant season diazinon use for the three crops of concern. Diazinon use for a given dormant season is plotted together with the crop value for the previous year, since a grower's investment in the current year's crop is likely to be strongly influenced by the value of the crop the previous year.

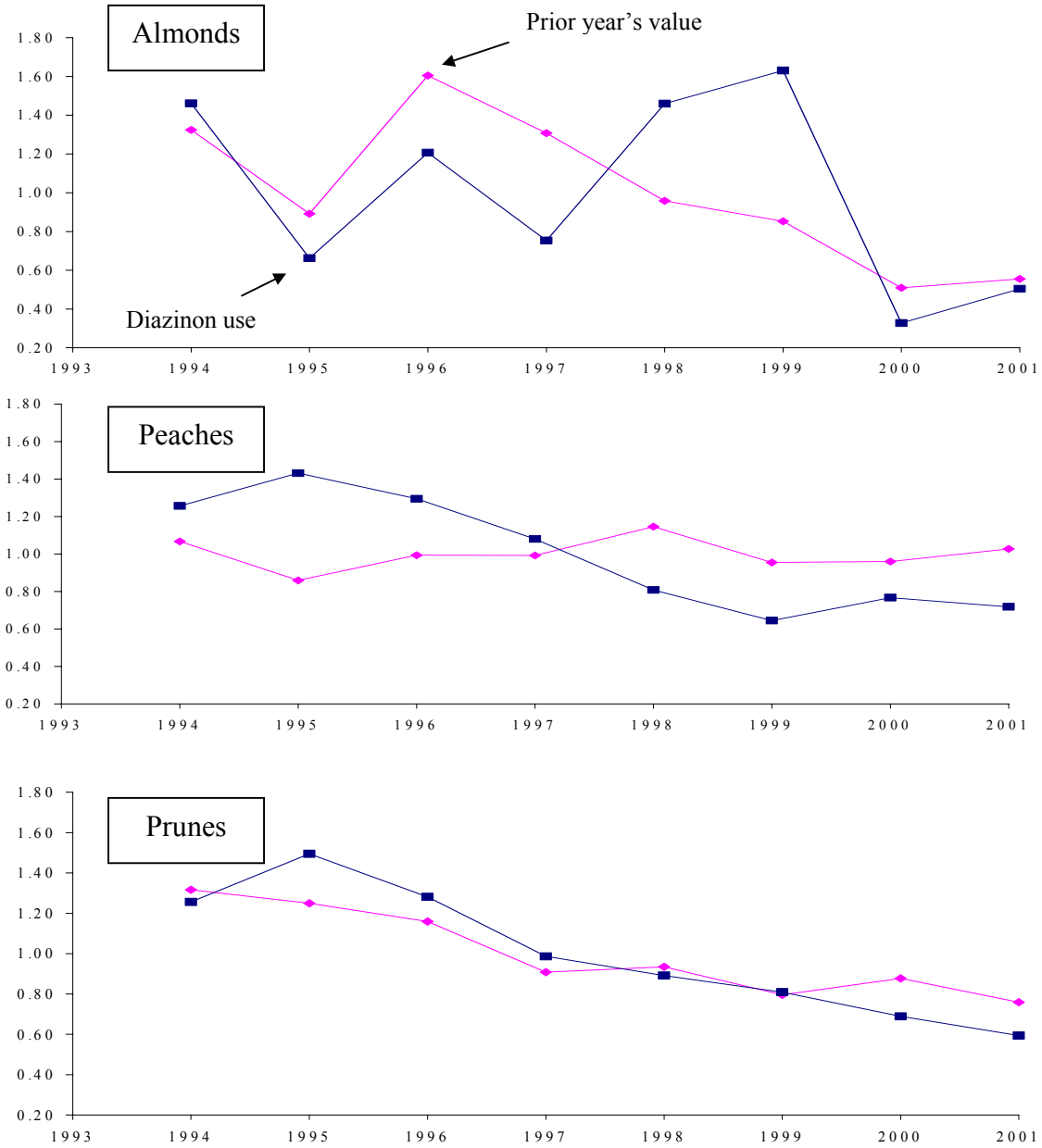
Diazinon use on peach and plum orchards has generally declined since 1994. The value of peaches has remained generally consistent, but the value of dried plums has decreased significantly. Diazinon use on almond orchards has varied significantly from year to year since 1994. The value of almonds decreased significantly from its peak in 1995 to 1999, but has remained relatively constant since 1999.

Regression analysis of crop value versus diazinon use was performed for each crop. Crop value and use were strongly correlated for dried plums (R^2= 0.84) and weakly correlated for almonds (R^2= 0.25) and peaches (R^2= 0.10). Diazinon use on almonds and commodity value appear to go in tandem for all years except 1998 and 1999, in which value goes down and use goes up. If 1998 and 1999 are not included in the regression analysis, the correlation between use and value for almonds is strong (R^2= 0.72).

Crop value is one of the factors, but not necessarily the primary or only factor, driving the reduction in the use of diazinon. Various groups have conducted outreach to promote better management practices and alternatives to diazinon, including the University of California's Integrated Pest Management Program (UCIPM, 1999;2002); the Coalition for Urban/Rural Environmental Stewardship (SRWP, 2003); and the Glenn County Surface Water Stewardship Program. Many of the outreach efforts have included a discussion of water quality problems caused by diazinon and the TMDL being pursued by the Regional Board.

Diazinon use patterns may also be strongly influenced by the availability of alternatives to diazinon that can provide similar control of pests at a lower cost (e.g. see discussion in Section 8).

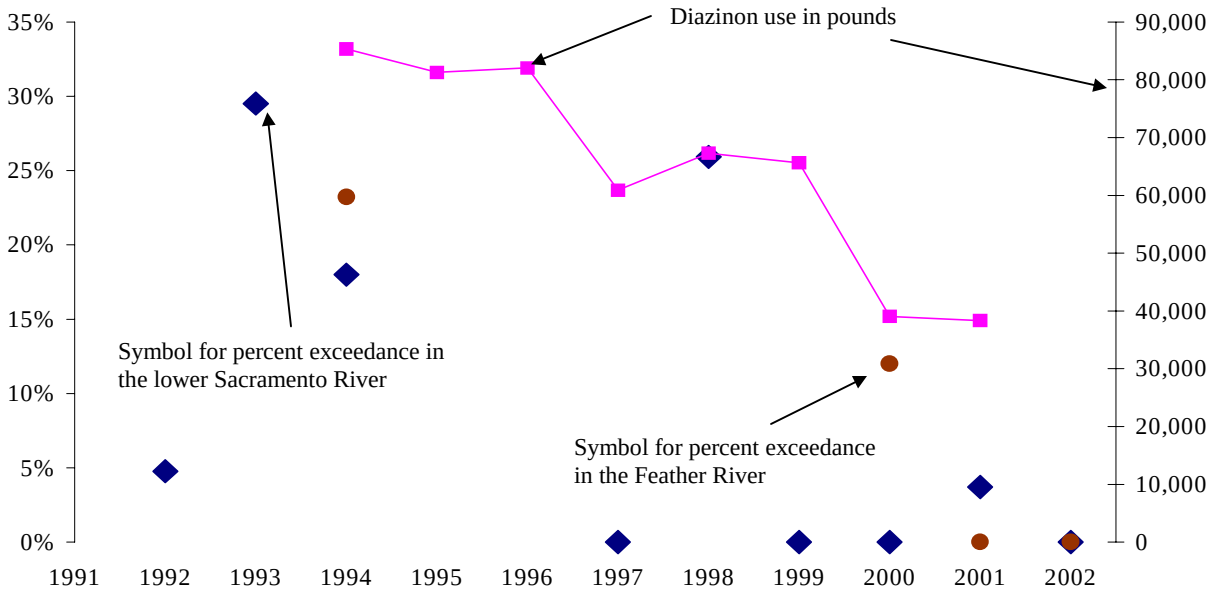
Figure 1.3. Normalized annual diazinon use and normalized commodity value (CPI adjusted).



Diazinon use is from the California Department of Pesticide Regulation annual use reports (CDPR, 2002). Use is determined for Butte, Colusa, Glenn, Placer, Sacramento, Sutter, Tehama, Yolo, and Yuba counties. A "year" represents December of the previous year through March of the year identified. Commodity value is from the National Agricultural Statistics Service web site (ftp://www.nass.usda.gov/pub/nass/ca/AgStats/2001-frt.pdf) accessed on 12/23/02. Values reported were adjusted by the Consumer Price Index (CPI) using the inflation calculator at the Bureau of Labor Statistics web site (www.bls.gov/cpi) accessed on 12/23/02. Data is normalized by taking the value for a given year and dividing it by the average of the time series plotted. The average dormant season diazinon use in 1994-2001 was 18,167 lbs and the average value (in 1994 dollars) for almonds was $1.50 per pound from 1993-2000. The average dormant season diazinon use in 1994-2001 was 11,135 lbs and the average value (in 1994 dollars) for clingstone peaches was $209.47 per ton from 1993-2000. The average dormant season diazinon use in 1994-2001 was 35,690 lbs and the average price (in 1994 dollars) for dried plums was $872.64 per ton from 1993-2000.

The figure below shows the percentage of time that diazinon levels were above the Department of Fish and Game acute criteria (0.080 µg/L) for the Sacramento River below the Feather River and for the Feather River. The percentage was only plotted if at least 10 samples were analyzed for diazinon. The figure does not seem to show any clear correlation between diazinon use and river concentration. This lack of apparent correlation is most likely due to the variations in monitoring study design coupled with variations in timing of diazinon use and rainfall patterns. The concentration data are from monitoring studies that were designed to either sample at a specific frequency or in response to rainfall events. Depending on the year, most diazinon applications may have occurred during a relatively dry period or shortly preceding significant rainfall events. The timing of diazinon use and the intensity and timing of rainfall are likely to be significant variables affecting river concentration.

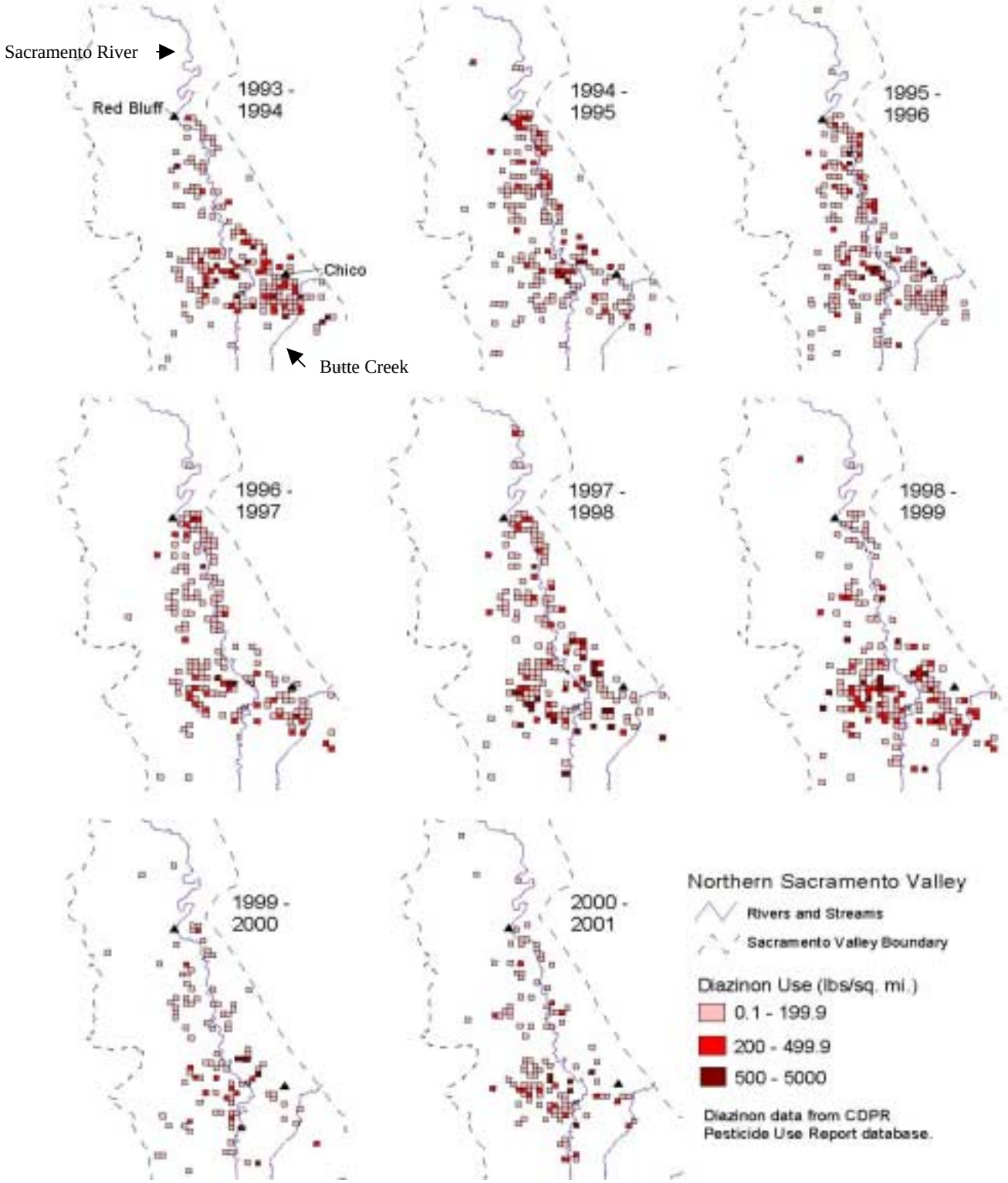
Figure 1.4. Percent of samples exceeding 0.080 µg/L (CDFG acute criterion) versus pounds of diazinon use.



Diazinon use is from the California Department of Pesticide Regulation annual use reports (CDPR, 2002). Use is determined for Butte, Colusa, Glenn, Placer, Sacramento, Sutter, Tehama, Yolo, and Yuba counties. A "year" represents December of the previous year through March of the year identified. Water quality data is from the monitoring studies identified in Appendix A. Percent exceedance (# of samples greater than 0.080 µg/L/ total # samples) is calculated when at least 10 samples were collected in January and February of a given year. Lower Sacramento River includes sites 2.5 miles south of the Feather River confluence; near the city of Bryte; the bridge near the Alamar marina; and at the I Street bridge in Sacramento. The Feather River includes sites at Yuba City and near the mouth of the Feather River.

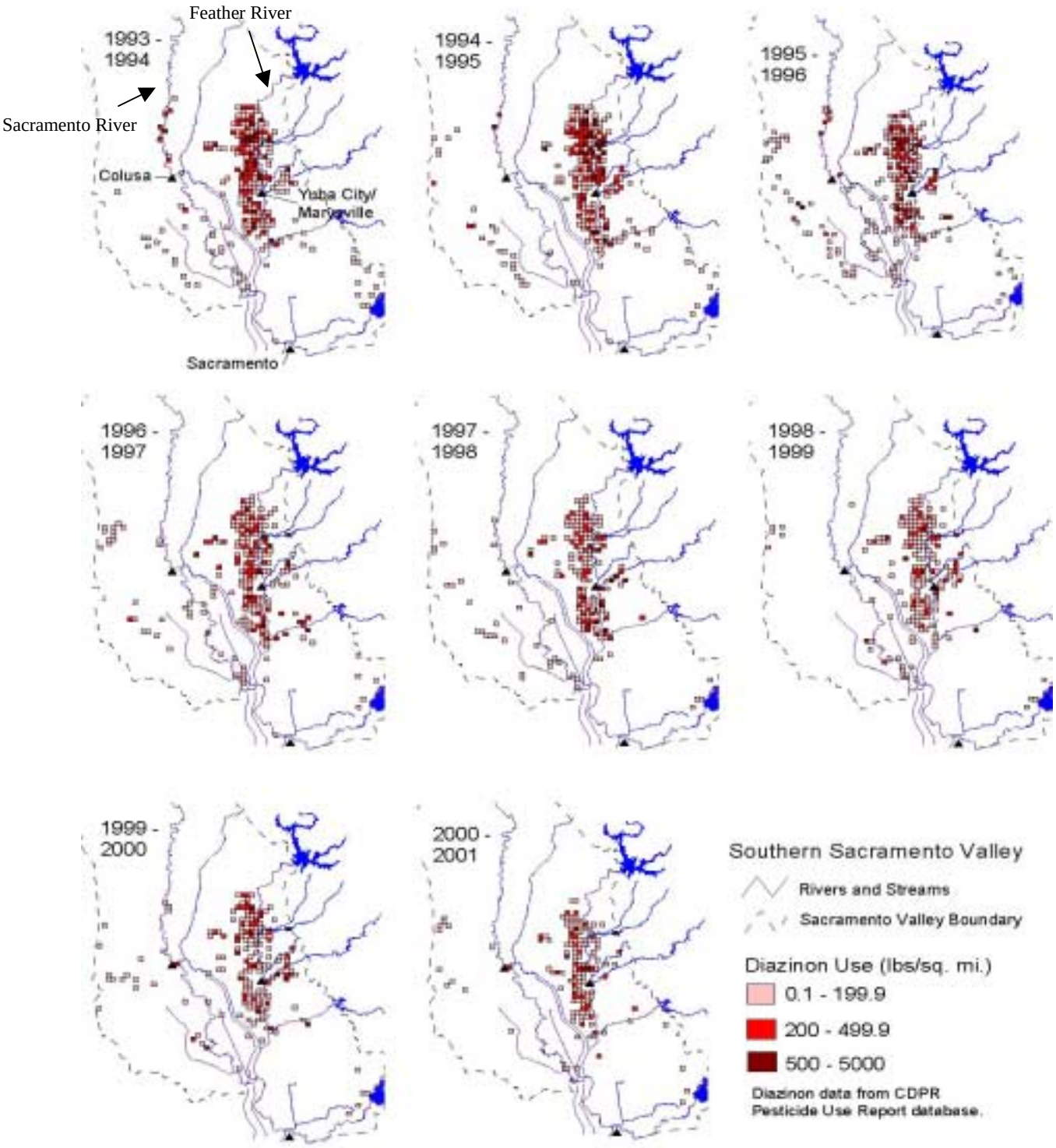
Figures 1.5 and 1.6 show the distribution of diazinon use in the northern and southern Sacramento Valley. The reduction in total diazinon use shown in Figure 1.4 can also be seen in Figures 1.5 and 1.6.

Figure 1.5. Diazinon use in the northern Sacramento Valley from 1993/94 to 2000/01.



The total diazinon used in a given section is plotted for the dormant season, which is defined as December through March.

Figure 1.6. Diazinon use in the southern Sacramento Valley from 1993/94 to 2000/01.



The total diazinon used in a given section is plotted for the dormant season, which is defined as December through March.

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 runoff from orchards in the Sacramento River watershed. In addition, there are no numeric water quality objectives for diazinon in the Basin Plan for the Sacramento and Feather Rivers. The Basin Plan should be revised to address diazinon in the Sacramento and Feather Rivers in order to be consistent with the existing requirements described in Section 1.3.1.

The settlement agreement to address orchard runoff, the Pesticide Management Plan established under the MAA, and existing Regional Board Basin Plan 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 approaches suggests that the Regional Board should take action if an implementation program has not been established and water quality is not protected.

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.

In addition, new water quality objectives and an implementation plan are being proposed. The new objectives must be established by amending the Basin Plan, and must be adopted in compliance with the Administrative Procedures Act. (See CWC §§13241-13242; California Government Code §11353.)

The approach proposed in this Basin Plan Amendment is to establish an orchard runoff control program that is focused on protecting the Sacramento and Feather Rivers from the impacts of diazinon. The focus is on the dormant season, since this is the time of greatest use of insecticides on orchards and the time period when criteria have been exceeded. Adoption of the Basin Plan Amendment will result in the establishment of clear water quality goals for diazinon, a specific time frame for compliance, and an approach to ensuring compliance.

There are six other streams in the Sacramento River watershed that have been identified as not attaining standards due to elevated levels of diazinon (CRWQCB-CVR, 2001). A more comprehensive Basin Plan Amendment revision is not proposed at this time, since the data and information available for the tributary streams is more limited and the level of effort required to meet water quality objectives is less clear. It is anticipated that future amendments to the Basin Plan will be required to address diazinon runoff, and other pesticide runoff from orchards, in tributaries to the Sacramento and Feather Rivers.

2 Proposed Amendments to the Basin Plan

The text in this section constitutes the proposed changes to the Basin Plan. Deletions are shown by strikeout and additions are shown by underline.

The final placement in the Basin Plan of the proposed changes 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.

compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.

For Goose Lake (2), pH shall be less than 9.5 and greater than 7.5 at all times.

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
Diazinon	0.080 µ g/L ; 1-hour average 0.050 µ g/L ; 4-day average Not to be exceeded more than once every three years on average.	Sacramento River from Shasta Dam to Colusa Basin Drain (13) and the Sacramento River from the Colusa Basin Drain to I Street Bridge (30). Feather River from Fish Barrier Dam to Sacramento River (40).

3. *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 the 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.

4. *The Water Quality Limited Segment Policy*

   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 critical pollutants so that water quality objectives can be met in the segment.

   To determine an allowable load for dischargers, the "Loading Capacity" must be determined. The "Loading Capacity" is the maximum amount of pollution that can be present in a water body without violating water quality objectives. The Loading Capacity can be established to address multiple pollutants or a single pollutant. The Loading Capacity can be allocated to NPDES permitted sources (point sources) as waste load allocations and to non-NPDES permitted sources (nonpoint sources) and background as load allocations. Part of the Loading Capacity may also be set aside or not assigned to account for any uncertainty in the Loading Capacity calculation.

   The Loading Capacity and allocations are established to meet Clean Water Act Section 303(d) requirements. In addition, the Loading Capacity and allocations can provide a framework for actions to be taken by the Regional Water Board for achieving pollutant reductions and attaining water quality objectives.

5. *Regional Water Board Resolution No. 70-118, Delegation of Duties and Powers to the Regional Water Board's Executive Officer*

   In January 1970, the Regional Water Board adopted Resolution No. 70-118 which delegates certain duties and powers of the Board to its Executive Officer pursuant to Section 13223 of the California Water Code. See Appendix Item 25.

6. *Regional Water Board Resolution No. 96-147, San Joaquin River Agricultural Subsurface Drainage Policy*

   a. The control of toxic trace elements in agriculture subsurface drainage, especially selenium, is the first priority.

   b. The control of agricultural subsurface drainage will be pursued on a regional basis.

   c. The reuse of agricultural subsurface drainage will be encouraged, and actions that would limit or prohibit reuse discouraged.

   d. Of the two major options for disposal of salts produced by agricultural irrigation, export out of the basin has less potential for environmental impacts and, therefore, is the favored option. The San Joaquin River may continue to be used to remove salts from the basin so long as water quality objectives are met.

   e. The valley-wide drain to carry the salts generated by agricultural irrigation out of the valley remains the best technical solution to the water quality problems of the San Joaquin River and Tulare Lake Basin. The Regional Water Board, at this time, feels that a valley-wide drain will be the only feasible, long-range solution for achieving a salt balance in the Central Valley. The Regional Water Board favors the construction of a valley-wide drain under the following conditions:

such discharge began prior to the effective date of this amendment (10 January 1997) or unless such discharge is governed by waste discharge requirements.

b. The discharge of agricultural subsurface drainage water to Salt Slough and wetland water supply channels identified in Appendix 40 is prohibited after 10 January 1997, unless water quality objectives for selenium are being met. This prohibition may be reconsidered if public or private interests prevent the implementation of a separate conveyance facility for agricultural subsurface drainage.

c. The discharge of agricultural subsurface drainage water to Mud Slough (north) and the San Joaquin River from Sack Dam to the mouth of the Merced River is prohibited after 1 October 2010, unless water quality objectives for selenium are being met. This prohibition may be reconsidered if public or private interests prevent the implementation of a separate conveyance facility for agricultural subsurface drainage to the San Joaquin River.

d. The discharge of selenium from agricultural subsurface drainage systems in the Grassland watershed to the San Joaquin River is prohibited in amounts exceeding 8,000 lbs/year for all water year types beginning 10 January 1997.

e. Activities that increase the discharge of poor quality agricultural subsurface drainage are prohibited.

7. *Diazinon Discharges into the Sacramento and Feather Rivers*

Beginning July 1, 2008, (i) the direct or indirect discharge of diazinon into the Sacramento and Feather Rivers is prohibited if, in the previous year (July-June), any exceedance of the diazinon water quality objectives occurred , and (ii) the direct or indirect discharge of diazinon into any sub-watershed (identified in Table IV-5) is prohibited if, in the previous year (July-June), the load allocation was not met in that sub-watershed. Prohibition (i) applies only to diazinon discharges that are tributary to or upstream from the location where the water quality objective was exceeded.

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

Regional Water Board Guidelines

The Regional Water Board has adopted guidance for certain types of dischargers which is designed to reduce the possibility that water quality will be impaired. The Regional Water Board may still impose discharge requirements. All of the Guidelines are contained in the Appendix (Items 33 through 37). Currently, the following Guidelines apply to the Sacramento and San Joaquin River Basins:

1. *Wineries*

This Guideline contains criteria for protecting beneficial uses and preventing nuisance from the disposal to land of stillage wastes.

2. *Erosion and Sedimentation*

This Guideline identifies practices to be implemented by local government to reduce erosion and sedimentation from construction activities.

3. *Small Hydroelectric Facilities*

This Guideline specifies measures to protect water quality from temperature, turbidity, and dissolved oxygen effects from the construction and operation of small hydroelectric Facilities.

4. *Disposal from Land Developments*

This Guideline contains criteria for the siting of septic tanks, sewer lines, leach fields, and seepage pits to protect water quality.

To ensure the best possible program, the Board will coordinate its pesticide control efforts with other agencies and organizations. Wherever possible, the burdens on pesticide dischargers will be reduced by working through the DFA or other appropriate regulatory processes. The Board may also designate another agency or organization as the responsible party for the development and/or implementation of management practices, but it will retain overall review and control authority. The Board will work with water agencies and others whose activities may influence pesticide levels to minimize concentrations in surface waters.

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.

Orchard Pesticide Runoff and Diazinon Runoff into the Sacramento and Feather Rivers

1. The orchard pesticide runoff and diazinon runoff control program shall:
   a. ensure compliance with the diazinon water quality objectives in the Sacramento and Feather Rivers through the implementation of necessary management practices;
   b. ensure that measures that are implemented to reduce diazinon discharges do not lead to an increase in the discharge of other pesticides to levels that violate applicable water quality objectives and Regional Water Board policies; and
   c. ensure that pesticide discharges from orchards to surface waters are controlled so that the pesticide discharges are at the lowest level that is technically and economically achievable.

2. Orchard dischargers must consider whether a proposed alternative to diazinon has the potential to degrade ground or surface water. If the alternative to diazinon has the potential to degrade ground water, alternative pest control methods must be considered. If the alternative to diazinon has the potential to degrade surface water, control measures must be implemented to ensure that applicable water quality objectives and Regional Water Board policies are not violated.

3. Compliance with water quality objectives, waste load allocations, and load allocations for diazinon in the Sacramento and Feather Rivers is required by June 30, 2008.

   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 waste load allocations for all NPDES-permitted discharges are the diazinon water quality objectives.

5. The Regional Water Board will review the diazinon allocations and the implementation provisions in the Basin Plan at least once every five years, beginning no later than June 30, 2007.

6. Regional Water 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 application season and to consider the effectiveness of management measures in meeting water quality objectives.

7. The Loading Capacity (LC) for diazinon is determined by:
   LC=C x Q x a Unit Conversion Factor;
   where C= the maximum concentration established by the diazinon water quality objectives and Q= the flow (the daily average flow is used in conjunction with the 0.080 µ g/L diazinon objective and the four-day average flow is used in conjunction with the 0.050 µ g/L diazinon objective). The LC

will be calculated for the Sacramento River at I Street; the Sacramento River at Verona; the Sacramento River at Colusa; and the Feather River near its mouth. The value for Q (flow) in the Loading Capacity calculations for the Sacramento River sites will be increased to account for any flood control diversions into the Yolo Bypass or Butte Sink. The best available estimates of such diversions will be used.

8. The Load Allocation for discharges into the Sacramento River between Verona and I Street is determined by the following: [LC(Sacramento River at I Street) minus LC(Sacramento River at Verona)] multiplied by 0.70.

   The Load Allocations required to meet the Loading Capacity in the Sacramento River at Verona are determined by multiplying the LC calculated for the Sacramento River at Verona by the Load Allocation factors in Table IV-5. If the calculated Load Allocation for the Feather River or Sacramento River at Colusa is greater than the Loading Capacity for that site, then the Loading Capacity for that site applies.

   The Load Allocations establish the allowable diazinon load from nonpoint source dischargers.[a]

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

10. Pursuant to CWC §13267, dischargers of diazinon must submit a management plan that describes the actions that the discharger will take to reduce diazinon 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 discharger must document the relationship between the actions to be taken and the expected reductions in diazinon discharge. Individual dischargers or a discharger group or coalition may submit management plans.

    The management plan must comply with the provisions of any applicable waiver of waste discharge requirements or waste discharge requirements and must be submitted no later than June 30, 2005. The Regional Water Board 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.

11. Any waiver of waste discharge requirements or waste discharge requirements that govern the control of orchard pesticide runoff or diazinon runoff that is discharged directly or indirectly into the Sacramento or Feather Rivers must be consistent with the policies and actions described in paragraphs 1-10.

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

a. If the Sacramento River at Verona mean daily flow were 15,000 cubic feet per second or cfs, the loading capacity would equal approximately 2,900 grams/day for the 0.080 µg/L diazinon water quality objective. The Unit Conversion Factor would be 2.446.

The load allocations would be approximately 493 grams/day for the Colusa Basin Drain; 348 grams/day for the Feather River; 783 grams/day for the Sacramento River at Colusa; and 957 grams/day for Sutter/Butte.

If the mean daily flow in the Feather River were 5,000 cubic feet per second or cfs, the loading capacity would be approximately 978 grams/day for the 0.080 µg/L diazinon

water quality objective. The Unit Conversion Factor would be 2.446.

If the load allocation for the Feather River for that day were 348 grams/day, the load allocation would apply.

Location Descriptions

Colusa Basin Drain - is the Colusa Basin Drain at the confluence with the Sacramento River. The Colusa Basin Drain sub-watershed includes all land that drains into the Colusa Basin Drain.

Feather River - is the Feather River near the confluence with the Sacramento River. The Feather River sub-watershed includes all land that drains into the Feather River below the Oroville Dam, but does not include flow from the Sutter Bypass.

Sacramento River at Colusa – is the Sacramento River at the River Road bridge in the town of Colusa. (United States Geological Survey gauging Station 11389500) The Sacramento River at Colusa sub-watershed includes all land below Shasta Dam that drains to the Sacramento River at Colusa.

Sutter/Butte - is Sacramento Slough near the confluence with the Sacramento River or the sum of the Sutter Bypass near the confluence with the Feather River and Reclamation Slough near the confluence with the Sutter Bypass depending on flow conditions (minus diazinon loading resulting from Sacramento River water being bypassed into tributaries of Sacramento Slough or the Sutter Bypass). The Sutter/Butte sub-watershed includes all land that drains to Sacramento Slough, the Sutter Bypass, and Reclamation Slough.

Sacramento River at I Street – is the Sacramento River at the I Street Bridge in the city of Sacramento.

Sacramento River at Verona – is the Sacramento River at the United States Geological Survey gauging station at Verona (Station Number 11425500).

Table IV-5 Load Allocation Factors for Diazinon in the Sacramento River Watershed

Load Allocation Factors by Sub-watershed			
Colusa Basin Drain	Feather River	Sacramento River at Colusa	Sutter/ Butte
17%	12%	27 %	33%

ESTIMATED COSTS OF AGRICULTURAL WATER QUALITY CONTROL PROGRAMS AND POTENTIAL SOURCES OF FINANCING

San Joaquin River Subsurface Agricultural Drainage Control Program

The estimates of capital and operational costs to achieve the selenium objective for the San Joaquin River range from $3.6 million/year to $27.4 million/year (1990 dollars). The cost of meeting water quality objectives in Mud Slough (north), Salt Slough, and the wetland supply channels is approximately $2.7 million /year (1990 dollars).

Potential funding sources include:

1. Private financing by individual sources.
2. Bonded indebtedness or loans from governmental 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).

Pesticide Control Program

Based on an average of $15 per acre per year for 500,000 acres of land planted to rice and an average of $5 per acre per year for the remaining 3,500,000 acres of irrigated agriculture in the Sacramento and San Joaquin River Basins, the total annual cost to agriculture is estimated at $25,000,000. Financial assistance for complying with this program may be obtainable through the U.S.D.A. Agricultural Stabilization and Conservation Service and technical assistance is available from the University of California Cooperative Extension Service and the U.S.D.A. Soil Conservation Service.

Sacramento and Feather Rivers Orchard Runoff Control Program

The total estimated costs for management practices to meet the diazinon objectives for the Sacramento and Feather Rivers are from a $0.3 million/ year cost savings to a $3.8 million/year cost (2001 dollars). The estimated costs for discharger monitoring, planning, and evaluation are from $0.5 to $9.3 million/year (2003 dollars).

Potential funding sources include:

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

2. The Regional Board will inspect discharge flow monitoring facilities and will continue its cooperative effort with dischargers to ensure the quality of laboratory results.

3. The Regional Board will, on a regular basis, inspect any facilities constructed to store or treat agricultural subsurface drainage.

4. The Regional Board will continue to maintain and update its information on agricultural subsurface drainage facilities in the Grassland watershed. Efforts at collecting basic data on all facilities, including flow estimates and water quality will continue.

5. The Regional Water Board, in cooperation with other agencies, will regularly assess water conservation achievements, cost of such efforts and drainage reduction effectiveness information. In addition, in cooperation with the programs of other agencies and local district managers, the Regional Board will gather information on irrigation practices, i.e., irrigation efficiency, pre-irrigation efficiency, excessive deep percolation and on seepage losses.

The Regional Water Board requires a focused monitoring effort of pesticide runoff from orchards in the Sacramento Valley.

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

1. determine compliance with established water quality objectives for diazinon in the Sacramento and Feather Rivers ;
2. determine compliance with established waste load allocations and load allocations for diazinon;
3. determine the degree of implementation of management practices to reduce off-site migration of diazinon;
4. determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon;
5. determine whether alternatives to diazinon 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.

Aerial Surveillance

Low-altitude flights are conducted primarily to observe variations in field conditions, gather photographic records of discharges, and document variations in water quality.

Self-Monitoring

Self-monitoring reports are normally submitted by the discharger on a monthly or quarterly basis as required by the permit conditions. They are routinely reviewed by Regional Water Board staff.

Compliance Monitoring

Compliance monitoring determines permit compliance, validates self-monitoring reports, and provides support for enforcement actions. Discharger compliance monitoring and enforcement actions are the responsibility of the Regional Water Board staff.

Complaint Investigation

Complaints from the public or governmental agencies regarding the discharge of pollutants or creation of nuisance conditions are investigated and pertinent information collected.

3 Beneficial Uses

Beneficial uses designated by the Regional Board for the Sacramento River from the Shasta Dam to the Colusa Basin Drain include: domestic supply (MUN); agriculture irrigation and stock watering (AGR); industry service supply (IND); power (PWR); contact recreation (REC-1); non-contact recreation (REC-2); warm and cold freshwater habitat (WARM and COLD); warm and cold migration and spawning (MIGR and SPWN); wildlife habitat (WILD); and navigation (NAV). The Sacramento River from the Colusa Basin Drain to the "I" Street Bridge has the same designated uses, except for stock watering, IND, and PWR. The Feather River from the Fish Barrier Dam to the confluence with the Sacramento River has the same designated uses as the Sacramento River from the Colusa Basin Drain to the "I" Street Bridge, except it does not have the NAV use designated (CRWQCB-CVR, 1998).

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 Sacramento and Feather Rivers, 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 water quality objectives.

3.1 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 water quality objectives.

3.1.1 No Changes in Uses for the Sacramento and Feather Rivers

This alternative would consider no changes in the already existing uses for the Sacramento River below Shasta Dam and the Feather River below the Fish Barrier Dam.

Aquatic invertebrates have been identified as the most sensitive aquatic organisms to diazinon (see Section 4). The Warm Freshwater Habitat and Cold Freshwater Habitat are defined as follows: "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." The existing designated uses for the Sacramento and Feather Rivers, therefore, address the use that is most sensitive to diazinon.

3.1.2 Modification of Uses Affected by Diazinon for the Sacramento and Feather Rivers

This alternative would result in creating a sub-category of the designated WARM and COLD uses to account for factors that would make attainment of the WARM and COLD uses infeasible. The factors that could be considered in establishing a sub-category of the WARM and COLD uses 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. Diazinon is not a natural pollutant (Factor 1). Flow conditions in the Sacramento and Feather Rivers would not prevent attainment of the use (Factor 2). It is not expected that environmental damage would result from reducing diazinon discharges (Factor 3). Although there is hyrdomodification in both rivers, discharges of diazinon are not impacted by those modifications (Factor 4). The natural features of the rivers do not prevent attainment of the uses (Factor 5). As discussed elsewhere in this report (section 5 and section 8), the Regional Board does not anticipate establishing control requirements and the cost for compliance is expected to be modest (Factor 6).

3.1.3 Addition of Uses for the Sacramento and Feather Rivers

There are a number of defined uses in the Basin Plan that likely apply to the Sacramento and Feather Rivers. Those uses include: Freshwater Replenishment; 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 than the WARM and COLD uses. Any potential effects of diazinon on salmon (see Section 4.4.3) can be addressed by ensuring that existing designated uses are protected. Protection of salmon would be addressed by ensuring protection of the COLD, MIGR, and SPWN uses.

3.2 Recommended Alternative for Beneficial Uses

It is recommended that no change be made to existing designated uses for the Sacramento and Feather Rivers. The use that is most sensitive to diazinon has already been designated, so additional use designations are not necessary at this time.

4 Water Quality Objectives for Diazinon

4.1 Introduction

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

In California, the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (Regional Boards) are responsible for developing and submitting water quality standards to USEPA, under the state's Porter-Cologne Water Quality Control Act. Upon USEPA 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 for the Sacramento River basin (CRWQCB-CVR, 1998) does not currently contain numeric water quality objectives for diazinon. This section examines and evaluates methodologies for establishing numeric water quality objectives, and describes the basis for the recommended numeric water quality objectives for diazinon.

4.1.1 Water Quality Objectives

Water quality objectives can be either numeric or narrative, and the Basin Plan for the Sacramento River basin (CRWQCB-CVR, 1998) currently contains narrative water quality objectives for pesticides and for toxicity, as follows:

- 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 that "…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.

In addition to the Basin Plan's narrative water quality objectives for pesticides and toxicity, 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.

4.1.2 Available Criteria for Protection of Beneficial Uses

The freshwater habitat beneficial use designations are the most sensitive use to diazinon in the Sacramento and Feather Rivers. Table 4.1 presents water quality criteria used in the US and Canada for aquatic life and human health. Criteria for other beneficial uses specified in Section 3 are not available.

Table 4.1. Existing US and Canadian water quality criteria for diazinon

Aquatic Life Criteria for Surface Water	**µg/L**
CDFG Aquatic Life Criteria for freshwater – 4 day average concentration	0.050
CDFG Aquatic Life Criteria for freshwater – 1 hour maximum concentration	0.080
Aquatic Life Criteria for freshwater – 4 day average concentration[3]	0.100
Aquatic Life Criteria for freshwater – 1 hour maximum concentration[3]	0.100
Human Health Criteria for Drinking Water	
USEPA Suggested No Adverse Response Levels (SNARL) for non-cancer toxicity	0.600
California Department of Health Services State Action Level for Toxicity	6.000
National Academy of Sciences SNARL for non-cancer toxicity	14.000
Canadian Environmental Quality Guidelines	20.000

Sources: Marshack, 2000a; Canadian Council of Ministers of the Environment, 1999; University of Wisconsin-Superior and Great Lakes Environmental Center, 2000

[3] The criteria represent numbers derived by the University of Wisconsin-Superior and the Great Lakes Environmental Center as part of a contract with USEPA. These criteria have not yet been published by USEPA as recommended national criteria.

Invertebrates are specifically mentioned in the definition of freshwater habitat uses: "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." (CRWQCB-CVR, 1998) Any methodology used to derive water quality objectives must be fully protective of beneficial uses (40 CFR §131.11(a)), which for this use specifically includes invertebrates.

4.2 Alternate Methods Considered for Deriving a Water Quality Objective

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 approvable by the SWRCB, the USEPA, 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 an approvable water quality objective.

The methods considered for deriving water quality objectives for diazinon are:

- No change in water quality objectives
- No detectable levels of diazinon
- Effects Analysis as applied by Novartis Crop Protection (1997)
- USEPA Water Quality Criteria methodology as applied by USEPA's contractors (University of Wisconsin-Superior and Great Lakes Environmental Center) and California Department of Fish and Game (CDFG)

Although reviewed in an earlier Regional Board report (Azimi-Gaylon, et al., 2001), the criterion (0.009 µg/L as a maximum) derived by the National Academy of Sciences (NAS, 1972) was not considered a reasonable alternative for establishing water quality objectives for diazinon. The methodology applied by NAS is no longer used by USEPA to derive aquatic life criteria. Since the preferred USEPA (1985) methodology has been applied to diazinon recently (by CDFG and USEPA's contractors), detailed evaluation of the NAS criterion was considered unnecessary.

4.2.1 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 (Siepmann and Finlayson, 2000) to interpret compliance with its narrative toxicity and pesticide water quality objectives.

One alternative would be to make no change in the current narrative water quality objectives for pesticides and toxicity in the Basin Plan, and to continue to use the CDFG criteria to interpret the narrative water quality objectives. The CDFG water quality criteria (WQC) for diazinon were derived according to USEPA methodology for deriving WQC, as described below.

4.2.2 Numeric Water Quality Objectives Based on No Diazinon

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. This is a stricter standard than the State and federal anti-degradation policies require, since a no-diazinon standard does not permit degradation even where it is consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial uses and will not result in water quality less than that prescribed in existing policies. (See Resolution 68-16 and 40 CFR 131.12.)

4.2.3 Numeric Water Quality Objectives Based on Probabilistic Ecological Risk Assessment Effects Analysis

The Probabilistic Ecological Risk Assessment (PERA) methodology plots distributions of concentrations associated with a specific toxicologic benchmark, such as the LC_{50}, against distributions of concentrations detected in a waterbody. For the effects analysis of PERA, toxicity values are ranked from lowest to highest and the percentile rank for each value is found. A linear regression is performed on the log-transformed toxicity values and their normalized percentile rank. Toxicity limits at specific levels of environmental protection can then be determined, which are expressed as the percent of species for which the toxic effect is considered acceptable (Novartis, 1997).

Novartis Crop Protection, Inc. (1997) conducted an effects analysis as part of a probabilistic ecological risk assessment for diazinon in the Sacramento-San Joaquin River system. The study used acute toxicity data (EC_{50}s and LC_{50}s) from three sources: the USEPA's pesticide toxicity database (USEPA, 1995a), the USEPA's AQUIRE database (USEPA, 1995b), and a hazard assessment prepared by the CDFG (Menconi and Cox, 1994) used to derive CDFG water quality criteria for diazinon. The USEPA toxicity database contained data for 19 species (32 values) that had been evaluated for product registration. AQUIRE provided acute toxicity data for 57 species (112 values). The CDFG hazard assessment used data for 19 species (33 values) to derive a freshwater water quality criterion for protection of aquatic species. Although the studies overlapped considerably, data were available for a total of 63 different species, approximately half of which were arthropods.

Using environmental protection levels of 5 and 10 percentile of the LC50 values for arthropods, the acute water quality criteria were 0.195 and 0.483 µg/L, respectively. The 5 and 10 percentile of the LC50 values for all species were 1.117 and 3.710 µg/ L, respectively.

For purposes of this analysis, the lowest value (0.195 µg/L) suggested by Novartis will be evaluated and it will be assumed that the criterion would be applied as a maximum.

4.2.4 Numeric Water Quality Objectives Based on USEPA Method for Deriving Numeric Water Quality Criteria

USEPA guidelines (USEPA, 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.

USEPA 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 purpose of the allowed frequency of three years is to provide an appropriate average period of time during which the aquatic community can recover from the effect of an excursion and then function normally for a period of time before the next excursion. The three-year period is based on studies of freshwater systems in which some aspect of recovery from the impact of a disturbance was reported. The three-year period is adequate to protect invertebrates, but recovery periods longer than three years may be necessary to protect long-lived fish species, especially after large excursions or multiple minor excursions over an extensive area (USEPA, 1991).

Acute toxicity data from acceptable tests on freshwater and saltwater organisms are used to determine a Final Acute Value (FAV). USEPA guidelines (USEPA, 1985) require eight families of freshwater organisms for which data should be available for deriving a freshwater FAV, and eight families of saltwater organisms for deriving a saltwater FAV, including:

- family Salmonidae (e.g., chinook salmon, rainbow trout)
- a second fish family, preferably including commercial or recreational species (e.g., bluegill)
- a third family of vertebrates (e.g. fish, amphibian)
- a planktonic crustacean (e.g., daphnid, copepods)
- a benthic (bottom-dwelling) crustacean (e.g., crayfish)
- an aquatic insect
- a family from a group that is not an arthropod or vertebrate (e.g., mollusks)
- another taxonomic group not already represented

The FAV is calculated using the selected genus mean acute values (GMAVs) and cumulative probabilities (P), as follows:

$$S^2 = \frac{\sum((\ln GMAV)^2) - \frac{(\sum(\ln GMAV))^2}{4}}{\sum(P) - \frac{((\sum(\sqrt{P}))^2}{4}}$$

$$\mathrm{L} = \frac{\Sigma(\ln GMAV) - S \cdot \Sigma(\sqrt{P})}{4}$$

$$A = S(\sqrt{0.05}) + L$$

$$FAV = e^A$$

where:

-the Genus Mean Acute Value (GMAV) is the geometric mean of all species mean acute values (SMAVs) for each genus; the SMAV is the geometric mean of all EC_{50} and LC_{50} values for a species.

- the GMAVs are ranked (R) from "1" for the lowest to "N" for the highest; identical GMAVs are arbitrarily assigned successive ranks

- the cumulative probability (P) is calculated for each GMAV as R/(N+1)

- the four GMAVs with cumulative probabilities closest to 0.05 are selected; if fewer than 59 GMAVs are available, these will always be the four lowest GMAVs

The equation generates a more conservative (i.e. lower) FAV as the number of GMAVs decreases; this mitigates the uncertainties associated with small data sets. If data are not available from all eight taxonomic groups, the criteria cannot be developed unless there is a specific rationale for making an exception.

Chronic toxicity data from acceptable tests on freshwater and saltwater organisms are used to determine a Final Chronic Value (FCV). If data are available for the eight families, the FCV is calculated using the same procedure as described for the FAV. If sufficient data are not available, the following formula is used:

$$FCV = \frac{FAV}{FACR}$$

where:

- Chronic values are obtained by calculating the geometric mean of the NOEC and the LOEC values from accepted chronic toxicity tests

- Acute-Chronic Ratios (ACR) are calculated for each chronic value for which at least one corresponding acute value is available; whenever possible, the acute test(s) should be part of the same study as the chronic test

- The Final ACR (FACR) is calculated as the geometric mean of all the species mean ACRs available for both freshwater and saltwater species

Plant toxicity data from algae or aquatic vascular plants are used to determine a Final Plant Value (FPV). The FPV is the lowest result from a test with a biologically important endpoint.

USEPA guidelines specify that a WQC consists of two concentrations, the Criterion Maximum Concentration (CMC), and the Criterion Continuous Concentration (CCC). The CMC is one-half the FAV. The CCC is the lowest of three values: the FCV; the FPV; or the Final Residue Value (FRV). The FRV is intended to prevent pesticide concentrations in commercially or recreationally important species from affecting marketability because applicable action levels are exceeded, and to protect wildlife that consume aquatic organisms. The WQC can be lowered to protect important resident species (USEPA, 1985).

4.2.4.1 USEPA Contractor's Criteria for Diazinon

Freshwater water quality criteria for diazinon have been derived using the guidelines described above by contractors to the USEPA and are being reviewed by the USEPA (University of Wisconsin-Superior and Great Lakes Environmental Center, 2000). Acceptable acute toxicity data were available for twelve invertebrate, ten fish, and one amphibian species. Eight of the twelve invertebrates were the most sensitive organisms tested. Freshwater fish demonstrated only moderate sensitivity to diazinon. The four lowest GMAVs for freshwater organisms were used to calculate the FAV. The FAV for diazinon was 0.192 µg/L, and the draft acute criterion is one-half of that value, so the acute criterion, or CMC, is 0.100 µg/L.

Six chronic toxicity values for five species of freshwater organisms were evaluated. However, an FACR of 2.0 was used because the computed FACR was less than 2.0. The FCV = FAV/ACR, so the chronic criterion, or CCC, is 0.100 µg/L, or equivalent to the CMC. No saltwater CMC or CCC was calculated for diazinon due to insufficient data for saltwater species.

4.2.4.2 California Department of Fish and Game WQC for Diazinon

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

Forty acceptable acute toxicity values were available to calculate a freshwater FAV for diazinon. All eight families specified by USEPA (USEPA, 1985) were represented. The

FAV for diazinon was 0.160 µg/L. Based upon USEPA guidelines, a CMC is calculated as one-half of the final acute value, and the CDFG CMC for diazinon is 0.080 µg/L.

Five ACRs for four species were available to calculate a FCV for diazinon. As required by USEPA (USEPA, 1985), these included a fish (fathead minnow), an invertebrate (mysid), and an acutely sensitive freshwater species (cladoceran). USEPA guidelines (USEPA. 1985) specify that in cases where acute-chronic ratio (ACR) values increase with increasing LC_{50} values, only ACR values for species with SMAVs close to the FAV should be used to calculate the final ACR. This was the case with diazinon; ACR values for only the three acutely sensitive species (*Daphnia magna*, *Ceriodaphnia dubia,* and *Mysid bahia*) were used to calculate the final ACR. The final ACR was 3. The FCV, and thus the chronic criterion, was 0.050 µg/L. Insufficient data were available to calculate acute or chronic saltwater WQC for diazinon.

4.2.5 Summary of Potential Water Quality Objectives Derived by Alternate Methods

The potential water quality objectives are summarized below.

Table 4.2. Summary of potential water quality objectives derived by alternate methods

Method	Acute (µg/L)	Chronic (µg/L)	Frequency of Excursion
No Change	CDFG criteria currently used to interpret narrative		
No degradation	0	0	None
Novartis Effects Analysis (arthropods only, 5 percentile)	0.195	NA	NA
USEPA Contractor (USEPA Method)	0.100[4]	0.100[5]	1 in 3 years
CDFG (USEPA Method)	0.080[4]	0.050[5]	1 in 3 years

NA = not applicable

4.2.6 Comparison of Water Quality Data to Alternative Objectives

The following tables compare 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" method, any detection of diazinon would be counted as an exceedance.

[4] One-hour average concentration.
[5] Four-day average concentration.

Table 4.3. Percent of samples in which measured diazinon concentrations exceeded specific criteria in Sacramento River at I Street in downtown Sacramento[6] during January and February.

Method (criteria)	1992	1993	1994	2000	2001
No Diazinon (0 µg/L)	76%	93%	90%	100%	100%
Novartis Effects Analysis (0.195 µg/L) (arthropods only, 5th percentile)	0%	5%	5%	0%	0%
USEPA (0.100 µg/L)	5%	18%	15%	0%	0%
CDFG - USEPA Method (0.080 µg/L)	5%	20%	20%	0%	8%
Number of Samples	21	61	41	16	12

Table 4.4. Percent of samples in which measured diazinon concentrations exceeded specific criteria in Sacramento River at Colusa[7] during January and February.

Method (criteria)	1994	2000	2001	2002
No Diazinon (0 µg/L)	75%	40%	82%	89%
Novartis Effects Analysis (0.195 µg/L) (arthropods only, 5th percentile)	4%	0%	0%	0%
USEPA (0.100 µg/L)	11%	0%	0%	0%
CDFG - USEPA Method (0.080 µg/L)	14%	0%	0%	0%
Number of Samples	28	10	11	9

Table 4.5. Percent of samples in which measured diazinon concentrations exceeded specific criteria in Feather River at Highway 99 near Nicolaus[8] during January and February.

Method (criteria)	1994	2000	2001	2002
No Diazinon (0 µg/L)	55%	94%	91%	100%
Novartis Effects Analysis (0.195 µg/L) (arthropods only, 5th percentile)	14%	0%	0%	0%
USEPA (0.100 µg/L)	21%	6%	0%	0%
CDFG - USEPA Method (0.080 µg/L)	24%	6%	0%	0%
Number of Samples	29	16	11	8

[6] Water quality data from Dileanis, 2002; Dileanis, et al., 2002; Holmes, et al., 2000; MacCoy et al, 1995.
[7] Water quality data from Dileanis, et al., 2002; Holmes, et al., 2002.
[8] Water quality data from Dileanis, et al. 2002; Domagalski, 2000; Holmes, et al., 2000.

4.3 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.

Table 4.6 presents 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.

Table 4.6. Assessment of alternate methods for their consistency with Porter-Cologne and other state and federal requirements.

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

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

Beneficial Uses:	Not protective of beneficial uses: -	Fully protective: +
Environmental Characteristics:	Not attainable: -	Fully attainable: +
Achievability:	Not reasonably achievable: -	Fully achievable: +
Economic Considerations:	Substantial negative impact: -	No negative impact: +
Housing:	Significant housing impact: -	Little or no impact: +
Recycling Water:	Significant impact on recycling water: -	Little or no impact: +
C = Consistent	NC =Not Consistent	

4.3.1 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.).

4.3.1.1 No Change in Water Quality Objectives

The Basin Plan's narrative water quality objectives for pesticides and toxicity provide useful 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) for diazinon, or for other quantitative applications that require numeric criteria.

Existing numeric criteria, such as the CDFG water quality criteria, have been used as screening tools 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. The CDFG WQC were considered the most appropriate criteria for these applications because they were derived by a California state agency charged with protecting fish and wildlife, using methodology developed by the USEPA for calculating water quality criteria.

4.3.1.2 Numeric Water Quality Objectives Based on No Diazinon

Water quality objectives based on no diazinon would be highly protective of beneficial uses, and would be consistent with State and Federal Policies. Meeting a "no-detectable" diazinon objective may also be difficult to achieve.

4.3.1.3 Numeric Water Quality Objectives Based on PERA Effects Analysis

The PERA effects analysis methodology, as applied to the Sacramento-San Joaquin River system discussed above (Novartis, 1997), is based on the assumption that some portion of individuals or species can be lost without significant damage to the ecosystem. The basis for this assumption is not clearly supported. An approach that assumes lethality to a certain percentage of species could lead to the extirpation of sensitive species, and may place the ecosystem at greater risk in times when the remaining species are under environmental stress and a readjustment in balance takes place. The final balance in the ecosystem over the long term would not be known, and therefore it could not be concluded that beneficial uses were being protected as required by State policy in the Basin Plan.

In addition, the PERA effects analysis uses LC_{50} acute toxicity values, which means that the concentration associated with the tenth percentile of LC_{50} data does not protect 90% of species because the LC_{50} endpoint already represents 50% mortality of individuals. A significant number of individuals of several species would be affected even at levels below the LC_{50} concentration. Therefore, at the proposed level of protection in the cited PERA example, detrimental physiological responses (e.g. mortality) could occur to significantly more than 10% of the aquatic species. (Marshack, 2000b) Allowing impacts of this magnitude would not be in keeping with the requirements of the Water Quality Control Plan.

The organisms most likely to be affected under the PERA effects analysis methodology as applied by Novartis (1997) are sensitive arthropods, especially cladocerans, during January and February. Cladocerans have been identified as an important prey item for larval Sacramento splittail (*Pogonichthys macrolepidotus*), a federally listed threatened species (CDFG, 2002). Cladocerans, mostly Daphnids, were important components of all larval splittail size classes studied in the Sacramento-San Joaquin Delta from February to

July, 1998, comprising 56% of their diet (gut contents, dry weight). Chironomid larvae comprised another 40%, and copepods 4%. About 30% of the splittail larvae examined had no food in their guts, especially in the smallest size classes, possibly indicating an inadequate food supply (Kurth and Nobriga, 2001).

The PERA effects analysis methodology could be made more consistent with protection of the most sensitive species by using more conservative risk management assumptions. It may also be advisable to apply an appropriate safety factor to protect against acute and chronic effects that occur at concentrations below the LC_{50}. If sufficient data were available, protection from chronic toxicity could also be achieved by using data for commonly accepted chronic endpoints such as no or lowest observable effects concentrations (NOEC, LOEC).

In addition, data from the USEPA AQUIRE database and used in the Novartis (1997) PERA effects analysis, are not screened for compliance with accepted standards. References for the original studies are provided in the AQUIRE database and data users can obtain studies and screen them for compliance (D. Brimwald, pers. comm., 2002). However, there is no evidence that this was done in the Novartis (1997) effects analysis.

A cursory review of the species and toxicity tests included in the Novartis effects analysis (Novartis, 1997; Table 10) indicates that there were a significant number of toxicity test results that should not have been included (additional detail is provided in Appendix G). At least two saltwater species were included (Yellowtail and Zebrafish), as well as several species that do not appear to be established in North America (e.g Green Fish, Golden orfe, Oriental weatherfish, Snake-head catfish, Indian catfish, and Crucian carp).

As detailed in Appendix G, a number of the toxicity test results used were reported as "formulation" concentration rather than "active ingredient" concentration. The "formulation" concentration is the concentration of the pesticide product (active ingredient plus adjuvants). The actual concentration of the active ingredient (in this case diazinon) that was present during the toxicity test will be less than that reported as the formulation concentration. Approximately, 75% of the toxicity test results used by Novartis are reported as the "formulation" concentration in the AQUIRE database.

The lack of rigorous screening of the toxicity tests used in the Novartis effects analysis calls into question the effect that is being reported. It is not clear whether the effects analysis is for freshwater species, saltwater species or both. It is also unclear whether the effects analysis is supposed to represent the effect of diazinon alone or diazinon in combination with adjuvants used by the different registrants.

Although the USEPA Office of Pesticide Programs (OPP) has been involved in recent efforts to develop PERA methodology, the method is still under development and is not used by the USEPA Office of Water to establish water quality criteria. In addition, the OPP reviewed the Novartis PERA analysis as part of the reregistration process for diazinon. USEPA had significant reservations about the Norvatis PERA analysis from both the policy and scientific perspective (USEPA, 2002b). USEPA scientists concluded

that "…the underlying assumptions of the refined risk assessment and the report's conclusions are inconsistent with EPA's mandate to be protective." The PERA method is not described in Clean Water Act 304(a) guidance, nor is it a site-specific modification of that guidance.

4.3.1.4 Numeric Water Quality Objectives Based on USEPA Method (as used by USEPA and CDFG)

The USEPA criteria method, as applied by the USEPA contractors and CDFG, 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 (invertebrates, for diazinon) and the acute and chronic criteria are designed to avoid detrimental physiologic responses. Studies used to derive these data are screened to ensure compliance with accepted laboratory practices. The method has been used by the USEPA 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.

The USEPA criteria methodology is consistent with existing state and federal regulations and Basin Plan provisions. The USEPA criteria methodology is based on the Clean Water Act Section 304(a) guidance. In addition, National Pollutant Discharge Elimination System (NPDES) permit effluent limits are set to meet water quality objectives based on USEPA criteria.

4.3.2 Environmental Characteristics and Quality of Water Available

About 290 square miles of land in the Sacramento Valley are planted to stonefruit and almond orchards, mostly in the northern and central parts of the valley (DWR, 2001). Most of the Valley's precipitation (approximately 36" annually) falls during the months of November through March.

Diazinon enters the Sacramento and Feather River systems primarily from applications to almond, peach, and dried plum orchards during the dormant season of December through March. Diazinon is washed off the trees and orchard floor, carried to surface water in rainfall runoff, and enters the Sacramento and Feather Rivers either directly or via a network of drainage canals and tributaries.

The Sacramento and Feather Rivers are currently listed on California's Clean Water Act Section 303(d) List, an inventory of surface waters not currently meeting water quality standards. Concentrations of diazinon detected in the Sacramento and Feather Rivers (MacCoy et al., 1995; Foe and Sheipline, 1993; Domagalski, 1996; Kuivila and Foe, 1995; Holmes et al., 2000; Dileanis et al., 2001; Dileanis et al., 2002; Nordmark, 1998; LWA, 2002) have exceeded the CDFG acute WQC for diazinon of 0.080 µg/L.

None of the alternate methods of deriving water quality objectives are dependent on any natural environmental characteristic. Available water quality data (see Appendix A) indicates that upstream of orchards diazinon is not present in the Sacramento or Feather

Rivers and there are no known "background" levels of diazinon. All of the potential criteria are, therefore, equally consistent with the environmental characteristics of the watershed, and of the water quality available to it.

4.3.3 Water Quality Conditions Reasonably Achievable

Diazinon concentrations detected in the Sacramento River system are the result of current-year applications of these pesticides. Unlike DDT or certain other chlorinated pesticides, diazinon breaks down relatively rapidly in the aqueous environment, and is not sequestered in sediments to an appreciable extent. Unlike some naturally occurring compounds such as selenium, there are no natural sources of diazinon, and there are no natural, or "background" concentrations. If these pesticides were prevented from entering surface waters then concentrations of diazinon in the Sacramento and Feather River system would decline rapidly. The evidence for this can be seen in the seasonality of diazinon levels in ambient water that correspond directly to diazinon use patterns.

The difficulty and cost of preventing diazinon 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 Sacramento and Feather River systems are presented in section 5.1 and Karkoski and others (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. Table 4.3 reflects this assumption. However, some options presented in section 5.1 and Karkoski and others (2002) are more likely to be effective than others, and it is currently unknown which options will deliver the greatest reductions with the least cost and effort. If current water quality data (Tables 4.3-4.5) are indicative of conditions likely to occur in the future, relatively small changes in current pest management practices will be needed to attain standards on a consistent basis to meet the CDFG and EPA criteria. No changes would be needed for PERA, but significant changes would be needed to meet the no detectable levels of diazinon alternative.

4.3.4 Economic Considerations

It is likely that at least some changes in pest management practices will be necessary to reduce diazinon concentrations in the Sacramento-Feather River systems. Alternative pesticides and practices have been identified by the University of California Integrated Pest Management Program (Zalom et al., 1999) and described in Karkoski and others (2002). An economic analysis of these alternate practices is provided in Section 8.

The cost of diazinon applied with dormant oil represents 1% or less of the total production costs for almond, peach, and dried plum orchards - the major orchard crops receiving dormant applications in the Sacramento Valley. The cost of replacements for diazinon would be a similar proportion of total production cost. Providing mitigation for, or preventing, diazinon runoff could change total production cost by a 1% decrease to an

8% increase (see section 8) for those growers that must change their current management practices.

For the "no diazinon" alternative, all growers would either need to use a product other than diazinon or implement measures to prevent surface water runoff. Using an alternative to diazinon would not necessarily lead to a greater cost to the grower (see Section 8). Preventing off-site movement of diazinon would be more costly since both runoff and aerial drift would need to be strictly 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 to take effect.

Given the recent decreases in diazinon levels (see Sections 1 and 5.6; Appendix A; and Tables 4.3-4.5), minor changes in pesticide management practices will be needed to attain the CDFG criteria. As discussed above and in Section 8, the changes may result in either a cost savings or slight cost increase depending on the option pursued by individual growers. As discussed further in Section 8, NPDES dischargers are not expected to be required to put in additional treatment technologies or management practices to meet the CDFG criteria. The ban on the sale of non-agricultural uses of diazinon should be sufficient to reduce the levels of diazinon in the NPDES permitted discharges to below the CDFG criteria.

Since diazinon levels have been below the Novartis PERA criteria for the last several years, no change in pesticide management practices would be required to meet that criteria. Therefore, there would be no economic cost to growers or NPDES dischargers to meet the Novartis PERA criteria.

4.3.5 The Need to Develop Housing

The use of diazinon 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 in the Sacramento and Feather River systems is expected to affect housing.

4.3.6 The Need To Develop And Use Recycled Water

Diazinon 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 for diazinon in the Sacramento and Feather River systems is expected to affect the development or use of recycled water.

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

4.4.1 Anti-degradation Policy

Establishing a water quality objective based on "no diazinon" would be consistent with the anti-degradation policy. The "no change" alternative is protective of beneficial uses, since the CDFG criteria are currently being used to apply the existing narrative objectives and is consistent with the anti-degradation policy. Water quality objectives based on the USEPA methodology should be protective of beneficial uses and would not cause degradation of the existing quality of the Sacramento and Feather Rivers. This is further discussed in Section 4.5.

The PERA effects analysis as applied by Novartis (1997) would not be consistent because it is based on an environmental effects percentile that could result in adverse impacts to beneficial uses. Other applications of PERA that use more protective assumptions, as discussed above, could be more in keeping with the anti-degradation policy.

4.4.2 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 alternative would be consistent with the Clean Water Act. Criteria based on the USEPA methodology would be consistent with the Clean Water Act, since the methodology is part of the 304(a) Guidance. PERA as applied by Novartis (1997) would not be consistent because it is based on a criterion of management likely to result in impacts to the WARM and COLD freshwater habitat beneficial use designation. Other applications of PERA that use more protective assumptions, as discussed above, could be more in keeping with the Clean Water Act and may be acceptable as a "scientifically defensible method".

4.4.3 Endangered Species Act

Several species of special concern, including the federally threatened Sacramento splittail (*Pogonichthys macrolepidotus*) and the state- and federally-endangered winter-run Chinook salmon (*Oncorhynchus tshawytscha)*, occur in the Sacramento and San Joaquin Rivers and Delta (www.dfg.ca.gov/hcpb/species/t_e_spp/tefish/tefisha.shtml). Indirect effects on these fish could occur if populations of sensitive arthropods were reduced at critical periods when they are needed as food by juvenile fish. For Sacramento splittail, winter-run Chinook salmon, and several other fish species this critical early life stage

occurs January through March, when diazinon concentrations in the Sacramento and San Joaquin Rivers and Delta tend to be highest.

Studies conducted on Chinook salmon found that diazinon significantly inhibited olfactory-mediated avoidance response to predators at concentrations as low as 1,000 ng/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 alternative would provide the greatest protection. Water quality objectives derived by the USEPA methodology would still be protective, although the methodology is based on data from tested species, and these species are only surrogates for resident or endangered species.

PERA as applied by Novartis (1997) establishes an effects level that could result in a certain percentage of arthropod species to be critically impacted by diazinon (at or above the LC50 for a certain percentage of species). The effects level chosen is not adjusted by a safety factor to reduce the probability of impact. Therefore, the use of PERA as applied by Novartis could result in a potential impact to the food supply of listed species. This could add further stress to those species during critical development periods.

4.5 Recommended Method for Deriving Water Quality Objectives for Diazinon in the Sacramento and Feather Rivers

In adopting water quality objectives, the Regional Board must consider certain factors specified in Porter-Cologne (§13241), as follows:

- 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.

In addition, the water quality objectives must be consistent with state and federal laws and policies, and must also be acceptable to the State Water Resources Control Board and the USEPA.

Based on these criteria, Regional Board staff is recommending adoption of water quality criteria derived by CDFG as water quality objectives for diazinon in the mainstem of the Feather and Sacramento Rivers. These criteria are:

Acute[1] (µg/L)	Chronic[2] (µg/L)	Allowable Frequency of Excursion
0.080	0.050	1 in 3 years on the average

1) One-hour average maximum concentration
2) Four-day average maximum concentration

The methodology used to derive the CDFG water quality criteria was developed and approved by the USEPA, and is consistent with state and federal laws and policies. The methodology was applied by a California state agency responsible for the protection of aquatic organisms, using toxicity test data screened for compliance with USEPA and American Society for Testing and Materials protocols for conducting toxicity tests (see Menconi and Cox, 1994 and Siepmann and Finlayson, 2000 for references to protocols).

The CDFG criteria for diazinon were first published in 1994 (Menconi and Cox, 1994), with funding from the California Department of Pesticide Regulation. In 2000, the CDFG criteria for diazinon were revised to include new data (Siepmann and Finlayson, 2000), with funding from CALFED and review by the California Department of Pesticide Regulation, the Regional Board, and the USEPA.

The CDFG criteria should be protective of all the designated beneficial uses of the Sacramento and Feather River system, including sensitive aquatic invertebrates. The CDFG criteria are below levels at which deleterious indirect or direct effects to endangered species are likely to occur.

As discussed in more detail in Section 5 and Karkoski and others (2002), there are a wide variety of management practices that can be used and have been used to minimize or eliminate diazinon runoff, so the objectives are reasonably achievable.

The economic cost of complying with these water quality objectives has also been considered (see Section 4.3.4 above and Section 8 for more details).

The environmental characteristics of the hydrographic unit, the need for developing housing, and the need to develop and use recycled water were considered, but are not significant factors in establishing the diazinon water quality objective.

The proposed diazinon water quality objectives are consistent with the anti-degradation policy (State Board Resolution 68-16 and 40 C.F.R. §131.12). For purposes of determining whether degradation will occur, the dormant season and the non-dormant season are considered separately.

The objectives are expected to improve the current quality of the Sacramento and Feather Rivers during the dormant season. No data or information is available to determine the existing quality of water in 1968, when the state anti-degradation policy was adopted, or 1975, when the federal policy was adopted. Use information and diazinon sampling are

available for the early 1990's forward (CDPR, 2002). Pre-1990's toxicity testing suggests that diazinon was likely present in the Rivers, but include no specific diazinon data. However, diazinon has been available since the 1950's (Larkin and Tjeerdema, 2000), and application practices have improved over the past 10 years with the introduction of integrated pest management techniques (see for example Zalom, et al., 1999). For purposes of this analysis, it is reasonable to assume that water quality as of 1968/1975 was no better than in the early 1990's. Therefore, the water quality objective will not cause degradation during the dormant spray season since the objective will improve water quality.

In addition, the diazinon water quality objectives represent a maximum allowable level of diazinon in the Sacramento and Feather Rivers. If other established water quality objectives (e.g. the pesticide narrative objectives) are more stringent then the diazinon water quality objectives, the more stringent objectives apply. Thus, the diazinon objective does not relax existing water quality standards. A policy has also been established that the Regional Board may require further reductions in diazinon levels in the Sacramento and Feather Rivers to protect beneficial uses in tributary waters or to account for additive or synergistic toxicity effects.

Any potential degradation during the non-dormant season is merely hypothetical and does not require further findings. Diazinon levels in the Sacramento and Feather Rivers should not increase because (1) there is no evidence from which to conclude dischargers will change their use practices during the non-dormant season in response to this Basin Plan Amendment; (2) the presence of diazinon in the Rivers is due mostly to rainfall runoff during the dormant season as demonstrated by historical monitoring results; and (3) proposed federal labeling requirements would restrict use to one annual dormant-season application for the crops of primary concern (USEPA, 2002b).

In summary, the proposed diazinon water quality objectives provide for the reasonable protection of beneficial uses from the presence of diazinon in the Sacramento and Feather Rivers. There are a number of cost effective options currently used by many growers that would avoid the use of diazinon or mitigate runoff (also see Section 5.1 and 8.1), which are technologically and economically feasible to implement. The available information indicates that the proposed diazinon water quality objectives have been met at times during dormant season storms, so it is reasonable to expect that the objectives can be met on a consistent basis. Finally, the methodology applied by CDFG is reasonable and based on the standard USEPA method for establishing criteria that are protective of aquatic life.

5 Program of Implementation

Porter-Cologne (§ 13242) requires the identification of a program of implementation for achieving water quality objectives "…that shall include, but not be limited to:

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

This section summarizes the available practices and technology that could be used to reduce diazinon runoff. Since the overwhelming majority of diazinon use during the dormant season is on almond, peach, and dried plum orchards, the focus of the analysis of management practices has been on those three crops. The practices and technology fall into two broad categories: the use of alternative pest management methods that reduce or eliminate the use of diazinon; and the adoption of management measures to reduce the off-site movement of diazinon.

This section also evaluates the potential frameworks for ensuring that appropriate actions are implemented; presents a time schedule for compliance; and recommends the TMDL for diazinon in the Sacramento and Feather Rivers.

5.1 Available Practices and Technology to Reduce Diazinon Runoff

Regional Board staff has reviewed available management practices to control the movement of diazinon into the Sacramento and Feather Rivers in two reports: the Agricultural Practices and Technologies Report (Reyes and Menconi, 2002) and the Draft Program of Implementation Report for the Control of Diazinon in the Sacramento and Feather Rivers (Karkoski, et al., 2002). The focus of this evaluation is on the dormant season, since available data indicates that no additional implementation measures are required to protect the rivers during other times of the year. The information available on alternative pest control practices did not suggest or quantify any yield reduction in almond, peach, or dried plum orchards based on switching from diazinon to other pest control methods. In addition, there was no data or information to suggest that the implementation of management measures to reduce diazinon runoff would result in yield reductions in almond, peach, or dried plum orchards. The conclusions from those reports are summarized below.

The individual management practices fall into two broad categories: 1) pest management practices that rely on pest control products other than diazinon; and 2) farm or pest management practices that reduce the amount or likelihood of off-site movement of diazinon.

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

Actions by growers to switch pest control products may still result in discharge of waste that is environmentally harmful. Although the proposed Basin Plan Amendment is focused on control of diazinon, Regional Board staff assessed strategies that should be viable for both pest management and water quality protection.

A range of management scenarios was evaluated (see Karkoski, et al., 2002, for a more detailed discussion). These scenarios included: 1) an approach in which growers only use pest management materials that pose little or no risk to water quality (Management Scenario 1); 2) an approach in which some growers use materials that pose little or no risk to water quality, while other growers put in management practices to mitigate the runoff of potentially harmful material (Management Scenario 2); and 3) an approach in which all growers put in place management practices to mitigate runoff of potentially harmful material (Management Scenario 3).

A review of Figure 5.1 indicates that the percentage of harvested acres treated with diazinon in the dormant season in a given year ranges from around 10% for almonds to 20% for peaches and dried plums. The median percentage of acres treated with all insecticides in the dormant season is 63% for almonds, 97% for dried plums, and 69% for peaches[9]. The median percentage of acres treated with biological pesticides or pheromones is 22% for almonds, 5% for peaches and 2% for dried plums. The pyrethroid and organo-phosphorus insecticides used on these crops during the dormant season contain warnings about toxicity to fish, wildlife, and or aquatic invertebrates.

[9] The median is calculated for 1993-94 through 2000-01. "All" insecticides include diazinon, other organo-phosphorus pesticides, pyrethroids, pheromones, biological and other insecticides used on almond, peach, and dried plum orchards. The use of oil is not included, since oil is often used with other pesticides. For two dormant seasons (1996/97 & 1999/00), the percentage of acres treated with insecticides is more than 100% of the acres harvested. This may be due to either of two factors: 1) the growers may need to treat all of their crop, even if it is not all harvested or 2) peach growers apply more than one dormant pesticide (e.g. if they applied diazinon and a pyrethroid, the acres treated would be counted each time).

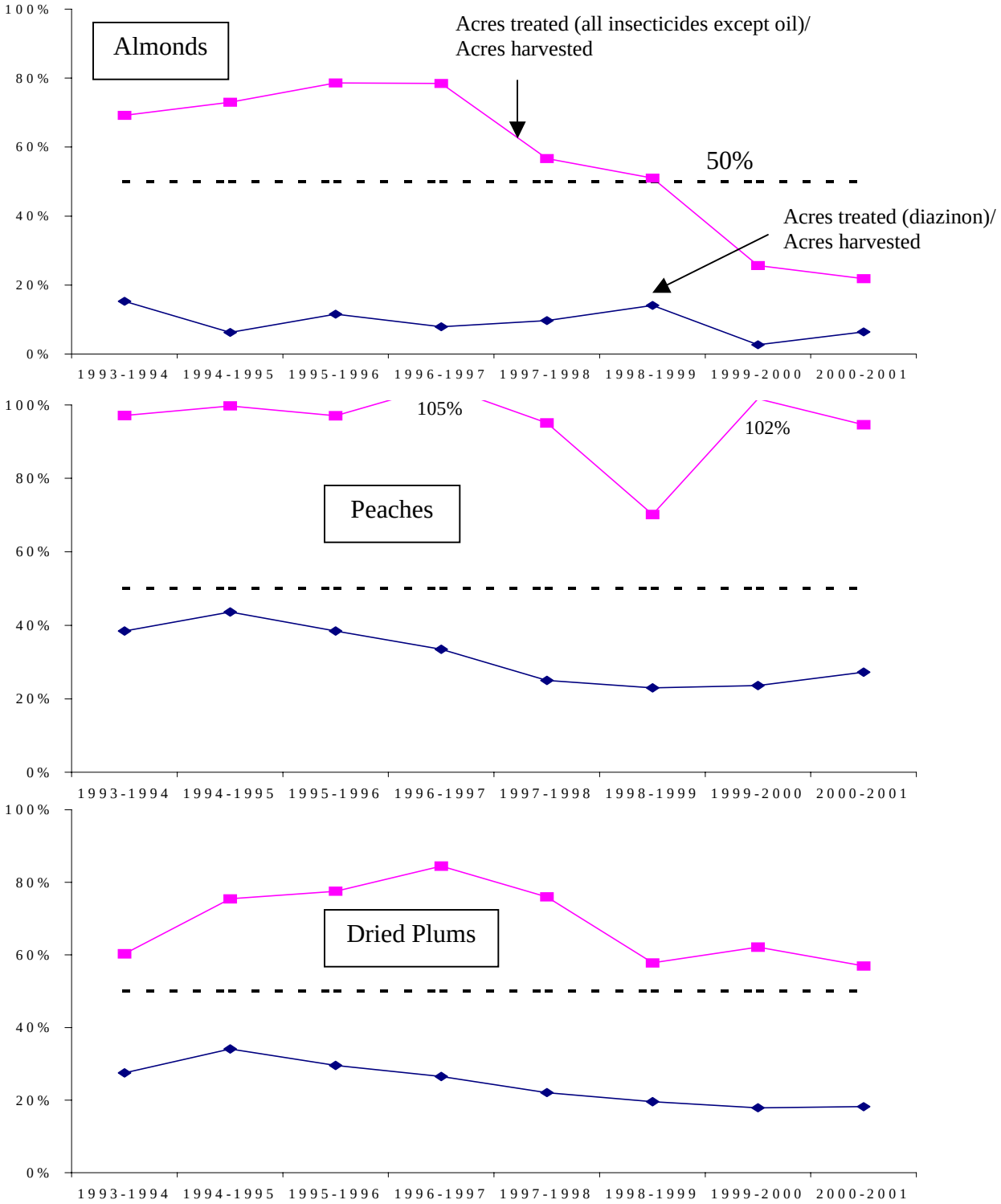


Figure 5.1. Percentage of acres treated with insecticides during the dormant season.

Diazinon use is from the California Department of Pesticide Regulation annual use reports (CDPR, 2002). A "year" represents December of the previous year through March of the year identified. Use and acres

harvested (NASS, 2003. http://www.nass.usda.gov/ca/bul/agcom/indexcac.htm) are summed for Butte, Colusa, Glenn, Placer, Sacramento, Shasta, Sutter, Tehama, Yolo, and Yuba counties.
These pesticide use patterns indicate that: 1) diazinon is an important orchard pest control product, but its use in any given year is on 20%, or less, of the orchard crops that have the highest historic use of diazinon; 2) two to three times the acres treated with diazinon are currently being treated with other pesticides that are potentially harmful if they find their way to surface water; and 3) a significant percentage of orchard acreage is receiving no dormant season pesticide treatment or treatment with materials that pose little to no water quality risk (about 20% for peaches, 40% for dried plums and 65% for almonds).

Based on this review, growers are already applying Management Scenario 1 to some extent. Growers also are employing pest control products other than diazinon that could result in water quality impacts, if not mitigated. Since it is unlikely that all growers could effectively and economically manage pests with pesticides that pose a low water quality risk, Management Scenario 2 will likely be adopted on a basin-wide basis.

Management Scenario 2 would allow growers to maintain maximum farm management flexibility, while still protecting water quality. Growers that can switch to pest control products that pose no or low risk to water quality will likely do so in order to avoid putting in place additional mitigation measures. Growers who continue to use diazinon or other pesticides that could harm water quality have a wide range of options that could be deployed to mitigate or reduce discharge of those materials to surface water.

A broad range of mitigation options is available to growers (Reyes and Menconi, 2002; Karkoski and others (2002)). Those options range from changes in application practices to adoption of vegetative management practices that would prevent or reduce the amount of material running off fields.

Changes in application practices could include: use of new sprayer technologies; more frequent calibration of sprayer equipment; use of drift retardants; improving mixing/loading procedures; and other practices that would result in application of less material or mitigate the off-site movement of material.

Vegetation management practices could be put in place to increase infiltration and/or decrease the amount of material available for runoff. Such practices could include planting cover crops, buffer strips, or allowing native vegetation to grow before and during the dormant season. Reductions in pesticide runoff from ground with vegetation compared to bare soil is due to a combination of an increase in infiltration and decrease in runoff volume, adsorption to plant surfaces, and greater degradation of pesticides on vegetative versus bare soil surfaces (Karkoski, et al., 2002; Ross et al., 1997). In addition to reducing pesticide runoff, vegetative cover would also result in reduction of sediment runoff and excess nutrients, as well as recharging groundwater resources through increased infiltration.

Growers may also be able to change pest management practices, while continuing to use diazinon. For example, alternate year applications of diazinon have been suggested as

being efficacious in orchards with low pest pressures. In addition, closer monitoring of pests may result in fewer or more targeted applications of diazinon (i.e. applications could be targeted to the portion of the orchard with the infestation rather than the whole orchard).

In summary, a wide variety of options are open to growers in response to efforts to reduce runoff of diazinon and other pesticides that are potentially harmful to water quality. The precise suite of management practices adopted by a given grower will vary, but can be chosen in a manner to minimize the off-site movement of pesticides.

5.2 Implementation Framework Alternatives Considered

Karkoski and others (2002) includes a detailed review of the applicable law and a number of alternatives that could be used as the institutional framework for the program of implementation. This section reviews those alternatives relative to a number of factors and provides the basis for the recommended implementation framework. The factors considered include: feasibility, time needed to implement the alternative, accountability, flexibility, limitations on pesticide use and pest management options, certainty in meeting water quality objectives, government cost, and grower cost.

The alternatives include combinations of lead agency/entity (DPR/Agricultural Commissioners, Regional Board, Other group(s)) and regulatory mechanism (prohibition, waiver of WDRs, WDRs, or no regulation).

5.2.1 Lead Agency or Entity

Under all of the alternatives considered, the Regional Board would still be responsible for assuring that water quality objectives would be met. Identification of an entity, other than the Regional Board, as taking the lead in overseeing implementation does not provide that entity with any additional legal responsibilities or authority not already provided in law. The Regional Board does recognize that other entities could be better suited to encourage or require the changes in on-farm management practices that will be needed to meet water quality objectives.

The Regional Board will only consider another entity as the lead if that entity demonstrates the capability and willingness to serve in that role. Additionally, an entity that may not be able to take a lead role may still make significant contributions to the overall success of the program of implementation. The lead entity and other groups supporting the program of implementation can help facilitate adoption of improved management practices, but, ultimately, the dischargers will be responsible for complying with water quality objectives.

The potential regulatory mechanisms that different lead entities could use to promote adoption of improved management practices are summarized below.

5.2.1.1 Department of Pesticide Regulation/ County Agricultural Commissioners

The Department of Pesticide Regulation (DPR) has broad authority over the use of pesticides. The County Agricultural Commissioners (CACs) serve as lead local government agencies for enforcement of federal and state pesticide laws and regulations. The CACs also serve an important function in making growers aware of new requirements and emerging issues related to pesticide use. The Department of Pesticide Regulation contracts with the CACs every year to support local enforcement and outreach efforts.

The Department of Pesticide Regulation has a broad range of available options to ensure pesticides are used in a manner that protect the environment and human health. DPR's regulatory authorities range from cancellation of materials or uses (when the harm caused by the material or use cannot be mitigated) to requiring specific mitigation measures (established at the state level or through local county permits). DPR also has ongoing non-regulatory programs that promote the evaluation of alternative pest control methods and mitigation measures.

As discussed in Section 1, DPR has recently put diazinon into the re-evaluation process. Once the registrants have submitted the information requested by DPR, DPR may take regulatory action to mitigate the impact of diazinon on surface waters. In addition, DPR has indicated that it will develop new regulations on application of dormant sprays. Once any new requirements are in place, growers may base their diazinon runoff management plans wholly or in part on compliance with DPR regulations, depending on the anticipated reduction in diazinon runoff.

The CACs have the most direct interaction with growers, often meeting with them on an annual basis to review potential pesticide applications for the upcoming year. Some counties have also established formal outreach or stewardship programs (e.g. the Glenn County Stewardship Program) to promote the adoption of management practices that will not impact water quality.

5.2.1.2 Regional Board

The Regional Board has a wide range of approaches that it has used to address water quality problems. In most instances when permits (either NPDES permits or waste discharge requirements) are issued, the Regional Board is directly interacting with the discharger to determine compliance with the permit conditions. This oversight can include review and approval of planned changes to facilities; inspections of facilities to determine whether permit conditions are being met; and monitoring of the discharge.

In some cases, permits are issued to an entity that conveys the waste discharge, but the Regional Board does not interact directly with the individual waste dischargers (e.g. municipal storm water permits and the waste discharge requirements issued for selenium discharge to the San Joaquin River). For these types of permits, the entity receiving the

permit would try to influence the behavior of individual dischargers through use of their authorities or through outreach efforts.

For the rice pesticide control program, the Regional Board adopted a conditional prohibition of discharge of waste. The prohibition applies unless the discharger is following a management practice approved by the Regional Board. The rice industry and California Department of Food & Agriculture (and now DPR) worked with the Regional Board directly in getting approval of management practices. The practices were required as part of local county pesticide use permits. Although the role of the rice industry and DPR was not described in the Basin Plan, those entities served as the lead. The Regional Board did not directly interact with the dischargers.

The Regional Board also provides grants and other technical assistance to groups working on projects that are intended to reduce the discharge of waste. The funding and assistance can take place before the Regional Board has an adopted control program in place and after such a control program has been approved.

5.2.1.3 Other Entity

Other entities could serve as the lead in a program of implementation. The waiver program for discharges from irrigated land (CRWQCB-CVR, 2003c) allows for watershed groups to serve as the lead in developing implementation plans and monitoring plans.

In the San Joaquin River watershed, a Joint Powers Authority (JPA) has been used to organize the selenium control efforts of growers in the Grasslands area. The San Joaquin River Group Authority (a JPA of a number of irrigation districts) may address water quality issues, in addition to the flow and water supply issues that they already address.

The potential exists for other entities to take the lead in the program of implementation. There are a variety of different ways of organizing watershed groups or government JPAs, so the capability of any particular group to effectively address diazinon issues in the Sacramento and Feather River watersheds would need to be evaluated on a case-by-case basis.

5.2.2 Regulatory Mechanism

The Regional Board has three primary mechanisms to regulate the discharge of waste from agricultural sources: 1) not allowing the discharge of waste (a “prohibition” under §13243 of Porter-Cologne); 2) issuing requirements for the discharge of waste (waste discharge requirements or WDRs under §13263 of Porter-Cologne); and 3) waiving waste discharge requirements (a “waiver” under §13269 of Porter-Cologne. Each of those mechanisms is briefly summarized below, together with the potential application for the control of the discharge of diazinon to the Sacramento and Feather Rivers.

5.2.2.1 Prohibition

The Regional Board may "…specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted." (Porter-Cologne § 13243). The conditions could be structured to prohibit discharge if discharge standards (e.g. specific load or concentration limits) are not met. Such discharge standards could be applied to discharge from a given field or to discharge from a specific sub-watershed.

The prohibition could also be conditioned on following approved management practices. Discharge would be allowed as long as approved management practices were being followed. This is the approach that is used with the rice pesticide control program.

A prohibition could be described in a manner that allows for different entities to take the lead in overseeing adoption of the management practices. For example, a prohibition could be conditioned based on DPR or the CACs taking action that would lead to adoption of management practices. A prohibition could also be conditioned such that discharge would be allowed if management practices recommended by a stakeholder group were being followed. The recommended management practices would need to undergo some form of Regional Board review and approval.

5.2.2.2 Waste Discharge Requirements - Individual

The Regional Board routinely issues waste discharge requirements to individual dischargers. The Regional Board could issue waste discharge requirements to any individual or entity that is likely to discharge diazinon. Waste discharge requirements could be issued to individual growers/landowners or to an irrigation district that is responsible for conveyance of runoff. In either case, the waste discharge requirements could include discharge standards and or requirements to implement additional management practices. In waste discharge requirements, the Regional Board would not specify the management practices to be adopted, but might require the submittal of a plan and timeline for implementation of management practices that reduce diazinon runoff.

Individual waste discharge requirements would require the identification of the discharger and submittal of a filing fee along with the report of waste discharge. The submittal of an annual report and annual fee would be required.

5.2.2.3 Waste Discharge Requirements - General

The Regional Board can also issue general waste discharge requirements. Such requirements have been issued when a given category of waste is the same or similar and general WDRs are more appropriate, for example, if the number of dischargers is so great as to make the issuance of individual WDRs impractical.

General WDRs could be constructed in a manner similar to a prohibition. Discharge standards and or requirements to adopt approved management practices could be incorporated into a general WDR. General WDRs could be structured in a manner that

could identify an entity, other than the discharger, that would take the lead in identifying the suite of management practices to be implemented.

For general WDRs, an individual discharger would still need to notify the Regional Board of their intent to comply with the general WDR, submit a filing fee, and possibly submit an annual report. The filing fee schedule for general WDRs could be structured to reflect the lower administrative cost to the Regional Board versus administration of an individual WDR.

5.2.2.4 Waste Discharge Requirements – Waiver

The Regional Board may waive the requirements related to WDRs for specific types of discharge when it is not against the public interest. The waiver must be conditional. A waiver can, therefore, be structured in a manner similar to a prohibition. The conditions of the waiver can be structured based on discharge standards and or requirements to follow approved management practices. A waiver could identify an entity, other than the discharger, as taking the lead in identifying appropriate management practices. A waiver could also be based on actions taken by a regulatory agency with adequate authority to address the identified problem.

Waivers do not necessarily require identification of the individual dischargers nor does a waiver require submittal of a filing fee. Compliance with the conditions of the waiver is required.

5.2.2.5 No Regulatory Mechanism

The Regional Board could choose not to identify a particular regulatory mechanism for ensuring compliance with diazinon water quality objectives. The selenium control program in the San Joaquin River was initially focused on encouraging the adoption of improved irrigation practices. No specific waiver, WDRs, or prohibitions were initially adopted. This initial approach was not successful in achieving full compliance with water quality objectives, so the Regional Board is using WDRs to control selenium discharges to the San Joaquin River.

5.2.2.6 Summary of Regulatory Mechanisms

The three primary regulatory mechanisms available to the Regional Board (prohibition, WDRs, waivers) can all be structured in a similar manner. Each mechanism could be structured to: a) require specific discharge standards to be met; b) require approved management practices to be followed; and/or c) identify a specific entity, other than the Regional Board, to take the lead in the program of implementation.

The primary differences between the three mechanisms are: a) the requirements to specifically identify the discharger; and b) the requirements to submit filing fees or annual fees.

The use of WDRs would require the identification of the discharger. A prohibition or waiver could be implemented without requiring the identification of the discharger.

The use of WDRs would require the submittal of filing fees and annual fees. A waiver may include the submittal of filing fees, but not annual fees and a prohibition would not involve the submittal of any fees.

Civil penalties may be issued by the court, Regional Board, or State Water Board to any person who is in violation of waste discharge requirements, waiver conditions, or a prohibition (§ 13350 (a) of Porter-Cologne).

Individual or general waste discharge requirements are the only regulatory mechanism for which only the Regional Board must provide direct oversight. For any other mechanism, DPR and the CACs or another entity could take the lead. Therefore, the two primary factors that define the implementation framework, the lead entity and the regulatory mechanism, will be evaluated separately, rather than in combination.

5.3 Evaluation of Alternatives

Each of the potential leads and regulatory mechanisms are evaluated with respect to each of the evaluation factors identified above. A relative score is then given for each alternative and each evaluation factor.

5.3.1 Feasibility

> Evaluation of feasibility will be based on: 1) the degree to which a given alternative has a clearly defined process; and 2) the degree to which any constraints/requirements associated with the alternative are likely to be met.

Lead – The Regional Board, DPR, and the CACs all have clearly defined responsibilities under federal and state statute. The mechanisms for the Regional Board to take the lead in addressing waste discharge or for DPR and the CACs to address pesticide use are, therefore clearly defined. The primary constraints on these agencies to take the lead will be resources. The greater the requirements for direct oversight and involvement by the agencies, the greater the resource demands. Specific DPR or CAC regulatory action may also be constrained by the particular requirements in the Food and Agricultural Code or FIFRA. The feasibility for another entity to take the lead in the program of implementation will be highly dependent on the structure of that entity. The better defined the organizational structure is, the more feasible it would be to have that entity play a lead role. The feasibility of any particular entity (other than the Regional Board, DPR, and the CACs) taking the lead is difficult to predict without understanding the structure and capacity of that entity to fulfill a lead role.

Regulatory Mechanism – All of the regulatory mechanisms in Porter-Cologne have a clearly defined process (prohibition, WDRs, and waivers). A non-regulatory approach

does not provide the same degree of clarity, with respect to the implementation framework. A prohibition would be difficult for the Regional Board to enforce if the conditions of the prohibition were not met. Diazinon in agricultural storm water return flows is of primary concern and it would be difficult to prevent storm water runoff from leaving a field. Individual WDRs would be difficult to implement due to the large number of potential dischargers. General WDRs and waivers have few inherent constraints. The use of general WDRs would require implementation of an information management system to track the dischargers covered by the general WDRs. A non-regulatory approach would have no inherent constraints.

5.3.2 Time Needed to Implement the Alternative

Certain alternatives will depend on additional regulatory actions by the Regional Board or other entities or may require time to develop the implementation infrastructure (e.g. for a program that is not currently in place). An estimate of the time required to establish the implementation framework of a given alternative will be made.

Lead – The Regional Board, DPR, and the CACs already have established organizations in place to address water quality and pesticide use related issues, respectively. If the program of implementation could be accomplished by redirecting staff, implementation could begin immediately. If additional funding were required, it would take from six to twelve months for the Regional Board, DPR, or the CACs to hire any additional staff and establish a new program. If DPR also needed to take regulatory action (e.g. making diazinon a state-restricted material), one to two years may be required before such an action was completed. Another entity that does not have an established infrastructure to address water quality problems would take a longer time. Local watershed groups often take two to three years to raise the necessary funding and establish their organizational infrastructure.

Regulatory Mechanism - A prohibition or waiver could go into effect immediately upon adoption by the Regional Board, depending on the conditions of the prohibition or waiver. A non-regulatory approach could also go into effect immediately. General waste discharge requirements would require the Regional Board to develop a system to notify dischargers of the requirements and track notices of intent to comply submitted by dischargers. Getting such a system in place would take about six to twelve months given adequate staffing. Besides requiring more staff, issuing individual waste discharge requirements would be much more time consuming. Reports of waste discharge would need to be reviewed from each grower and site-specific WDRs developed (i.e. a single grower may need multiple WDRs depending on the locations of the fields that are farmed). The WDRs would need to be negotiated with each grower and any grower or other interested party could request Regional Board consideration of their WDR. Such a program would likely take up to three years before all WDRs are issued.

5.3.3 Accountability

> The Regional Board will need to know who is responsible for ensuring that necessary changes in management practices are made and who is responsible for tracking and reporting on the progress of the implementation program. This criteria will evaluate whether it is clear which party(ies) are accountable for implementation for a given alternative and whether those party(ies) have the ability and authority to ensure implementation.

Lead - The Regional Board has the necessary authority to require reduction in discharge of waste. DPR and the CACs have the necessary authority to encourage or require changes in pesticide application practices. Whether the Regional Board, DPR, or the CACs would be able to ensure implementation of management practices occurs would depend primarily on whether adequate resources are available.

Whether another entity has the ability and authority to take the lead would need to be evaluated on case-by-case basis. A non-governmental organization would not have the authority to ensure implementation, but may have the ability if adequate funding is available and if growers are willingly adopting needed management practices.

Regulatory Mechanism – Individual WDRs and general WDRs provide for a higher degree of accountability since the dischargers must be identified. A prohibition or waiver may have the same conditions as WDRs and can have the same penalties if the conditions are not met. The prohibition or waiver may or may not have a requirement that dischargers identify themselves. A non-regulatory approach would have the least degree of accountability, since there would be no defined sanctions for failure to follow a non-regulatory approach.

5.3.4 Flexibility

> This criterion will evaluate the degree to which a given alternative can be responsive to or adapt to new data and information.

Lead - The Regional Board, DPR, and the CACs all have a high degree of flexibility in the use of their authorities. Certain approaches that could be used may not be flexible – for example, if DPR established specific use requirements through a rule-making, it would be difficult to change such requirements. Other entities could also have a great deal of flexibility in how they respond or adapt to new data and information.

Regulatory Mechanism – A prohibition, waiver, individual or general waste discharge requirement could be designed in a manner that provides a great deal of flexibility. For example, if a requirement were to submit a management plan for approval, that management plan could be changed from year to year in response to new information. If the requirement were to meet specific discharge standards, there would be limited flexibility to meet that discharge standard, but a great deal of flexibility in how to meet it.

A non-regulatory approach would have a great deal of flexibility, since compliance with specific provisions would not be required.

5.3.5 Limitations on Pesticide Use and Pest Management Options

This criterion will evaluate the degree to which a given alternative could limit a grower's options with respect to pesticide use and pest management.

Lead – The Regional Board only has authority over discharge of waste and not over pesticide use or pest management. The Regional Board could not directly put limitations on the options available to a grower. DPR and the CACs do have authority over pesticide use and could put limitations on pesticide use and management options. If such limitations were necessary, DPR and the CACs would take into consideration the need to protect crops from economically damaging pests, as well as the need to protect the environment. Only DPR and the CACs have authority over pesticide use and management. No other entity could directly limit a grower's options.

Regulatory Mechanism - No regulatory mechanism available to the Regional Board could directly reduce a grower's pesticide use or pest management options. If the Regional Board established discharge standards or developed other requirements that growers felt were too costly to implement, grower pesticide use and management options could be indirectly limited. A non-regulatory option would not put any limitations on pesticide use and pest management.

5.3.6 Certainty in Meeting Water Quality Objectives

This criterion will evaluate the degree of certainty in meeting water quality objectives associated with a given alternative.

Lead - The Regional Board has responsibility for implementing federal and State clean water laws. Even if the Regional Board does not take the lead in the program of implementation, that responsibility remains with the Regional Board. Although the Regional Board has the greatest interest in ensuring water quality objectives are met, the Regional Board does not currently have the staff and infrastructure to directly engage growers. This makes the success of a program of implementation run primarily by the Regional Board less certain. DPR and the CACs have an infrastructure established that includes frequent interaction with growers on pesticide use issues. Since growers are familiar with the CACs and DPR, they would likely be more accepting of a new program originating from the CACs and DPR versus one coming from the Regional Board. DPR and the CACs do not have direct responsibility for implementing the clean water laws, so they do not have a direct interest in ensuring that water quality objectives are attained. The ability of another entity to take the lead and provide certainty that water quality objectives are attained would be dependent on a number of factors, including: the organizational structure of the entity; funding available to lead the implementation efforts; and credibility with growers.

Regulatory Mechanism – A prohibition would provide the greatest certainty that water quality objectives would be met, since discharge of diazinon would not be allowed if the conditions of the prohibition were not met. General WDRs or a waiver could also provide a great deal of certainty that objectives would be met with properly defined requirements or conditions. The success of a prohibition, general WDRs, or a waiver would be highly dependent on the resources available to determine whether the conditions or requirements are being met. Individual WDRs would provide a high degree of certainty that water quality objectives would be met, since requirements would be tailored to individual discharge sites. A non-regulatory program would provide the least amount of certainty that objectives would be met, since there would be no provisions to address any failure to comply with a non-regulatory program.

5.3.7 Government Cost

> This criterion will evaluate the relative cost to local and state governments to implement a given alternative. Cost considerations will include: cost, if any, to develop new regulations or regulatory programs; cost associated with compliance and enforcement; and cost associated with monitoring and reporting.

Lead – The implementation costs to the Regional Board could vary significantly depending on the regulatory mechanism being used. Issuing individual waste discharge requirements would be the greatest cost, whereas, a prohibition, waiver, or general WDRs would likely be less costly to the Regional Board. Additional staff or redirection of staff would be required for the Regional Board to take the lead, since there is currently little staff effort devoted to implementation of improved pesticide management practices. The Regional Board would need contract funds in order to monitor water quality in the Sacramento and Feather Rivers and major tributaries. The CACs and DPR already routinely deal with pesticide management issues. Any requirements for additional staff would be dependent on the nature of the program of implementation. If new DPR restrictions are put on diazinon, the CACs may need to issue permits and conduct inspections. If DPR and the CACs are primarily conducting an outreach effort, there may be no additional staff requirements. The least cost to government would occur if a non-governmental entity took the lead in overseeing the program of implementation. Some government oversight would be required, but the greater level of effort would fall to the lead entity.

Regulatory Mechanism – Individual WDRs would be the greatest cost to the Regional Board. There would be significant administrative costs for tracking submittals of reports of waste discharge and fees, reviewing reports of waste discharge, writing waste discharge requirements, and preparing for Regional Board action for those WDRs that are not consent items. General WDRs would still have costs related to tracking, but there would be significant cost savings since the requirements would only be written once and apply to all dischargers covered. For both individual and general WDRs, some of the administrative cost would be recovered, since dischargers would need to submit annual fees along with their report of waste discharge. A waiver of waste discharge requirements or prohibition would have similar costs as a General WDR, but there would

be no submittal of annual fees by dischargers (a filing fee may be required for a waiver). The cost of enforcing the provisions of WDRs, a waiver, or a prohibition would be similar, since Porter-Cologne provides sanctions that do not differentiate between the regulatory mechanisms being used. The regulatory mechanism used by the Regional Board would not impose a cost on DPR, the CACs, or other local government agencies, unless that agency is a discharger. The least cost to state government would occur for a non-regulatory program, since there would be no specific requirements to administer the program.

5.3.8 Grower Cost

This criterion will evaluate the relative cost to growers to operate under a given implementation framework. Costs associated with any requirements to adopt specific management methods/practices and any additional administrative cost will be considered.

Lead – The primary cost to growers will be the cost to make any necessary changes in management practices (the range of potential cost is discussed in Section 8 of this report). There should be minimal cost impact to the grower based on who takes the lead in the program of implementation. The primary difference between leads, in terms of cost to the grower, will be based on whether the lead is able to require that changes in management practices take place. If the lead (e.g. Regional Board, DPR, or CACs) can require specific changes, then the likelihood that the grower will incur some cost is greater. If the lead cannot or does not require changes in management practices, then the grower will have greater discretion about any additional costs he or she is willing to absorb (i.e. a grower could choose not to participate in the program without consequence).

Regulatory Mechanism – The primary cost difference between different regulatory mechanisms would be associated with the administrative cost to the grower. Under individual or general waste discharge requirements, growers would need to submit an annual fee. A grower may need assistance in preparing individual WDRs from a consultant and the grower may incur cost associated with characterizing their discharge (i.e. collecting and analyzing discharge samples). A waiver may require the submittal of a filing fee. A prohibition would not require a filing fee, nor would a non-regulatory program.

5.3.9 Consistency with State and Federal Laws and Policies

5.3.9.1 Porter-Cologne

Porter-Cologne requires the establishment of a program of implementation to meet water quality objectives. Porter-Cologne provides the Regional Boards with three general mechanisms for regulating the discharge of waste to waters of the state – waste discharge requirements; waivers of waste discharge requirements;

and conditional prohibitions of discharge. The alternatives will be evaluated with respect to their consistency with the regulatory framework described in Porter-Cologne.

Lead – Section 13242 of Porter-Cologne requires the Regional Board to include "…recommendations for appropriate action by any entity, public or private." If an entity, other than the Regional Board were to take the lead, the Regional Board could identify that entity and the scope of their anticipated responsibilities. This would be consistent with Porter-Cologne.

Regulatory Mechanism – All of the regulatory mechanisms are defined in Porter-Cologne and would need to be implemented consistent with Porter-Cologne. A non-regulatory approach (i.e. no established WDRs, waiver, or prohibition) would not be consistent with Porter-Cologne. Porter-Cologne requires one of those regulatory tools to be used when the discharge of waste could affect the quality of the waters of the state.

5.3.9.2 NPS Management Plan

The Nonpoint Source (NPS) Management Plan includes a three-tier process for implementation of best management practices: Tier 1: Self-Determined Implementation of Management Practices [formerly referred to as "voluntary" implementation]; Tier 2: Regulatory Based Encouragement of Management Practices; and Tier 3: Effluent Limitations and Enforcement Actions. The lowest "tier" that is likely to result in attainment of water quality standards should be used. Higher "tiers" are to be used for persistent or more difficult water quality problems. "Tier 1" relies on voluntary efforts to adopt improved management practices; "tier 2" relies on incentives such as waivers of WDRs to encourage adoption of management practices; and "tier 3" relies on adoption and enforcement of waste discharge requirements.

Lead – Any of the entities could take the lead in a program that is based on a "self-determined" or non-regulatory approach (Tier 1); a conditional waiver or prohibition (Tier 2); or general waste discharge requirements (Tier 3). A Tier 3 approach based on individual WDRs could only be carried out with the Regional Board as the lead, since responsibility for review of reports of waste discharge and issuance of WDRs could not be delegated.

Regulatory Mechanism – A non-regulatory approach (Tier 1) would not be consistent with the NPS Management Plan since water quality standards have not been attained with that approach. Waivers or a conditional prohibition could result in attainment of standards and would therefore be consistent with the NPS Management Plan. Individual or general WDRs would also likely result in attainment of standards, but may not be the lowest tier likely to result in attainment of standards.

5.3.9.3 DPR/State Board Management Agency Agreement

> The Department of Pesticide Regulation and the State Water Resources Control Board have signed a Management Agency Agreement (MAA) that provides a framework for the agencies to work together on water quality problems caused by registered pesticides. The agreement envisions a four stage process that includes pollution prevention efforts during stage 1; self-determined compliance efforts led by a sponsor or sponsors during stage 2; DPR regulatory action in stage 3; and Regional Board or State Board action for stage 4. Stages 2-4 apply when a water quality problem has been identified. Stage 3 is triggered if a sponsor has not been identified or the sponsor's program is not successfully addressing the water quality problem. Stage 4 applies when the Regional Board determines that it is necessary to use its authorities or when DPR is unable to address a water quality problem using its authorities.

Lead – The MAA allows for either the Regional Board or DPR to act on their own initiative to address a water quality problem caused by pesticides. If either DPR or the Regional Board takes the lead, it would be consistent with the MAA. CAC leadership coupled with DPR oversight would also be consistent with the MAA. Another entity taking the lead could be consistent with the description of the stage 2 process outlined in the MAA.

Regulatory Mechanism – The MAA does not require the use of any particular regulatory mechanism. The MAA states the stages that should be implemented as necessary to protect beneficial uses. Therefore, any of the Regional Board regulatory mechanisms described would be consistent with the MAA.

5.3.9.4 Bay Protection Toxic Hot Spots Cleanup Program

> The Regional Board has adopted a clean-up plan under the Bay Protection Toxic Hot Spots Cleanup Program (Bay Protection Program) for control of orchard runoff into the Sacramento-San Joaquin Delta (Resolution No. R5-2003-0034). The clean-up plan for orchard runoff requires the development of a Basin Plan Amendment that includes: water quality objectives for diazinon; an implementation program and framework; a compliance time schedule; a monitoring program; and other required TMDL elements. The clean-up plan states that the implementation framework will be based on the three regulatory mechanisms described in Porter-Cologne: prohibiting the discharge of waste; issuing waste discharge requirements; or a conditional waiver of waste discharge requirements.

Lead – The clean-up plan adopted under the Bay Protection Program does not require that any specific entity or group take the lead in working with growers to ensure compliance.

Regulatory Mechanism – The clean-up plan states that a prohibition, waste discharge requirements, or a conditional waiver of waste discharge requirements will be used as the

implementation framework to control orchard runoff. A non-regulatory approach is not described as an option for the implementation framework and, therefore, would not be consistent with the adopted clean-up plan.

5.3.9.5 CALFED Bay-Delta Program

The CALFED Bay-Delta Program Water Quality Program Plan includes the following objective to address pesticides: "The objective is to manage pesticides through existing regulatory agencies and voluntary cooperation of pesticide users such that the beneficial uses of the waters of the Bay-Delta and its tributaries are not impaired by toxicity originating from pesticide use." (CALFED, 2000). The implementation alternative should be consistent with this goal.

Since the CALFED Bay-Delta Program does not specify a particular approach for meeting its pesticide program objective, any Lead or Regulatory Mechanism could be employed as long as the objective of protecting beneficial uses from pesticide toxicity was met.

5.3.9.6 Basin Plan Policies

Currently the Regional Board's Basin Plan includes a policy for "Pesticide Discharges from Nonpoint Sources". The following statements in this policy must be considered in selecting an implementation alternative:

1. "The control of pesticide discharges to surface waters from nonpoint sources will be achieved primarily by the development and implementation of management practices that minimize or eliminate the amount discharged."
2. "When the Board determines that despite any actions taken by DFA[10] use of the pesticide may result in discharge to surface waters in violation of the objectives, the Board will take regulatory action, such as adoption of a prohibition of discharge or issuance of waste discharge requirements to control discharges of the pesticide. Monitoring may be required to verify that management practices are effective in protecting water quality."
3. " The Board will conduct reviews of the management practices being followed to verify that they produce discharges that comply with water quality objectives."
4. "…the Board will place the pesticides into one of the following three classifications… 1.Where the Board finds that pesticide discharges pose a significant threat to drinking water supplies or other beneficial uses, it will request DFA to act to prevent further impacts. If DFA does not proceed with such action(s) within six months of the Board's request, the Board will act within a reasonable time period to place restrictions on the discharges. 2. Where the Board finds that currently used discharge management practices are resulting in violations of water quality objectives, but the impacts of the discharge are not so severe as to require immediate changes, dischargers will be given three years,

[10] The Department of Food and Agriculture (DFA) was originally responsible for overseeing pesticide registration and use. That responsibility is now with the Department of Pesticide Regulation. Any reference to DFA, therefore, now applies to the Department of Pesticide Regulation.

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

5. "Wherever possible, the burdens on pesticide dischargers will be reduced by working through the DFA or other appropriate regulatory processes. The Board may also designate another agency or organization as the responsible party for the development and/or implementation of management practices, but it will retain overall review and control authority."

Lead – Provision 5 of the existing Pesticide policy allows for other agencies or organizations having a lead role with Regional Board oversight. The designation of any lead would be consistent with this policy.

Regulatory Mechanism – Provision 2 indicates that the Regional Board will take regulatory action when violations of objectives are occurring and any DPR actions are not completely addressing the violations. Use of any of the proposed regulatory mechanisms would be consistent with this policy. A non-regulatory approach would be inconsistent with this policy, since Provision 2 states that the Regional Board will take regulatory action.

5.3.9.7 Clean Water Act

Section 502(14) of the Clean Water Act defines "point" sources of pollution and specifically excludes "agricultural stormwater discharges and return flows from irrigated agriculture" from that definition. Section 319 of the CWA specifically addresses non-point sources. Section 319 requires the State to submit a management plan for controlling pollution of non-point sources. Beyond approval of the statewide management plan, there are no provisions requiring USEPA approval of site-specific or pollutant-specific non-point source implementation programs.

Since there are no specific CWA provisions that govern adoption of site-specific or pollution-specific non-point source implementation programs, the alternatives for the Lead and Regulatory Mechanism do not need to be evaluated with respect to the CWA.

5.3.10 Summary of Evaluation of Implementation Framework Alternatives

The scores given below are intended to provide a screening level analysis of the available alternatives and do not provide the sole basis for selecting an alternative. A higher score for a given factor indicates that the alternative is more favorable relative to that factor.

Table 5.1. Scoring of Alternatives Relative to Evaluation Factors and Consistency of Alternatives with State and Federal laws and policies.

	Lead			Regulatory Mechanism				
Factor	DPR/ CAC	Regional Board	Other	Prohibition	WDRs/ Individual	WDRs/ General	WDRs/ Waiver	None
Feasibility	4	4	1	3	2	4	4	2
Time	4	4	3	5	2	3	5	5
Accountability	5	5	0	3	5	5	3	0
Flexibility	4	4	5	3	2	3	3	5
Few Use Limitations	4	5	5	5	5	5	5	5
Certainty	4	3	0	5	4	4	4	0
Govt. Cost	4	2	4	4	1	3	3	5
Grower Cost	3	3	4	4	2	3	4	5
Total	**32**	**30**	**22**	**32**	**23**	**30**	**31**	**27**
Consistency with Laws and Policies								
Porter-Cologne	C	C	C	C	C	C	C	**NC**
NPS Mgmt. Plan	C	C	C	C	**NC**	**NC**	C	**NC**
MAA	C	C	C	C	C	C	C	C
Bay Protection	C	C	C	C	C	C	C	**NC**
CALFED	C	C	C	C	C	C	C	C
Basin Plan	C	C	C	C	C	C	C	**NC**
Clean Water Act	NA	NA	NA	NA	NA	NA	NA	NA

Feasibility – process is not defined and constraints cannot be addressed (0); process is well defined and constraints can be readily addressed (5)
Time – 3 years or greater to begin implementation (0); can be implemented immediately (5)
Accountability – no specific mechanism for accountability defined (0); specific obligations defined in statute or regulations (5)
Flexibility – 2-year or longer process needed to adjust to new data/information (0); can adapt readily to new data or information immediately (5)
Few Use Limitations – limitations on pesticide use could result in crop damage from infestation (0); no limitations on pesticide use (5)
Certainty – no clear mechanism or capacity to ensure compliance with objectives (0); clear mechanism or authority to ensure compliance with objectives (5)
Government Cost – greater than 10 person-years of additional resources and/or $1,000,000 in contract resources required to implement (0); no cost or can be addressed through minor redirection of resources (5)
Grower Cost – greater than 5% increase in total production costs (0); less than 1% increase in total production cost or reduction in total production cost (5)

C – consistent with State or federal law or policy **NC** – not consistent with State or federal law or policy
NA – not applicable

5.3.11 Recommended Implementation Framework

The recommended regulatory mechanism for implementation is a conditional prohibition of discharge (Porter-Cologne § 13243). It is recommended that the prohibition be structured so that it only applies if the diazinon water quality objectives are not being met and the diazinon discharge is not being addressed through an applicable waiver of waste discharge requirements or waste discharge requirements. This approach will allow the Regional Board to determine whether the recently adopted waiver of WDRs for irrigated lands is sufficient to address diazinon and other pesticide discharges from orchards or whether another regulatory mechanism is required.

Lead – The identification of a specific lead in the Basin Plan is not recommended, since no agency or organization has volunteered to take the lead in implementing a Sacramento Valley-wide control program. A waiver of waste discharge requirements or waste discharge requirements could have the flexibility to allow different organizations or agencies to: take the lead in conducting any necessary monitoring and reporting; suggest or require specific changes in pesticide management practices; or conduct outreach. Such a flexible program, with Regional Board oversight, appears the most feasible and appropriate given the evaluation factors considered.

Regulatory Mechanism – A conditional prohibition is the suggested regulatory mechanism, only if the Regional Board is not addressing the discharge of diazinon through a waiver of waste discharge requirements or waste discharge requirements. If the conditional waiver for irrigated lands includes conditions sufficient to fully implement this proposed Basin Plan Amendment (CRWQCB-CVR, 2003c), the Regional Board may not need a separate waiver or WDR to specifically address orchard runoff. WDRs are already in place for NPDES discharges.

The option of not having a regulatory mechanism to address diazinon discharges appears inconsistent with Porter-Cologne and established policies and is not recommended. Sole reliance on individual waste discharge requirements would be costly to the Regional Board and growers and would be more difficult to administer effectively. General waste discharge requirements would be feasible, but would impose a greater cost to growers since annual fees would be required. A waiver of WDRs could be structured in a similar fashion to WDRs, but the Regional Board would not receive annual fees. The prohibition is recommended since it provides a default regulatory program if objectives are not met and no mechanism is in place (i.e. waivers or WDRs) to control the discharge.

Porter-Cologne requires a discharger of waste to file a report of waste discharge (§13260) and the Regional Board to prescribe waste discharge requirements (§13263), unless such requirements have been waived (§13260 and §13269). Any discharge of diazinon not covered by a waiver of waste discharge requirements or governed by waste discharge requirements is not a legal discharge. Application of this prohibition provides the Regional Board with more enforcement options (e.g. civil penalties could be immediately issued) for any illegal discharge of diazinon that is contributing to an exceedance of water quality objectives.

It should be noted that a discharger can avoid any difficulties posed by the prohibition by participating in an applicable waiver or general waste discharge requirement program or by seeking individual waste discharge requirements. All dischargers must submit management plans by June 30, 2005, whether or not the Regional Board incorporates this requirement into waste discharge requirements or a waiver. The monitoring requirements of this proposed Basin Plan Amendment have been specifically designed to be implemented through the applicable waiver or waste discharge requirement program. However, if a discharger is not participating in a waiver or waste discharge requirement program, the Regional Board will not have an efficient mechanism for ensuring the necessary monitoring is taking place and that management plans are being implemented.

5.4 Time Schedules

5.4.1 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. In addition to the time schedule for compliance, the proposed Basin Plan Amendment includes a time schedule for submitting a management plan for dischargers of diazinon. The management plan will allow dischargers to describe the actions that they will take to meet the allocations.

Dischargers will have the flexibility to determine the appropriate actions necessary to meet the allocations, but must demonstrate why they expect those actions to be effective. The actions to be taken by the discharger can include any relevant pesticide regulatory requirements that should reduce diazinon discharges. Since the Irrigated Lands Waiver (CRWQCB-CVR, 2003c) allows groups or coalitions to collect and submit information to the Regional Board, it is proposed that the management plan can be submitted in a similar fashion.

The management plans must be submitted by June 30, 2005 pursuant to requirements under CWC § 13267. This will allow the dischargers time to implement the plan before the compliance date and allow the Regional Board to evaluate the effectiveness of the plan in reducing diazinon discharges. The management plan is necessary to allow the Regional Board to determine compliance with applicable load and wasteload allocations and water quality objectives, and to ensure that adequate progress is being made toward attaining compliance within the sub-watersheds.

Any other required actions will be identified in the applicable waiver of waste discharge requirements or waste discharge requirements.

5.4.2 Time Schedule for Compliance with Diazinon Water Quality Objectives

This section will discuss the time schedule for compliance with water quality objectives and the TMDL based on considerations of feasibility and cost. A short term (2-3 years or 2005-2006), medium term (4-6 years or 2007-2009), and long term (7-10 years or 2010-2013) time frame for compliance will be 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 (see Figure 1.4 and Section 1.3), diazinon use in the Sacramento Valley has decreased significantly since the peaked in the early 1990's. Median diazinon concentrations in the Sacramento and Feather Rivers have also decreased (Appendix A), as has the frequency of exceedance of the proposed acute water quality objective. Recent data indicates that compliance with the proposed water quality objectives has nearly been achieved. Although the recent data provide no assurance or guarantee that the observed trends will continue, the data do suggest that only incremental changes in management practices will be required to achieve full compliance.

As discussed in Karkoski and others (2002), a number of the potential practices could be implemented in a short time frame (i.e. within the next two dormant seasons) 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 use; and 2) unfavorable weather conditions. Diazinon use may increase if pests develop resistance to alternatives being used. Diazinon 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.

<u>Short Term (2005 or 2006) Time Schedule for Compliance</u>
Compliance with the proposed objectives is feasible to obtain in the short term. Only incremental reductions in diazinon 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 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 runoff. Growers who need to use diazinon may require several

seasons to fully implement practices that will reduce diazinon runoff, such as establishing buffer strips or implementing improved application techniques.

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 is fully in effect by December 2004. It may take a few years for any existing stocks of such products to be used.

Medium Term (2007-2009) Time Schedule for Compliance

Compliance with the proposed objectives 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. As discussed in Karkoski and others (2002), growers who use diazinon or other pesticides that could impact water quality have a number of alternatives available to reduce runoff to surface waters.

Growers would likely be able to implement an effective system to reduce pesticide runoff in a four to six year time frame (see practices discussed in Karkoski and others (2002)). Establishing buffer strips or improved application techniques or applicator technologies could be feasibly accomplished in a four to six year time frame. 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 changes in 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 used by residents will have been used (see discussion in 5.5.3.1). This should result in very few detections of diazinon 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 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. An additional benefit would include time to allow growers to determine which management practices are most cost effective at minimizing pesticide runoff. There are not likely to be any NPDES permitted sources of diazinon, since the sale of non-agricultural diazinon products would have been banned for over five years.

Recommendation

A medium term time schedule for compliance with diazinon water quality objectives is recommended. Approximately five years from Regional Board adoption of the Basin

Plan Amendment should provide sufficient time to attain the diazinon objectives and to begin 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 could just result in use of alternatives that may also impact surface water. A medium term 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 long term compliance time schedule is not recommended, since there is no clear environmental or economic benefit to extending compliance beyond six years. A medium term compliance schedule should also result in diazinon levels from NPDES discharges being reduced to negligible levels due to the ban on sale of non-agricultural uses of diazinon

5.5 Loading Capacity and Allocations

Section 303(d)(1)(C) of the Clean Water Act requires the establishment of the Total Maximum Daily Load (TMDL) for waters identified on the 303(d) list, if the USEPA 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 loading a water can receive without violating water quality standards (40 CFR § 130.2 (f), (g), (h), (i)).

The details of the TMDL calculations and methodology can be found in Appendix A. This section provides an overview of the alternatives considered, the factors considered in selecting a recommended alternative, and a description of the recommended alternative.

5.5.1 Factors Considered in Selecting Recommended Alternative

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

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; and
4) The degree of uncertainty associated with the method.

The factors considered in selecting the allocation method were:

1) The ease of determining compliance; and
2) Equity of the methodology in assigning responsibility to dischargers.

5.5.2 Alternatives for Determining the Loading Capacity

5.5.2.1 Pollutant Transport Method

A Pollutant Transport Method could be developed to describe the relationship between pollutant transport processes and receiving water concentrations. A Pollutant Transport Method can explicitly account for major variables that could affect receiving water concentrations, such as soil type, amount of pollutant available for wash-off, pollutant degradation on land and in water, and rainfall wash-off processes.

A Pollutant Transport Method would include modeling of the hydrologic process to account for the routing of the pollutants through the stream system. Accurate flow gauging and knowledge of flow routing are additional factors that must be considered.

For the purposes of establishing a TMDL, a Pollutant Transport Method could be used to establish a baseline condition. Pollutant reductions from the baseline could then be imposed, until the receiving water concentrations were at the levels necessary to attain the applicable standards.

In the Sacramento and Feather River watersheds, the soil type and amount of diazinon applied are fairly well known. Some key data is either missing or very limited, such as the partitioning of pesticide applied between the amount that reaches the tree versus the reaches the ground and the air. Additionally, modeling the routing of the flow from fields to rivers is often difficult, since drainage flows and river flows are often manipulated in the Sacramento Valley. There is also limited concentration data for the rivers and key tributaries, which makes accurate model calibration and validation very difficult.

5.5.2.2 Hydrologically-Based Method

A second approach to establishing a TMDL is to determine the total volume of water available to assimilate the pollutant. If the total volume of water or amount of flow is known, the loading capacity (or TMDL) can be determined directly by multiplying by a concentration-based water quality objective. The focus on hydrology greatly reduces the number of variables or parameters that must be considered. Issues such as the amount of material on the landscape or the fraction that runs off need not be addressed. For those variables that do need to be considered, a great deal of data is usually available (e.g. daily

flow records). Since a Hydrologically-Based Method relies on fewer variables and has a larger data set available, the uncertainty in determination of the loading capacity is greatly reduced.

In the Sacramento and Feather Rivers, flow data is available at a number of key sites. Where flow data is not available (e.g. the mouth of the Feather River), estimates of flow can readily be derived by summing the major inputs.

5.5.2.3 Hydrologically-Based Methods Considered

Due to the availability of data and the greater certainty in the accuracy of the calculated loading capacity, a Hydrologically-Based approach was used.

Two different approaches for determining the loading capacities were considered: one based on variations in the flow regime (variable loading capacity) and one based on a calculated design flow (or design loading capacity). Both loading capacities are calculated by finding the product of the flow and allowable concentration (Equation 1). The allowable concentration is the numeric diazinon water quality objective.

Equation 1:

Loading Capacity (Mass / time) =
Flow (Volume/time) X Allowable Concentration (Mass/ Volume)

The variable loading capacity approach uses the calculated flow for a given day to establish the loading capacity for that day. The four-day average flow is calculated to determine the loading capacity for the four-day average diazinon water quality objective. No exceedances of the water quality objective are explicitly allowed using this approach, but all of the assimilative capacity could be utilized.

The water quality objective does allow exceedances of the maximum concentration, although such allowed exceedances are infrequent – once every three years on the average. To account for these allowed exceedances, a design loading capacity can be established by determining a critical design flow.

The critical design flow is determined for the time frame when the greatest difficulty in attaining the objectives is assumed to occur – a rainfall-runoff event during the dormant season (January/February). The design flow used to calculate the loading capacity explicitly takes into account the allowed frequency of exceedance. Since only a single, non-varying, loading capacity is established with this approach, under normal flow conditions the full assimilative capacity of the rivers cannot be used without exceeding the design loading capacity.

Tables 5.2 and 5.3 summarize how the two different Hydrologically-based approaches could be applied, as described in Appendix A of Karkoski and others (2003). Table 5.4

describes how "storm-events" were identified for the design flow loading capacity calculations.

Table 5.2. Variable Loading Capacity

Diazinon Water Quality Objective	Sacramento River at I Street	Sacramento River at Colusa	Feather River
0.050 µ g/L ; 4-day average;LC_{VC}	Q4sac*0.050*f	Q4col*0.050*f	Q4fea*0.050*f
0.080 µ g/L; 1-hour average; LC_{VA}	Qsac*0.080*f	Qcol*0.080*f	Qfea*0.080*f

LC_{VC} = Variable Chronic Loading Capacity, calculated as a four-day average of grams per day:
And
LC_{VA} = Variable Acute Loading Capacity, in grams per day

Qsac = the daily average flow in the Sacramento River at Sacramento, cfs
Q4sac = the four-day average of the daily average flow in the Sacramento River at Sacramento, cfs
Qcol = the daily average flow in the Sacramento River at Colusa, cfs
Q4col = the four-day average of the daily average flow in the Sacramento River at Colusa. cfs
Qfea = the daily average flow in the Feather River near its outlet, cfs
Q4fea = the four-day average of the daily average flow in the Feather River near its outlet, cfs
f= 2.446 (conversion factor for cfs times µg/L to grams/day)

Table 5.3. Design Loading Capacity for January/February Storm Events

Diazinon Water Quality Objective	Sacramento River at I Street	Sacramento River at Colusa	Feather River
0.050 µ g/L ; 4-day average	1,589 g/day	954 g/day	301 g/day
0.080 µ g/L ; 1-hour average	2,035 g/day	1,211 g/day	391 g/day

Table 5.4. Storm Event Definition for January/February Storm Events

Sacramento River at I Street	Sacramento River at Colusa	Feather River
The day that 0.5 inches or greater of rain falls plus the following 3 days.	The day that 0.5 inches or greater of rain falls plus the following 2 days.	The day that 0.5 inches or greater of rain falls plus the following 2 days.

A third alternative would be to combine the two approaches. The variable loading capacity could apply at all times, except when the actual flow was below the design flow. When the actual flow was below the design flow, the design loading capacity would apply.

5.5.2.4 Recommended Method for Determining the Loading Capacity

The variable loading capacity approach is recommended. This approach directly assesses the actual available assimilative capacity, although the allowed frequency of exceedance is not taken into account. Flow data is generally available for the sites at which the loading capacity will be calculated. 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 (see Margin of Safety discussion below).

The design loading capacity approach is not recommended. The design loading capacity does adequately assess the loading capacity under critical conditions. There is a sufficient historical flow record to allow calculation of the design loading capacity. The method was specifically applied to the time period when exceedances of the water quality objectives have historically been observed. 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. The primary reason for not selecting the design loading capacity approach is that it does not take into account the dynamic rainfall-runoff processes. Since the loading capacity is established based on critical low-flow conditions, growers could be meeting water quality objectives and providing adequate control of runoff, but still exceed the loading capacity.

A combination of the two approaches is not recommended. Such a combination would be difficult to describe clearly in the Basin Plan and, therefore, difficult to implement. Also, there would be little benefit in combining the approaches, since over 99% of the time the variable loading capacity would apply.

It is proposed to calculate the loading capacity at three different points in the Sacramento River and at one point in the Feather River. The Sacramento River sites are: the Sacramento River at Colusa; the Sacramento River at Verona; and the Sacramento River at I Street (see Figure 5.2; the I Street site is just below the American River).

The Sacramento River at Colusa is the Sacramento River at the River Road bridge in the town of Colusa (United States Geological Survey gauging Station 11389500). The Sacramento River at Colusa sub-watershed includes all land below Shasta Dam that drains to the Sacramento River at Colusa. The Sacramento River at Colusa site was chosen as one of the sites for calculating Loading Capacity since: there is an existing flow gauging station and extensive historic flow record; the site integrates the orchard runoff from the northern part of the Sacramento Valley; the amount of dilution flow available is less than the downstream, Sacramento River at Verona site; and the site corresponds to one of the sub-watersheds assigned a Load Allocation (see discussion in Section 5.5.3.2). During high flow, diversions for flood control from the Sacramento River above the Colusa gauge can occur via the Moulton Weir Bypass or the Colusa Weir Bypass into the Butte Sink. The calculated Loading Capacity should be based on the total flow from the watershed area above the Sacramento River at Colusa site. When calculating the Loading Capacity, the flow from the watershed area above the

Sacramento River at Colusa site will equal the flow measured at the Colusa gauge plus any flow diverted to the Butte Sink, using the best available estimates of such diversions.

The Sacramento River at Verona is the Sacramento River at the United States Geological Survey gauging station at Verona (Station Number 11425500). The Sacramento River at Verona site was chosen as one of the sites for calculating Loading Capacity since there is an existing gauging station and extensive historic flow record; the site is just downstream of three major tributaries containing significant orchard runoff (the Colusa Basin Drain; Sutter/Butte; and Feather River sub-watersheds); and no significant orchard runoff enters the Sacramento River below this site. During high flow, diversions for flood control from the Sacramento River above the Verona gauge can occur via the Fremont Weir into the Yolo Bypass. The calculated Loading Capacity should be based on the total flow from the watershed area above the Sacramento River at Verona site. When calculating the Loading Capacity, the actual flow from the watershed area above the Sacramento River at Verona site will equal the flow measured at the Verona gauge plus any flow diverted to the Yolo Bypass, using the best available estimates of such diversions.

The Sacramento River at I Street is the Sacramento River at the I Street Bridge in the city of Sacramento. The Sacramento River at I Street site was chosen as one of the sites for calculating Loading Capacity since the site is at the legal boundary of the Delta and the site is the furthest downstream point at which the proposed diazinon water quality objectives apply. During high flow, diversions for flood control from the Sacramento River above I Street and below the Verona gauge can occur via the Sacramento Weir into the Yolo Bypass. Evaluation of the total flow gained in the Sacramento River Verona to I Street reach should account for any flow from this reach diverted to the Yolo Bypass. When calculating the Loading Capacity at the I Street site, the flow will equal the total estimated flow in the Sacramento River at I Street plus any flow diverted to the Yolo Bypass through the Sacramento Weir, based on the best available estimates of such diversions.

As discussed below, the difference in the Loading Capacity at the Sacramento River at I Street and the Sacramento River at Verona is calculated to determine the load allocation for non-point source runoff into the Sacramento River Verona to I Street reach. Although orchard runoff into this reach of the Sacramento River is minor, the calculation of Loading Capacity, load allocations, and waste load allocations is necessary to meet TMDL requirements. If the TMDL elements were not established for that reach of the Sacramento River, the reach would still be a water quality limited segment requiring a TMDL.

The Feather River site is the Feather River near the confluence with the Sacramento River. This site was chosen as one of the sites for calculating Loading Capacity since it integrates all orchard runoff in the Feather River watershed and corresponds to one of the sub-watersheds assigned a Load Allocation (see discussion in Section 5.5.3.2).

A flow gauging station does not exist at this site, so flow monitoring during sample collection will be necessary. When the Sutter Bypass is carrying flood flows the location for calculating the loading capacity should be prior to the Sutter Bypass input.

No other site on the Feather River is proposed for calculating the loading capacity. The downstream site should be sufficiently representative of conditions in the Feather River. In addition, since there are no flow gauges below orchard areas on the Feather River, flow would need to be monitored from a boat. The difficulty in accessing other sites on the Feather River by boat, together with the significant costs associated with such measurements, does not make the definition of additional sites for Loading Capacity calculations feasible at this time.

5.5.3 Alternatives for Establishing Allocations

5.5.3.1 Alternative and Recommended Waste Load Allocations

The point sources with potential to discharge diazinon into the lower Sacramento or Feather Rivers or their tributaries are the municipal wastewater treatment plants and the municipal stormwater discharges in the Sacramento Valley. Non-agricultural uses of diazinon are being phased out by USEPA (USEPA, 2001). Retailers must stop the sale of diazinon for indoor use by December 2002. Manufacturers of diazinon must stop sale of diazinon formulations for outdoor non-agricultural uses by August 2003. Retailers cannot sell diazinon for outdoor non-agricultural uses after December 2004.

Non-agricultural users (e.g. home-owners) of diazinon can use up their existing stock of diazinon. The amount of diazinon applied by non-agricultural users should decrease rapidly after diazinon is no longer available for purchase.

A survey conducted by the University of California Integrated Pest Management Project (UCIPM, 2001) provides some insight into how long diazinon products might be used by urban residents, even after retail sales end. The survey asked residents the age of the oldest pesticide product in their home. Over 70% stated that their oldest product was less than three years old and over 80% indicated the oldest product was less than five years old. Of those residents whose oldest pesticide product was identified as diazinon, none had diazinon older than five years old.

Note that the survey asked for the age of the oldest pesticide product in the home. It is likely that the average amount of time that a pesticide product is stored in the home before being used or discarded is much less. Also those pesticide products that are kept in the home for long periods of time are being used less frequently and in smaller amounts.

Based on the available information and the phase-out of diazinon it is likely that the vast majority of non-agricultural applications of diazinon would cease within a few years of the cancellation of retail sales. Infrequent applications of diazinon may occur for another few years as stored products are used up.

Since 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

waste load allocation should be established for the NPDES permitted discharges that may have diazinon in its runoff (e.g. stormwater discharges and waste water treatment plant discharges). The proposed waste load allocations for NPDES dischargers are the diazinon water quality objectives. Since diazinon from agricultural sources may still be present in rainfall in urban areas, the waste load allocation for municipal storm water discharges should account for this "background" level of diazinon.

A "zero" diazinon waste load allocation was also considered. A "zero" waste load allocation would be attainable over the longer term (e.g. five years or more after the phase out), since virtually all non-agricultural products would have been used or discarded. A "zero" waste load allocation may not be attainable within the compliance time frame currently proposed and is, therefore, not recommended. A longer compliance time schedule for point source dischargers would accommodate a lower waste load allocation.

It should be noted that the recommended waste load allocation (e.g. set equal to the proposed water quality objectives) could result in a reduction in the loading capacity, if all NPDES sources were discharging at the maximum allowed by the waste load allocation. Based on the phase out of urban uses of diazinon, the presence of diazinon in urban runoff is expected to be infrequent and below the allowable waste load allocation (i.e. since the proposed compliance schedule is several years after the phase out of urban uses of diazinon).

In addition, urban land uses account for less than 5 %[11] of the land use in the Sacramento Valley above the Sacramento River at Verona. The actual flow contribution by urban areas above Verona is much smaller then suggested by the percentage of land use, since the source of most of the flow in the Sacramento and Feather Rivers is from reservoir releases (i.e. not from runoff from the Valley floor). These factors taken together suggest that it is unlikely that the loading from NPDES sources will measurably reduce the available loading capacity in the Sacramento River above Verona. Therefore, it is not necessary to subtract the waste load allocation from the loading capacity to determine the available load allocation.

The exception to the discussion above is for the calculation of the available Loading Capacity between the Sacramento River at Verona and the Sacramento River at I Street. Forty-five percent of the land area below Folsom Dam discharging to this reach of the Sacramento River is urban land. This factor is taken into account in assigning load allocations and is discussed below.

[11] Urban land use data from DWR, 2001. Total land use was found using Arcview® GIS software to determine the area defined in Figure 1.1.

5.5.3.2 Alternative and Recommended Load Allocations

The load allocation scenarios identified are:

1. Allocation among the six Sacramento Valley sub-watersheds (see Figure 5.2) in proportion to the area in each sub-watershed that is used for crops that receive significant diazinon applications during the dormant spray season.

2. Allocation among the crops that receive significant diazinon applications during the dormant spray season in proportion to the area of the Sacramento Valley that is used to grow each crop.

3. Allocation among the six Sacramento Valley sub-watersheds in proportion to current diazinon use rates in each sub-watershed.

4. Allocation among the crops that receive significant diazinon applications during the dormant spray season in proportion to the current use rates in the Sacramento Valley.

5. Allocation among the six Sacramento Valley sub-watersheds based on historic loads.

6. Allocation among the crops that receive significant diazinon applications during the dormant spray based on historic loads.

Load Allocations based on Historic Loading - Of these potential scenarios, 5 and 6 were not examined in detail because there is not currently enough data to fully characterize the dormant season diazinon loads by either crop or sub-watershed.

Load Allocations by Crop - Scenarios 2 and 4 would allocate the load to the major crops that use diazinon in the dormant season (almonds, peaches, and dried plums). Assigning load allocations by crop type could allow for more involvement of the commodity groups related to these crops, and allow for coordination and pollutant trading among growers of a certain commodity. The means for assessing compliance with the load allocations developed under this scenario would be to determine monitoring points that drain areas that are predominantly used for one of each of these crops as well as for predominantly urban land use. Flow and water quality would be monitored at these sites.

An allocation method by crop type would present many challenges in terms of measuring compliance. Since runoff from all fields could not be measured, assumptions would have to be made regarding the representativeness of the discharge from the fields that are monitored. In addition, it would be difficult to account for aerial drift from the point of application to other land areas. Therefore, scenarios 2 and 4 make determining compliance difficult.

Load Allocations by Sub-Watershed - Scenarios 1 and 3 would allocate the available loading capacity to sub-watersheds. Local conditions such as soil types and weather and rainfall patterns are likely to cause variability in the potential for applied diazinon to contribute to the loads in the Sacramento and Feather Rivers. Therefore, achieving compliance with the load allocations may require more effort in some sub-watersheds than others. Assigning load allocations by sub-watershed is likely to encourage efforts based on organization of involved persons within each sub-watershed, and could allow for coordination and pollutant trading within a sub-watershed. This load allocation scenario would also connect those responsible for implementing practices to meet these loads with local waters quality conditions. Efforts at achieving compliance with this load allocation scenario would potentially provide for more progress towards reducing local loading where current loads are higher. Therefore this allocation scenario could provide for more progress at addressing impairments for those tributaries to the Sacramento and Feather Rivers that are also listed on the 303(d) list as impaired by diazinon (e.g. Sacramento Slough, Jack Slough, and Colusa Basin Drain).

Diazinon can be transported from the field upon which it is applied to surface waters via direct runoff from that field or via aerial transport and deposition (via aerial drift of pesticides when applied or volatilization). By focusing on sub-watersheds, it will be easier to address the off-site movement of diazinon. Diazinon loading from a sub-watershed will include direct runoff from points of diazinon application as well as diazinon transported via the atmosphere. The sub-watershed focus should emphasize the need to reduce off-site movement of diazinon and not just on methods to reduce surface runoff from their field. The load allocations are assigned to non-NPDES discharges to various sub-watersheds shown in Figure 5.2.

Assessing compliance with the loads could be achieved by monitoring at the outlets of the major tributaries to the Sacramento River, and at key stations along the main stem of the Sacramento River. Since the outlets for these sub-watersheds are well defined, measuring compliance should be relatively simple.

The choice between scenarios 1 and 3 is based on which approach seems most equitable. Scenario 1 is an allocation approach based on the acreage of the primary crops of concern that are in each sub-watershed. Scenario 3 is an allocation approach that is based on the diazinon use on those crops in each sub-watershed.

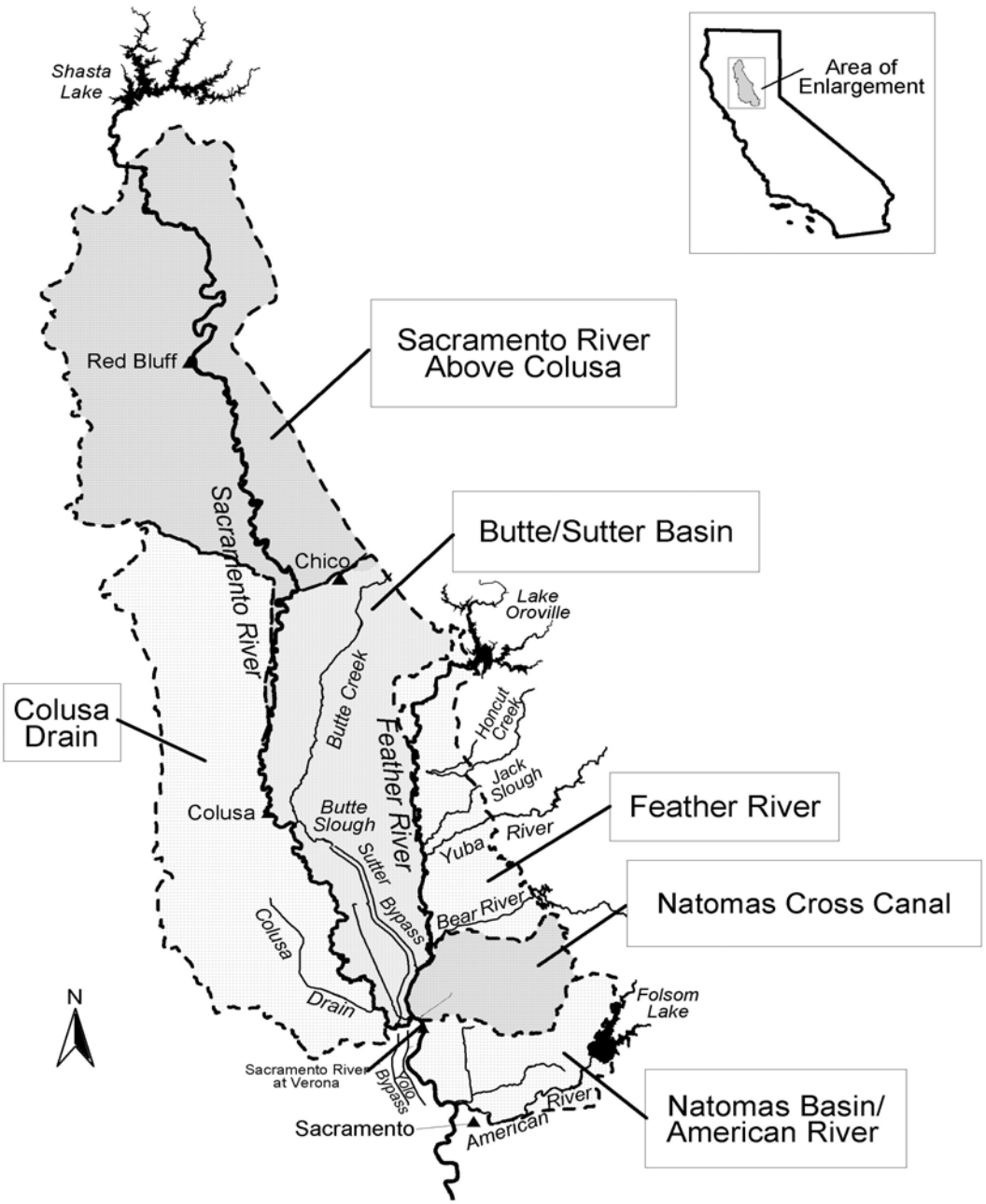
The allocation approach based on the relative land area in almond, peach, and plum orchards is recommended. This approach seems to be the most equitable, since growers with greater historic use of diazinon do not receive a disproportionately higher allocation. Additionally, since land use area varies less than diazinon use, the variations in the relative proportions are less likely to change over time.

Table 5.5. Fraction of the Load Allocation by Sub-watershed applied to the Loading Capacity for the Sacramento River at Verona

	Sub-watershed as Defined in Figure 5.2.			
	Colusa Drain	Feather River	Sacramento River Above Colusa	Sutter/Butte Basin
Relative land area in almonds, peaches, plums (dried & fresh)[12]	19.4%	13.0%	30.7%	36.9%
Relative load allocation accounting for the 11% margin of safety	17%	12%	27%	33%

[12] The Natomas Cross Canal discharges into the Sacramento River below the Feather River, but above the Sacramento River at Verona site. The Cross Canal sub-watershed is not assigned a load allocation since it accounts for less than 1% of the orchard land area that drains to the Sacramento River at Verona.

Figure 5.2. Sub-watersheds identified in the Sacramento Valley.



Sub-watersheds were determined based on CalWater hydrologic unit (HU) designations (Calwater Group, 1999). Sacramento River above Colusa includes HU #s 504.00 and 508.00 and the section of 520.40 that is west of the Sacramento River. Colusa Drain includes HU# 520.20 and the section of HU# 520.10 that is west of the Sacramento River. Butte/Sutter Basin includes HU# 520.30, the section of HU# 520.10 that is east of the Sacramento River and HU# 520.40, except the section included in the Sacramento River above Colusa. The Feather River includes HU# 515.00. The Natomas Cross Canal includes the sections of HU# 519.22 that typically drain to the Natomas Cross Canal. The American River includes HU# 519.21 and the remainder of HU#519.22 (i.e. not included in the Natomas Cross Canal sub-watershed). The watershed boundaries for the Butte/Sutter Basin and the Natomas Cross Canal Basin were adjusted to include Sacramento Slough in the Butte/Sutter Basin.

The final load allocations must take into account the margin of safety (see Table 5.5 and discussion below). The final load allocations are shown to two significant figures, which is consistent with how diazinon lab results below 1 µg/L are reported.

The previous Staff Report (Karkoski, et al., 2003) had included load allocations for the Natomas Cross Canal and Natomas Basin/American River sub-watersheds[13]. These sub-watersheds collectively account for less than 1% of the almond, peach, and plum (dried and fresh) acreage in the Sacramento Valley. The Natomas Cross Canal sub-watershed drains into the Sacramento River above the Verona flow gauge. The Natomas Basin/American River sub-watershed drains into the Sacramento River between the Verona gauge station and the Sacramento River at I Street.

No load allocation is assigned to the Natomas Cross Canal sub-watershed, since the almond, peach, and dried plum acreage only represents 0.7% of the total acreage in the Sacramento Valley. As discussed above, load allocations have been assigned to the four sub-watersheds that account over 99% of the almond, peach, and dried plum acreage that drains to the Sacramento River above Verona.

The load allocation for the Natomas Basin/American River sub-watershed is based on the available loading capacity between the Sacramento River at Verona and I Street. Since there is a significant amount of urban land area in these sub-watersheds (approximately 45%), the portion of the urban runoff contributing to the available loading capacity is taken into account to determine the load allocation (recall the load allocation applies to non-NPDES sources only).

The load allocation for non-NPDES discharges into the Sacramento River between Verona and I Street is 70% of the loading capacity in the Sacramento River at I Street (the downstream site) minus 70% of the loading capacity in the Sacramento River at the Verona site. This load allocation approach assumes that all available loading capacity in the Sacramento River at Verona may be used, so the only additional loading capacity will be from additional flow to the Sacramento River below Verona. Thirty percent of the available loading capacity in the Sacramento River between Verona and I Street is set-aside as a margin of safety to account for potential diazinon runoff from the urban land area.

No additional sub-watersheds are defined to derive load allocations based on the loading capacity for the Sacramento River at Colusa site or the Feather River site. The load allocation for these two sites are, therefore, based on the lower of: 1) the calculated loading capacity for those sites and 2) the load allocations that are based on the loading capacity of the Sacramento River at Verona times the appropriate load allocation factor.

[13] The Natomas Basin/American River sub-watershed includes all land discharging to the Sacramento River between the Sacramento River at Verona flow gauge and the Sacramento River at I Street. In the 29 August 2003 Staff Report, parts of this sub-watershed were included in the Natomas Cross Canal sub-watershed.

As discussed in more detail in Appendix A, the load allocation for the Sacramento River at Colusa and Feather River sites will be lower than the calculated Loading Capacity for those sites 98% of the time.

5.5.3.3 Margin of Safety

Both an implicit and explicit margin of safety are included. The load allocations are derived from the calculated loading capacity and do not take into account any degradation of diazinon as it moves through the system or the potential deposition of diazinon in association with sediments (i.e. diazinon is assumed to be conservative and present only in the dissolved phase). Additionally, the allowed frequency of exceedance of the water quality objective is not incorporated into the TMDL calculation, which provides an additional margin of safety.

An explicit margin of safety is established for the Sacramento River at Verona site based on the relative accuracy of the flow measurements upon which the loading capacity is based. The daily flow at the USGS gauging station being used has an accuracy of plus/minus 10% (Markham, 1996). Since the load allocations by sub-watershed are based on the loading capacity at the Sacramento River at Verona, the potential error in flow measurements could result in an overestimate of the actual available assimilative capacity.

Each of the Load Allocation factors based on land use (Table 5.5) is multiplied by 0.90 to account for the potential inaccuracy of the Verona flow measurements. When the Load Allocations in Table 5.5 are multiplied by 0.90 and summed, the Load Allocations account for 89% of the Loading Capacity at the Verona site. The additional one percent margin of safety accounts for the minor amount of orchard acreage in the Natomas Cross Canal sub-watershed. The explicit margin of safety is 11% of the total Loading Capacity for the Sacramento River at Verona (see also Appendix A).

An explicit margin of safety of 30% is applied to the available load allocation between the Sacramento River at Verona and the Sacramento River at I Street. This margin of safety accounts for the runoff from urban land areas into this reach of the Sacramento River. The urban land areas generally fall under NPDES permits and are subject to the waste load allocations, which are equivalent to the diazinon water quality objectives. This margin of safety assumes a worst-case condition in which diazinon concentrations in the urban runoff is equivalent to the waste load allocation, and, therefore, do not provide any additional assimilative capacity.

The Sacramento River from Verona to I Street receives flow from the Natomas/American River sub-watershed and reservoir releases from Folsom/Nimbus Dam on the American River. The discharge from the Natomas/American River sub-watershed is composed of both urban storm water runoff (NPDES permitted sources) and runoff from agricultural land or other rural/open land. A review of flow data since October 1993 (USGS, 2003; DWR, 2003) indicates that nearly all of the flow gain from Verona to I Street can be accounted for by releases from Folsom/Nimbus Dam. These data suggest that during

most of the year, very little flow to the Verona to I Street reach of the Sacramento River originates in the Natomas/American River sub-watershed.

The exception to this general observation is during storm events, when the Natomas/American River sub-watershed contributes runoff to the Verona to I Street reach. As discussed earlier, the critical time period for diazinon runoff has been January and February. The flow data for January and February (USGS, 2003; DWR, 2003) indicate that 5% of the time[14], the releases from Folsom/Nimbus dam account for 43% or less of the gain in flow in the Sacramento River from Verona to I Street. In other words, 5% of the time, the Natomas/American River sub-watershed (i.e. the land area below Folsom/Nimbus dam) accounts for 57% or more of the flow gain in the Sacramento River between Verona and I Street.

Approximately, 45% of the Natomas/American River sub-watershed is identified as urban land use (land use data from DWR 2001 and sub-watershed boundaries as shown in Figure 5.2). If it is assumed that the amount of surface runoff is equivalent for all land areas, then urban runoff would account for 26% of the estimated flow gain during times when Folsom/Nimbus dam releases are the least relative to the flow gain to the Sacramento River from Verona to I Street (57% of the flow gain is from the Natomas/American River sub-watershed and approximately 45% of that is coming from urban land areas (0.57 x 0.45)).

Since there is less infiltration in urban areas than rural/open space, the amount of surface runoff from urban areas will be greater than that suggested by the relative amount of land area. Therefore, it is estimated that during critical time periods the urban runoff could account for approximately 30% of the flow gain in the Sacramento River from Verona to I Street. This estimate of the urban land contribution to flow is used to establish the margin of safety for the available loading capacity in the Sacramento River from Verona to I Street. The available loading capacity that can be allocated to non-NPDES or non-point sources (i.e. the load allocation) is, therefore, reduced by 30%.

An implicit margin of safety applies to the load allocation for the Verona to I Street reach, since the load allocation is calculated assuming that all of the loading capacity in the Sacramento River at Verona is being used. Since this will not be the case in all circumstances, the actual available loading capacity for discharges to the Verona to I Street reach will often be greater than that provided by the calculated loading capacity.

As discussed in Section 5.5.3.2., the Load Allocation for the Sacramento River at Colusa and Feather River sites will be equal to the Loading Capacity for those sites or the Load Allocation derived from the Loading Capacity at the Sacramento River at Verona site.

[14] The flow gain between the Sacramento River at Verona and the Sacramento River at I Street is estimated by taking the difference in flow in the Sacramento River at Freeport, which is about 11 miles downstream of I Street with relatively little inflow, and the Sacramento River at Verona. The ratio of the discharge from Nimbus Dam to the flow difference between the Sacramento River at Freeport and Verona was found for each day. This ratio provides an estimate of the relative amount of flow gain in the Verona to I Street reach that can be accounted for by reservoir releases from Folsom dam. The 5th percentile of those ratios is 0.43.

The Load Allocations for the Sacramento River at Colusa and Feather Rivers are generally lower than the available Loading Capacity (i.e. this is the case 98% of the time). Therefore, no additional margin of safety is assigned to the calculation of the Loading Capacity for the Sacramento River at Colusa or the Feather River.

5.6 Achievability of the Loading Capacity

As discussed in Section 5.1, there are a number of alternatives available to growers that would result in reduction in the amount of diazinon present in the Sacramento and Feather Rivers. 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 known.

A review of recent diazinon loading can give some indication of the additional effort that will be required to consistently meet the diazinon water quality objectives (see Section A.5. of Appendix A). The recent diazinon loading data (2000 and 2001) indicate that there are only a few days during the critical time period (rain events during the dormant season) on which the loading capacity is exceeded. For the two days on which the loading capacity was exceeded recently, the reduction in loading on those days would have been about 20% (in the Sacramento River on 01/28/2001) and about 40% (in the Feather River on 1/31/2000). Excess loading capacity is available the days immediately preceding the observed peak concentration and the days following.

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

As discussed in section 5.1 viable pest control alternatives are available other than diazinon. An approach focused solely on reduction of diazinon 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 runoff (e.g. based on slope, soil type, and proximity to waterways), diazinon use could be maximized. Recent loading data suggests that a such a focused effort would require no more than a 20%-40% reduction in diazinon use to achieve water quality objectives consistently. Simple adjustments in timing of application (e.g. application in December when soils are not saturated or avoiding applications before storms) may require little or no reduction in overall use.

The reduction in the amount of diazinon that runs off fields 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. The available data suggests (pg. 55; Karkoski, et al., 2002), that at least a 70% reduction in pesticide runoff for a pesticide with diazinon's physico-chemical properties would be expected. Such a

reduction would be sufficient to maintain current (2000/2001) diazinon use levels while reducing peak loads by the amount required (20%-40%).

One other approach that has not been thoroughly evaluated is to delay diazinon runoff, so that peaks are attenuated. The graphs and data in Section A.5 clearly show that sufficient assimilative capacity is available over the course of a storm event. If a portion of the diazinon 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.

The available information indicates that any one or a combination of the three general approaches discussed above could be used to successfully reduce peak diazinon concentrations and consistently meet water quality objectives.

5.7 Summary and Key Points of Recommended Program of Implementation Provisions

- A wide array of management practices is available to growers to control pests and minimize runoff of pesticides that can cause toxicity.
- These practices are adequate to reduce diazinon loads to levels that should result in attainment of the proposed water quality objectives.
- The recommended implementation plan includes a prohibition of discharge, unless objectives are being met or a waiver of waste discharge requirements or waste discharge requirements are in place. Different agencies or organizations can take the lead to organize monitoring or planning efforts.
- Time schedules are proposed for compliance with the diazinon water quality objectives and the allocations. A time schedule for submission of a management plan is also proposed.
- The proposed time schedule for compliance with diazinon water quality objectives is 5 years.
- The proposed loading capacity and allocations are:
    - Loading capacity (LC): LC = Q x C, where C= 0.050 µg/L or 0.080 µg/L of diazinon and Q is the flow (the four-day average flow for the = 0.050 µg/L objective and the mean daily flow for the 0.080 µg/L objective)
    - Waste load allocations:– equal to the diazinon water quality objective. Dischargers can submit information regarding any diazinon originating from outside of their jurisdiction.
    - Load allocations for the Sacramento River at Verona: the loading capacity (LC) times the following load allocation factors taking into account an 11% reduction for the margin of safety.

Sub-watershed as Defined in Figure 5.2			
Colusa Basin Drain	Feather River	Sacramento River Above Colusa	Sutter/Butte Basin
17%	12%	27%	33%

The load allocations for the Feather River and Sacramento River above Colusa sites are the lower of the loading capacity for those sites or the load allocations found from application of the respective load allocation factors to the available loading capacity in the Sacramento River at Verona.

- Load allocations for non-NPDES discharge into the Sacramento River at Verona and the Sacramento River at I Street: [LC (Sac.River at Verona) – LC (Sac. River at I Street)] x 70%.
- Margin of Safety: 11% - each load allocation factor for the sub-watersheds above the Sacramento River at Verona has been reduced by 11% to account for the explicit margin of safety. The load allocation for discharge into the Sacramento River between Verona and I Street has been reduced by 30% to account for the potential for urban runoff to use some of the available assimilative capacity. An implicit margin of safety exists since in-stream degradation of diazinon is not considered and the allowed frequency of exceedance of the water quality objectives is not included in the loading capacity calculation.
- Seasonal Variations – explicitly accounted for by the loading capacity, which varies daily
- Critical Conditions – explicitly accounted for by the loading capacity, since the loading capacity varies during critical flow conditions

6 Policies

6.1 Evaluation of Existing Policies

Both the State Board and the Central Valley Regional Board have a number of existing policies that are potentially applicable to the control of diazinon in the Sacramento and Feather Rivers. The Basin Plan Amendment should be consistent with those policies. In addition, the Basin Plan Amendment will need to include new policies specific to the control of diazinon in the Sacramento and Feather Rivers. The new policies will address either the mitigation of a potential impact or will specify how the program of implementation will be carried out.

6.1.1 Central Valley Regional Board Policies

This section describes Central Valley Regional Board policies that are or could be applicable to this proposed Basin Plan Amendment. The proposed Basin Plan Amendment is evaluated with respect to these policies. The current Basin Plan policies are shown in quotes and smaller type.

6.1.1.1 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 the 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 available management practices (see Section 5.1 and Karkoski and others (2002)) indicates that diazinon runoff can be controlled. Those controls should result in attainment of the proposed water quality objectives. There are no other factors that would cause the proposed water quality objectives to be exceeded.

6.1.1.2 The Water Quality Limited Segment Policy

"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 critical pollutants so that water quality objectives can be met in the segment."

The proposed Basin Plan Amendment does establish a TMDL (total maximum daily load) and allocates that allowable load to dischargers by sub-watershed. The proposed Basin Plan Amendment is, therefore, consistent with the Water Quality Limited Segment Policy.

6.1.1.3 Antidegradation Implementation Policy

Excerpts from the policy are presented below. The full text can be found on page IV-15.00 of the Central Valley Regional Board's Basin Plan.

"…Implementation of this policy [State Water Board Resolution No. 68-16] to prevent or minimize surface and ground water degradation is a high priority for the Board. … The prevention of degradation is, therefore, an important strategy to meet the policy's objectives.

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

"Pursuant to this policy, a Report of Waste Discharge, or any other similar technical report required by the Board pursuant to Water Code Section 13267, must include information regarding the nature and extent of the discharge and the potential for the discharge to affect surface or ground water quality in the region. This information must be presented as an analysis of the impacts and potential impacts of the discharge on water quality, as measured by background concentrations and applicable water quality objectives. The extent of information necessary will depend on the specific conditions of the discharge. For example, use of best professional judgment and limited available information may be sufficient to determine that ground or surface water will not be degraded. In addition, the discharger must identify treatment or control measures to be taken to minimize or prevent water quality degradation."

The Antidegradation Implementation Policy states that the Regional Board will apply State Water Board Resolution 68-16 in considering whether "…to allow a certain degree of degradation to occur or remain." The Policy and Resolution 68-16 also state that "[a]ny discharge of waste must apply best practicable treatment or control not only to prevent pollution or nuisance from occurring, but also to maintain the highest water quality possible consistent with the maximum benefit to the people of the State."

As discussed in Section 1, the Sacramento and Feather Rivers pick up detectable levels of diazinon as the rivers flow from sites upstream of orchard areas to sites that receive drainage from orchards.[15] The proposed water quality objectives are designed to lower diazinon levels to ensure protection of beneficial uses in the reaches of the Sacramento and Feather River that currently receive diazinon runoff. The proposed policies and water quality objectives, therefore, should result in an improvement in the existing quality of the rivers and not a degradation of water quality.

The Antidegradation Implementation Policy also applies to: 1) potential degradation of ground water; 2) potential degradation in the rivers at times other than the current

[15] Stormwater discharges containing diazinon contribute to the diazinon levels in the rivers. However, due to the recent prohibition on sales of diazinon for residential and commercial use, stormwater discharges unrelated to orchard drainage are expected to cease prior to the effective date of the water quality objective.

dormant spray application season; and 3) potential degradation of the rivers due to the use and introduction of new chemicals that could impact ground or surface water.

As discussed in Section 5.1, there are a number of alternative practices available to growers that could lead to further reduction of diazinon levels in the Sacramento and Feather Rivers. Some of these alternatives could result in increased infiltration of water, changes in timing of application of diazinon, or the increased use of other chemicals that could degrade ground or surface water.

The proposed Basin Plan Amendment, therefore, includes new policies requiring that growers using an alternative to diazinon prevent ground water contamination and 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 Basin Plan Amendment is, therefore, consistent with the Regional Board's Antidegradation Implementation Policy.

6.1.1.4 Policy for Application of Water Quality Objectives

Excerpts from the policy are presented below. The full text can be found on page IV-16.00 of the Central Valley Regional Board's Basin Plan.

"The numerical and narrative water quality objectives define the least stringent standards that the Regional Water board will apply to regional waters in order to protect beneficial uses. Numerical receiving water limitations will be established in Board orders for constituents and parameters which will, at a minimum, meet all applicable water quality objectives. However, the water quality objectives do not require improvement over naturally occurring background concentrations. In cases where the natural background concentration of a particular constituent exceeds an applicable water quality objective, the natural background concentration will be considered to comply with the objective. Consistent with Resolution No. 68-16, the Regional Water Board will impose more stringent numerical limitations (or prohibitions) which will maintain the existing quality of the receiving water, unless, pursuant to Resolution No. 68-16, some adverse change in water quality is allowed. Maintenance of the existing high quality of water means maintenance of "background" water quality conditions, i.e., the water quality found upstream or upgradient of the discharge, unaffected by other discharges. Therefore, the water quality objectives will define the least stringent limits which will be imposed and background defines the most stringent limits which will be imposed on ambient water quality.

"This Basin Plan contains numerical water quality objectives for various constituents and parameters in Chapter III. Where numerical water quality objectives are listed, these are the limits necessary for the reasonable protection of beneficial uses of the water. In many instances, the Regional Water Board has not been able to adopt numerical water quality objectives for constituents or parameters, and instead has adopted narrative water quality objectives (e.g., for bacteria, chemical constituents, taste and odor, and toxicity). Where compliance with discharger and other interested parties, and relevant numerical criteria and guidelines developed and/or published by other agencies and organizations (e.g., State Water Board, California Department of Health Services, California Office of Environmental Health Hazard Assessment, California Department of Toxic Substances Control, University of California Cooperative Extension, California Department of Fish and Game, USEPA, U.S. Food and Drug Administration, National Academy of Sciences, U.S. Fish and Wildlife Service, Food and Agricultural Organization of the United Nations). In considering such criteria, the Board evaluates whether the specific numerical criteria, which are available through these sources and through other information supplied to the Board, are relevant and appropriate to the situation at hand and, therefore, should be used in determining compliance with the narrative objective.

For example, compliance with the narrative objective for taste and odor may be evaluated by comparing concentrations of pollutants in water with numerical taste and odor thresholds that have been published by other agencies. This technique provides relevant numerical limits for constituents and parameters which lack numerical water quality objectives. To assist dischargers and other interested parties, the Regional Water Board staff has compiled many of these numerical water quality criteria from other appropriate agencies and organizations in the Central Valley Regional Water Board's staff report, *A Compilation of Water Quality Goal*s. This staff report is updated regularly to reflect changes in these numerical criteria.

"Where multiple toxic pollutants exist together in water, the potential for toxicologic interactions exists. On a case by case basis, the Regional Water Board will evaluate available receiving water and effluent data to determine whether there is a reasonable potential for interactive toxicity. Pollutants which are carcinogens 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 Water Board in making determinations:

"n [Concentration of Toxic Substance]$_i$

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

"The concentration of each toxic substance is divided by its toxicologic limit. The resulting ratios are added for substances having similar toxicologic effects and, separately, for carcinogens. 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. For example, monitoring shows that ground water beneath a site has been degraded by three volatile organic chemicals, A, B, and C, in concentrations of 0.3, 0.4, and 0.04 mg/l, respectively. Toxicologic limits for these chemicals are 0.7, 3, and 0.06 mg/l, respectively. Individually, no chemical exceeds its toxicologic limit. However, an additive toxicity calculation shows:

$$\text{"}\frac{0.3}{0.7} + \frac{0.4}{3} + \frac{0.04}{0.06} = 1.2$$

"The sum of the ratios is greater than unity (>1.0); therefore, the additive toxicity criterion has been violated. The concentrations of chemicals A, B, and C together present a potentially unacceptable level of toxicity."

There are three primary issues identified in the Policy for Application of Water Quality Objectives that could apply to this Basin Plan Amendment: 1) "[m]aintenance of high quality of water means maintenance of "background" water quality conditions, i.e., the water quality found upstream or upgradient of the discharge, unaffected by other discharges" and that "water quality objectives will define the least stringent limits which will be imposed and background defines the most stringent limits which will be imposed on ambient water quality."; 2) the Regional Board will use a variety of information sources, including numerical criteria and guidelines from other agencies and organizations, to evaluate compliance with narrative water quality objectives on a case-by-case basis; and 3) "Pollutants which are carcinogens or which manifest their toxic effects on the same organ systems or through similar mechanisms will generally be considered to have potentially additive toxicity." An additivity formula is then described and would be applied to determine whether the additive toxicity criterion is violated.

1. The first issue must be considered in establishing site-specific numeric water quality objectives and the TMDL. As discussed in Section 4, site-specific objectives could be established based on prohibition of any diazinon or based on

considerations of beneficial use protection. Site-specific objectives must be established at a level no greater than that necessary to protect beneficial uses and no less than "background", as long as that objective can be reasonably achieved. The proposed amendment establishes the objectives at a level necessary to protect beneficial uses.

2. The second issue must be considered if no site-specific numerical water quality objective is established. The Regional Board must still make a case-specific (e.g. for the Sacramento and Feather Rivers) determination as to which criteria should be used to evaluate compliance with the existing narrative objectives, and, therefore, which criteria should be used to establish the TMDL. Since the proposed amendment establishes specific objectives for diazinon, no interpretation of the narrative objective is necessary.

3. The third issue must be considered since there could be other pesticides present in the Sacramento and Feather Rivers that have a similar mode of action on aquatic organisms and could exhibit additive toxicity. Since an additivity formula has already been established in the Regional Board's Basin Plan, no specific description is needed for the Sacramento and Feather Rivers.

6.1.1.5 Watershed Policy

"The Regional Water Board supports implementing a watershed based approach to addressing water quality problems. The State and Regional Water Boards are in the process of developing a proposal for integrating a watershed approach into the Board's programs. The benefits to implementing a watershed based program would include gaining participation of stakeholders and focusing efforts on the most important problems and those sources contributing most significantly to those problems."

The watershed policy has been implemented as part of the development of this Basin Plan Amendment in the following ways:

1. Regional Board staff has worked with the Sacramento River Watershed Program and its OP Focus Group for three years on many of the critical issues related to this Basin Plan Amendment. The OP Focus Group has included participants from both governmental organizations and the agricultural industry. Regional Board staff has used information the OP Focus Group has gathered on a number of topics in the development of this Basin Plan Amendment.
2. The alternatives considered for the program of implementation include an alternative to have a stakeholder group take the lead in overseeing implementation (see Section 5.2).
3. The proposed approach to allocation of loads is based on sub-watersheds. This approach should encourage greater involvement of stakeholders on a local level.

6.1.1.6 Pesticide Discharges from Nonpoint Sources

The Regional Board's policy on Pesticide Discharges from Nonpoint Sources (Pesticide Policy) was adopted to implement the water quality objectives for Pesticides. The Pesticide Policy includes a number of provisions that should be evaluated with respect to this Basin Plan Amendment. In the discussion below, the relevant provision from the Pesticide Policy is quoted, followed by an evaluation of that provision.

1. "The control of pesticide discharges to surface waters from nonpoint sources will be achieved primarily by the development and implementation of management practices that minimize or eliminate the amount discharged."

   The evaluation of available practices for the control of diazinon (Section 5.1) includes both management practices that should minimize the off-site movement of diazinon, as well as practices (i.e. use of other pest control methods) that would eliminate the amount discharged. The Basin Plan Amendment has, therefore, been prepared in a manner consistent with this provision of the Pesticide Policy.

2. "The Board will use water quality monitoring results to evaluate the effectiveness of control efforts and to help prioritize control efforts."

   The proposed Basin Plan Amendment does include provisions that address the evaluation of water quality monitoring results to evaluate the effectiveness of control efforts (see Sections 2 and 7). Prioritization of which control efforts to pursue will be conducted primarily by growers or their representatives in local watersheds. The Basin Plan Amendment has, therefore, been prepared in a manner consistent with this provision of the Pesticide Policy.

3. "Regional Board monitoring will consist primarily of chemical analysis and biotoxicity testing of major water bodies receiving irrigation return flows. The focus will be on pesticides with use patterns and chemical characteristics that indicate a high probability of entering surface waters at levels that may impact beneficial uses. Board staff will advise other agencies that conduct water quality and aquatic biota monitoring of high priority chemicals, and will review monitoring data developed by these agencies. Review of the impacts of "inert" ingredients contained in pesticide formulations will be integrated into the Board's pesticide monitoring program.

   "When a pesticide is detected more than once in surface waters, investigations will be conducted to identify sources. Priority for investigation will be determined through consideration of the following factors: toxicity of the compound, use patterns and the number of detections. These investigations may be limited to specific watersheds where the pesticide is heavily used or local practices result in unusually high discharges. Special studies will also be conducted to determine pesticide content of sediment and aquatic life when conditions warrant. Other agencies will be consulted regarding prioritization of monitoring projects, protocol, and interpretation of results."

   These provisions focus on the general approach the Regional Board will use in determining whether a water quality problem related to pesticides exist. This procedure was followed in the investigation of water quality problems related to diazinon. The Regional Board will need to continue following this procedure to determine if shifts in pesticides use patterns or use of alternatives to diazinon require investigation or special studies. The proposed Basin Plan Amendment

does include provisions that address continued sampling and evaluation of pesticides in the major waterbodies (see Sections 2 and 7). The Basin Plan Amendment has, therefore, been prepared in a manner consistent with this provision of the Pesticide Policy.

4. "To ensure that new pesticides do not create a threat to water quality, the Board, either directly or through the State Water Resources Control Board, will review the pesticides that are processed through the Department of Food and Agriculture's (DFA) registration program. Where use of the pesticide may result in a discharge to surface waters, the Board staff will make efforts to ensure that label instructions or use restrictions require management practices that will result in compliance with water quality objectives. When the Board determines that despite any actions taken by DFA, use of the pesticide may result in discharge to surface waters in violation of the objectives, the Board will take regulatory action, such as adoption of a prohibition of discharge or issuance of waste discharge requirements to control discharges of the pesticide. Monitoring may be required to verify that management practices are effective in protecting water quality."

   This provision of the Pesticide Policy describes a procedure to be applied during the registration process for new pesticides, and is, therefore, not directly related to the control of diazinon runoff and does not apply to this Basin Plan Amendment.

5. "The Board will notify pesticide dischargers through public notices, educational programs and the Department of Food and Agriculture's pesticide regulatory program of the water quality objectives related to pesticide discharges. Dischargers will be advised to implement management practices that result in full compliance with these objectives by 1 January 1993, unless required to do so earlier. (Dischargers of carbofuran, malathion, methyl parathion, molinate and thiobencarb must meet the requirements detailed in the Prohibitions section.) During this time period, dischargers will remain legally responsible for the impacts caused by their discharges.

   This provision of the Pesticide Policy refers to the pesticide water quality objectives adopted at the time of the policy. The provision, therefore, does not apply to the establishment of site-specific water quality objectives for diazinon contained in this Basin Plan Amendment.

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

   The proposed Basin Plan Amendment (see Section 2) does describe a role for the Regional Board in reviewing management practices and provides for periodic review of those practices. The Basin Plan Amendment has, therefore, been prepared in a manner consistent with this provision of the Pesticide Policy.

7. "Public hearings will be held at least once every two years to review the progress of the pesticide control program. At these hearings, the Board will

   - review monitoring results and identify pesticides of greatest concern,
   - review changes or trends in pesticide use that may impact water quality,
   - consider approval of proposed management practices for the control of pesticide discharges,

- set the schedule for reviewing management practices for specific pesticides, and
- consider enforcement action.

"After reviewing the testimony, the Board will place the pesticides into one of the following three classifications. When compliance with water quality objectives and performance goals is not obtained within the timeframes allowed, the Board will consider alternate control options, such as prohibition of discharge or issuance of waste discharge requirements.

"1. Where the Board finds that pesticide discharges pose a significant threat to drinking water supplies or other beneficial uses, it will request DFA to act to prevent further impacts. If DFA does not proceed with such action(s) within six months of the Board's request, the Board will act within a reasonable time period to place restrictions on the discharges.

"2.Where the Board finds that currently used discharge management practices are resulting in violations of water quality objectives, but the impacts of the discharge are not so severe as to require immediate changes, dischargers will be given three years, with a possibility of three one year time extensions depending on the circumstances involved, to develop and implement practices that will meet the objectives. During this period of time, dischargers may be required to take interim steps, such as meeting Board established performance goals to reduce impacts of the discharges. Monitoring will be required to show that the interim steps and proposed management practices are effective.

"3. The Board may approve the management practices as adequate to meet water quality objectives. After the Board has approved specific management practices for the use and discharge of a pesticide, no other management practice may be used until it has been reviewed by the Board and found to be equivalent to or better than previously approved practices. Waste discharge requirements will be waived for irrigation return water per Resolution No. 82-036 if the Board determines that the management practices are adequate to meet water quality objectives and meet the conditions of the waiver policy. Enforcement action may be taken against those who do not follow management practices approved by the Board."

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

In preparing this Basin Plan Amendment, the Regional Board has reviewed changes and trends in use of diazinon and potential replacement products, which is consistent with this provision of the Pesticide Policy.

As part of the review procedure identified in this Basin Plan Amendment (see Section 2), the Regional Board will consider enforcement action, which is consistent with this provision of the Pesticide Policy.

By adopting this Basin Plan Amendment, the Regional Board is effectively considering diazinon to fall within classification two identified by this provision of the Pesticide Policy. A conditional prohibition of discharge of diazinon is proposed unless such discharge is regulated either by a waiver of waste discharge requirements or waste discharge requirements or the diazinon water quality objectives are met. This Basin Plan Amendment requires monitoring to demonstrate that interim steps and proposed management practices are effective.

The Basin Plan Amendment is, therefore, consistent with this provision of the Pesticide Policy.

8. "To ensure the best possible program, the Board will coordinate its pesticide control efforts with other agencies and organizations. Wherever possible, the burdens on pesticide dischargers will be reduced by working through the DFA or other appropriate regulatory processes. The Board may also designate another agency or organization as the responsible party for the development and/or implementation of management practices, but it will retain overall review and control authority. The Board will work with water agencies and others whose activities may influence pesticide levels to minimize concentrations in surface waters."

   In its analysis of alternatives (see Section 5), the Regional Board has considered designating another agency or organization as the responsible party for the development and/or implementation of management practices. The Regional Board has also worked with the Department of Pesticide Regulation to identify possible ways of reducing the burden on pesticide dischargers. The program of implementation established by this Basin Plan Amendment also still retains the Regional Board's role in reviewing management practices and monitoring data, as well as determining what further control actions might be required. The Basin Plan Amendment has, therefore, been prepared in a manner consistent with this provision of the Pesticide Policy.

9. "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."

   Anti-degradation policies have been explicitly considered in a number of sections of this staff report. The Basin Plan Amendment has, therefore, been prepared in a manner consistent with this provision of the Pesticide Policy.

6.1.2 State Water Board Policies

6.1.2.1 The State Policy for Water Quality Control

This policy was established by the State Water Board in 1972 and includes general principles for the implementation of "water resources management programs". Key principles that are applicable to this Basin Plan Amendment include:[16]

"1. Water rights and water quality control decisions must assure protection of available fresh water and marine water resources for maximum beneficial use.

"2. Municipal, agricultural, and industrial wastewaters must be considered as a potential integral part of the total available fresh water resource.

"3. Coordinated management of water supplies and wastewaters on a regional basis must be promoted to achieve efficient utilization of water. …

[16] The numbering is from section II of the policy.

"11. Water quality criteria must be based on the latest scientific findings. Criteria must be continually refined as additional knowledge becomes available.

"12. Monitoring programs must be provided to determine the effects of discharges on all beneficial waters uses including effects on aquatic life and its diversity and seasonal fluctuations. …

"Water quality control plans and waste discharge requirements hereafter adopted by the State and Regional Boards under Division 7 of the California Water Code shall conform to this policy. …

"Departures from this policy and water quality control plans adopted by the State Board may be desirable for certain individual cases. Exceptions to the specific provisions may be permitted within the broad framework of well established goals and water quality objectives."

With respect to the first principle, this Basin Plan Amendment addresses water quality control issues. It is being established with the express purpose of assuring protection of freshwater (i.e. the Sacramento and Feather Rivers) for maximum beneficial use.

With respect to the second principle, the Regional Board has evaluated practices (see Section 5) that could potentially increase available fresh water resources. Practices that result in greater infiltration of surface runoff (e.g. buffer strips, cover crops) would enhance the ground water resources in the watershed. The Regional Board will encourage such practices as long as they do not result in degradation of ground water quality.

With respect to the third principle, the proposed Basin Plan Amendment includes allocations on a sub-watershed basis. This approach to allocations should encourage regional collaboration in addressing the control of diazinon runoff.

With respect to the eleventh principle, the proposed Basin Plan Amendment is based on recently developed criteria documents. In addition, the proposed Basin Plan Amendment contains provisions to periodically review the scientific basis for the water quality objective.

With respect to the twelfth principle, the proposed Basin Plan Amendment does include monitoring goals that provide the basis for determining the effects of diazinon discharges on beneficial uses.

The proposed Basin Plan Amendment conforms to this policy and no exception to this policy is needed.

6.1.2.2 Statement of Policy with Respect to Maintaining High Quality of Water in California (Anti-degradation Policy)

The policy (State Water Board Resolution No. 68-16)[17] includes the following statements:

"1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

"2. Any activity which produces or may produce a waste or increase volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained."

No degradation of ground or surface water is expected as a result of this Basin Plan Amendment. The establishment of water quality objectives and a program of implementation for diazinon will result in an improvement in water quality in the Sacramento River and Feather River, as well as their tributaries, as diazinon loadings are reduced to meet the new diazinon water quality objectives. The proposed Basin Plan Amendment is not allowing degradation in the existing quality of the Sacramento and Feather Rivers.

Practices that result in increased infiltration of surface runoff are not expected to degrade ground water due to the relatively short half-life of diazinon in soil (see Section A.4).

The application of diazinon could result in the production of a waste that discharges to existing high quality waters (i.e. the Sacramento and Feather Rivers). This Basin Plan Amendment includes a prohibition of discharge if the diazinon water quality objectives are not attained and the discharge is not addressed by a waiver of waste discharge requirements or waste discharge requirements. Any waiver or waste discharge requirements applicable to a specific discharge or discharge(s) must also comply with the anti-degradation policy. Resolution 68-16 has not been interpreted to prohibit waivers of waste discharge requirements for discharges to high quality waters, as long as the waivers themselves ensure that no degradation will occur, or are supported by the necessary findings and impose best practicable treatment or control requirements.

6.1.2.3 Nonpoint Source Management Plan

In 1988, the State Water Board adopted the first Nonpoint Source Management Plan (Resolution 88-123). An update to that plan, required under the Coastal Zone Act

[17] Resolution No. 68-16 incorporates the federal anti-degradation standards for surface waters. (see 40 CFR § 131.12)

Reauthorization Amendments of 1990, was approved by the USEPA and National Oceanic and Atmospheric Administration in July 2000. That plan outlines a three-tiered approach to address nonpoint source water quality problems.

Tier one, as described in the 2000 update, is "self-determined implementation of management practices". Tier one allows "…landowners and resource managers to develop and implement workable solutions to NPS pollution control and to afford them the opportunity to solve their own problems before more stringent regulatory actions are taken" (SWRCB/CCC, 2000). Tier two is defined as "regulatory-based encouragement of management practices". The two general approaches described for encouraging adoption of management practices are by waiving adoption of waste discharge requirements or by entering into Management Agency Agreements with agencies that have authority to enforce best management practices. Tier three includes the establishment of effluent limitations through waste discharge requirements or the application of other Regional Board authorities to bring about compliance with water quality objectives.

Tier two is in effect at this time for pesticides in storm water and irrigation return flows. The Regional Board currently has a waiver of waste discharge requirements in effect for storm water runoff and for irrigation return flows from irrigated lands (Resolution No. R5-2002-0201). In addition, the State Water Board has entered into a Management Agency Agreement (signed by DPR, the State Water Board, and CAL EPA March 1997) with the Department of Pesticide Regulation that describes the relative roles of DPR and the State Water Board in preventing and addressing surface and ground water quality problems caused by pesticides.

A number of efforts have been pursued to identify management practices that will mitigate diazinon runoff. Additionally, diazinon use on many crops has decreased in recent years. The decrease in use, possibly in combination with implementation of improved management practices, has resulted in a decrease in frequency of exceedances of the proposed water quality objectives.

It is difficult to determine whether the decrease in frequency of exceedances is a long-term trend or a temporary improvement in water quality driven primarily by economic considerations and the desire to reduce cost. Given the uncertainty of the long-term success of a Tier 1 effort, such an effort is not proposed. The conditional prohibition of discharge allows the Regional Board to determine whether a Tier 2 (e.g. waiver) or Tier 3 (e.g. WDR or prohibition) is the most appropriate mechanism for controlling diazinon discharges.

6.2 Need for New Policies

6.2.1 Compliance Policy

The proposed Basin Plan Amendment identifies water quality objectives for diazinon and a TMDL (with loads and waste load allocations) for diazinon. 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 in the Sacramento and Feather River watersheds requires compliance with both the allocations and the water quality objectives. The allocations are established to assign responsibility for meeting the water quality objectives. If all allocations are met, the water quality objectives should be met.

Although the Basin Plan Amendment establishes diazinon water quality objectives and allocations, the Basin Plan's general pesticide objectives and policies still apply to diazinon discharges. Based on current information, reduction of diazinon levels to meet the allocations and water quality objectives should be sufficient to protect the Sacramento and Feather Rivers from diazinon discharges. If it is later found that diazinon discharges are contributing to a violation of other Basin Plan water quality objectives (e.g. due to additive or synergistic toxicity impacts), additional Regional Board action to reduce diazinon discharges may be necessary.

For example, if diazinon levels were at 0.25 toxic units (or TU) and had an additive toxic effect with Pollutant Z that was at 1.25 TU (1.5 TU total), then reductions only in Pollutant Z may be sufficient to achieve a non-toxic condition. If both diazinon and Pollutant Z were at 0.75 TU (1.5 TU total), reductions in both pollutants would likely be necessary to achieve a non-toxic condition.

Given the potential for the need for further reductions of diazinon, either due to toxicity issues discussed above or to protect tributary waters, the Basin Plan Amendment clarifies that the diazinon objectives and allocations are maximum allowable levels. In addition, the Basin Plan Amendment states that the Regional Board shall require any necessary reductions in diazinon levels to account for additive or synergistic effects or protect beneficial uses in tributary waters. Depending on the nature of the needed reductions, the Regional Board may further regulate diazinon through any existing waste discharge requirements, waiver of waste discharge requirements, or by amending the Basin Plan.

6.2.2 Pesticide Runoff Management Policy

The Regional Board must follow federal, State and Regional Board anti-degradation policies when taking specific actions (see discussion in Sections 6.1.1.3 and 6.1.2.2). In the case of the control of diazinon, 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 "[p]esticide 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 pest management practices may be adjusted in response to this diazinon control program, which is focused on the dormant season application period.

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). The Department of Pesticide Regulation and the County Agricultural Commissioners 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 a policy that requires orchard dischargers to consider potential impacts to ground or surface waters of alternatives to diazinon.

6.2.3 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.

7 Surveillance and Monitoring

Chapter V of the Regional Board's Basin Plan identifies monitoring and surveillance activities. Porter-Cologne requires "a description of surveillance to be undertaken to determine compliance with objectives." Any waiver of waste discharge requirements or waste discharge requirements established to control pesticide runoff from orchards will need to address the policies and objectives established by this Basin Plan Amendment.

A detailed discussion of monitoring and surveillance is provided in Karkoski and others (2002). The key concepts from that discussion are provided below.

7.1 Proposed Surveillance and Monitoring Goals

The following seven general goals are proposed for any surveillance and monitoring program that applies to orchard runoff in the Sacramento Valley:

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

If goals 1-3 are met, the Regional Board will have the necessary information to determine whether dischargers are in compliance with the program of implementation. If goal 4 is met, the Regional Board and dischargers will know what types of adjustments need to be made to achieve any necessary further reductions.

The fifth goal is necessary to ensure that the program to control diazinon does not lead to other water quality problems. This goal is consistent with the proposed pesticide runoff policy. The sixth and seventh goals are established to determine whether the current narrative water quality objectives are being met.

In most cases when the Regional Board regulates the discharge of waste, it is the responsibility of the discharger to monitor receiving waters, their discharge, and to provide any other necessary technical reports. Although the discharger will be

responsible for ensuring the necessary information is provided to the Regional Board, the discharger may not necessarily need to fund the collection of that information.

Since the primary focus of the Regional Board is on compliance with the water quality objectives in the rivers, the Regional Board will likely continue to take the lead in river monitoring in consultation with the University of California, Davis, U.S. Geological Survey, Department of Pesticide Regulation, and other organizations. Organizations that have conducted river monitoring in the past include the U.S. Geological Survey, Department of Pesticide Regulation, the University of California, Davis, and the Sacramento River Watershed Program.

A wide variety of organizations will likely be involved to monitor tributaries (to meet goal 2), survey growers (to meet goal 3), evaluate the effectiveness of management practices (to meet goals 4 and 6), and assess potential redirected impacts (goal 5). Organizations that can either provide funding or carry out these activities include: County Agricultural Commissioners, DPR, the California Department of Food and Agriculture, commodity groups, water districts, U.C. Cooperative Extension, Natural Resource Conservation Service, Resource Conservation Districts, the CALFED Bay-Delta program, pesticide registrants, local watershed groups, non-profit organizations, and private consultants.

Since there are a number of different organizations that will likely participate in monitoring and surveillance efforts, it will be important that these efforts be organized. The focus of any organizational efforts should be on meeting the goals described above and providing the Regional Board with the necessary information to determine compliance with the program of implementation.

7.2 Potential Future Studies

There is a wide range of studies that could be conducted to assist in determining the most effective means of controlling pesticide runoff from orchards. These studies fall into three general categories: pesticide application, pesticide runoff control or mitigation, and pest management. The types of activities in each of these categories are described in Section 5.1 and Karkoski and others (2002).

In addition to evaluating specific approaches, the cumulative effect of these approaches can also be assessed. Comparative studies could be done between different small watersheds to determine which growers are using the suite of practices that appears most effective at mitigating pesticide runoff.

Another area of study will be of alternatives to diazinon that are potentially toxic to aquatic life. Materials such as pyrethroids are highly toxic, but also bind much more strongly to soil than diazinon. Minimizing sediment runoff becomes a concern with these materials, as well as the potential impact they might have in the aquatic environment.

Since adequate funding will not be available to perform all studies of interest, it will be critical for a steering committee to develop priorities that will provide the maximum benefit to the program of implementation.

8 Estimated Costs and Potential Sources of Financing

8.1 Estimated Costs for Improved Management Practices[18]

Meeting the water quality objectives for diazinon in the Sacramento and Feather River systems will likely require changes in orchard pest management practices to reduce diazinon runoff. Section 5.1 and Karkoski and others (2002) describe viable pest management and agronomic practices considered to be effective in controlling target pests and reducing diazinon runoff. As discussed in Section 5.1, the information available on pest control methods and runoff mitigation practices did not suggest or quantify yield reductions. The scenarios evaluated and costs presented in this section assume that a grower will continue to choose a pest control strategy that does not result in yield reductions. Since the proposed Basin Plan Amendment cannot and does not mandate specific pest control practices, the available information indicates that growers should be able to maintain effective pest control while mitigating water quality impacts.

This section describes four scenarios, each comprised of a suite of pest management and agronomic practices. One of these scenarios, the Base Case, has caused water quality impairment in the Sacramento and Feather River system. The other three are alternate scenarios that offer varying levels of water quality protection. These four scenarios present a spectrum that varies from all orchards using low risk pesticides (Scenario 1) to all orchards using higher-risk pesticides (Scenario 3), with Scenario 2 representing a combination of scenarios 1 and 2. In actuality, many 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. Alternate pesticide strategies and mitigation practices are evaluated.

This cost analysis identifies the change in costs to growers going from the base case to one of the three scenarios. Costs are compared for each crop and are expressed as a percent change and absolute change in production costs relative to the base case (Tables 8.1 and 8.3). The total production cost for the base case is compared to the production cost of the three scenarios (Tables 8.2 and 8.4). The total cost is a worst-case estimate for meeting the diazinon water quality objectives, since it is unlikely that all agricultural users of diazinon would need to make changes to attain the objectives on a consistent basis.

In addition, each of the alternative scenarios assumes that some sort of vegetative cover will be needed to control pesticide runoff (whether diazinon or an alternative) or to harbor beneficial insects. The suite of alternatives are evaluated based on two sets of assumptions: 1) that runoff will be managed by allowing resident vegetation to grow between tree rows at no cost to the grower (Tables 8.1 and 8.2); and 2) that growers

[18] Specific products are mentioned in order to develop cost estimates. The Regional Board does not recommend or endorse the use of any specific pesticide product.

would need to grow and maintain a cover crop at an annual cost of $50 per acre (Tables 8.3 and 8.4).

Table 8.1. Change in cost/acre from base case and percent change in production cost. Vegetated cover is resident vegetation grown at no cost to the grower.[19]

Scenario	Almonds	Peaches	Prunes
Low risk to water quality: dormant oil only	$3 : 0%	$(4) : 0%	$(20): (1)%
Low risk to water quality: dormant oil + Bt	$73 : 5%	$84 : 2%	$122: 5%
Low risk to water quality: dormant oil + spinosad	$71 : 5%	$138: 3%	$83 : 3%
Mix: Low risk & high risk	$59 : 4%	$18 : 0%	$49 : 2%
High risk to water quality	$(5) : 0%	$(1) : 0%	$(13): (1)%

Table 8.2. Total cost to meet diazinon water quality objectives for the Sacramento watershed rounded to the nearest $10,000. Vegetated cover is resident vegetation grown at no cost to the grower.

Scenario	Almonds	Peaches	Prunes	All Crops
Low risk to water quality: dormant oil only	$30,000	$(20,000)	$(270,000)	$(260,000)
Low risk to water quality: dormant oil + Bt	$540,000	$350,000	$1,680,000	$2,560,000
Low risk to water quality: dormant oil + spinosad	$520,000	$570,000	$1,140,000	$2,230,000
Mix: Low risk & high risk	$430,000	$70,000	$670,000	$1,170,000
High risk to water quality	$(40,000)	$(3,000)	$(180,000)	$(220,000)

Total cost assumes that all land recently treated with diazinon would incur the cost for a particular scenario. Average acres treated with diazinon from 1999-2001 were 7,300 acres almonds; 4,121 acres peaches; 13, 711 acres dried plums.

Table 8.3. Change in cost/acre from base case and percent change in production cost. Vegetated cover is provided by a planted cover crop at a cost of $50/acre.[20]

Scenario	Almonds	Peaches	Prunes
Low risk to water quality: dormant oil only	$ 55 : 4%	$ 47 : 1%	$ 32 : 1%
Low risk to water quality: dormant oil + Bt	$125 : 8%	$136 : 3%	$174 : 7%
Low risk to water quality: dormant oil + spinosad	$123 : 8%	$189 : 4%	$135 : 5%
Mix: Low risk & high risk	$110 : 7%	$ 69 : 1%	$100 : 4%
High risk to water quality	$ 46 : 3%	$ 51 : 1%	$ 38 : 1%

Table 8.4. Total cost to meet diazinon water quality objectives for the Sacramento watershed rounded to the nearest $10,000. Vegetated cover is provided by a planted cover crop at a cost of $50/acre.

Scenario	Almonds	Peaches	Prunes	All Crops
Low risk to water quality: dormant oil only	$400,000	$200,000	$430,000	$1,030,000
Low risk to water quality: dormant oil + Bt	$910,000	$560,000	$2,380,000	$3,850,000
Low risk to water quality: dormant oil + spinosad	$900,000	$780,000	$1,850,000	$3,530,000
Mix: Low risk & high risk	$800,000	$280,000	$1,380,000	$2,460,000
High risk to water quality	$340,000	$210,000	$ 530,000	$1,080,000

Total cost assumes that all land recently treated with diazinon would incur the cost for a particular scenario. Average acres treated with diazinon from 1999-2001 were 7,300 acres almonds; 4,121 acres peaches; 13, 711 acres dried plums.

[19] Parentheses indicate an estimated decrease in total or per acre cost.

[20] Differences between tables 8.1 and 8.3 of greater than $50/acre are from rounding costs to the nearest dollar.

More detail on these scenarios, and on the individual practices comprising the scenarios, is provided in Karkoski and others (2002). The pest management and agronomic practices presented here are all considered "viable", that is, they offer favorable levels of pest control efficacy when compared to the base case. Most of these pest management and agronomic practices have been recommended or at least 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 runoff from orchards (Zalom et al., 1999).

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 individual practices. Specific practices for each scenario, such as choice of pesticide used, may vary depending on pest pressure and agronomic and pest management practices used previously. Practices also vary by crop and by year, depending not only on pest pressure and environmental factors such as rainfall but also on crop price. Growers are less likely to apply pesticides in a year when the crop price is expected to be low, regardless of the pest pressure on the crop.

Total costs per acre include agronomic costs such as pesticides, orchard sanitation, and cover crops, plus harvesting costs, cash overhead, interest on capital, advisory board assessment (when applicable), and amortized costs of establishing the orchard. Gross revenue per acre is the commodity price per ton multiplied by the tons produced per acre. Returns to Land, Management, and Overhead is the gross revenue per acre minus the total costs per acre.

Data for pest management and agronomic costs for all crops are from Zalom and others (1999). Data for other costs and all revenue data were provided by SWRCB economist Gerald Horner (G. Horner, pers. comm., 2002). Costs and revenue data for almonds and plums are from 2001. Costs and revenue data for peaches are from 1998, but were adjusted to 2001 using an inflation rate of 3%.

The probabilities for needing in-season treatments for a given scenario were determined based on a review of dormant season applications and subsequent in-season use for the 1998/99 dormant season through the 2000/01 dormant season. The number of acres treated in the dormant season was found (e.g. for pyrethroids) and then the number of acres requiring a follow-up in-season pesticide treatment was determined by performing queries on the PUR database. The percentage of acres requiring an in-season treatment when a given dormant season treatment was used was then determined (e.g. acres requiring in-season treatment when pyrethroids are used in dormant season divided by acres treated with pyrethroids in the dormant season).

A detailed breakdown of the cost factors considered and the calculated cost is given in Tables 8.5 for almonds and the use of a planted cover crop. Similar tables for all other

scenarios evaluated can be found in Appendix F. The explanation for how each scenario was constructed and the assumptions used is also given below.

For tables 8.5 and the tables in Appendix F, the "low risk to water quality" scenarios include pesticides that should not require additional mitigation to protect water quality. The "high risk to water quality" scenario includes a mitigation practice (cover crop & border strips) to minimize runoff of pesticides that can pose a risk to water quality. The cost for cover crops is also included in the "low risk to water quality" scenarios, since cover crops can be used to harbor beneficial insects.

8.1.1 Cost Analysis of Base Case: Dormant Oil with Diazinon

The pest management practice of treating orchards with dormant oil (DO) and diazinon is generally very effective in controlling peach twig borer (PTB), San Jose scale (SJS), aphids, and mites, and greatly reduces the need for in-season applications of other pesticides to control these pests.

Per acre cultural costs (pest monitoring, orchard sanitation, pesticides, cover crops, etc.) for the base case are $993 for almonds, $1,470 for peaches, and $904 for dried plums. The base case assumes that diazinon is used for the dormant season application and in-season applications are made in some cases. Costs would vary if another of the most commonly-used organophosphates (OP) were applied instead of diazinon. Lorsban (chlorpyrifos) is slightly less expensive than diazinon; Guthion (azinphos-methyl) and Supracide (methidathion) are more expensive than diazinon but would probably be used only if the orchard had a history of scale problems.

For the 1998/99 through 2000/01 dormant seasons, in-season applications occurred on approximately 35% of the almond crop, when diazinon was applied as a dormant spray, 12% of the peach crop, and 4% of the prune crop. For the base case cost analysis, it is assumed that diazinon would be used as the in-season treatment.

Total costs of the Base Case as a percent of Gross Revenue for almonds, peaches, and dried plums are 77%, 62%, and 80%, respectively. This percentage would vary depending primarily on crop price. Changes in the value of the commodity, interest rates, advisory board assessments, harvest costs, and other factors would also cause these percentages to change.

Table 8.5. Detailed cost analysis for base case and alternate scenarios for almonds. Costs are per acre. Vegetated cover is provided by a planted cover crop.

	Base case: dormant oil + diazinon	Low risk to water quality[1]			Mix: high & low risk to water quality	High risk to water quality
Cost Category		Dormant oil only	Dormant oil[2] + Bt at bloom	Dormant oil + spinosad	SEE FOOT-NOTE 5	
Pest Management[a]						
Cost per Application (based on 100 acres)	$20	$20	$20	$20		$20
Dormant Pesticides						
Supreme Oil (4 gal/acre)	$12	$12	$12	$12		$12
Success (6 oz/ac)				$30		
Diazinon 50 (3.5 lb/acre)	$19					
Ambush 25SP (12-25 oz/acre)[3]						$30
Dipel (1 lb/ac)[2]			$28			
In-season Pesticides						
Trilogy 90EC (2g/acre)[2]		$140	$140	$140		
Omite 30 WP (7.5 lb/acre)						$45
Probability of Needing In-season Applications[b]	0.35	0.20	0.20	0.40		0.35
Cover Crop[c]		$50	$50	$50		$50
Other Cultural Costs	$928	$928	$928	$928	$928	$928
Total Cultural Costs	$993	$1,046	$1,114	$1,112	$1,100	$1,038
Other Costs[d]						
Harvest Costs per acre	$330	$330	$330	$330	$330	$330
Advisory Board Assessment	$-	$-	$-	$-	$-	$-
Interest on Operating Capital	$37	$39	$41	$41	$40	$38
Cash Overhead	$134	$134	$134	$134	$134	$134
Annualized Planting Costs	$43	$43	$43	$43	$43	$43
Total Costs	$1,537	$1,592	$1,662	$1,660	$1,647	$1,583
Gross Revenue[4]	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
Returns to Land, Mgt & Overhead	$463	$408	$338	$340	$353	$417
Total Costs as Percent of Gross Revenue	77%	80%	83%	83%	82%	79%
Change in Cost from Base Case	$-	$55	$125	$123	$110	$46
% Change in Cost from Base Case	0%	4%	8%	8%	7%	3%

1) Feasibility of this option may depend on pest pressure; 2) Two applications required--cost is for two applications; 3) Choice of this pesticide will also probably require use of miticide such as Vendex, Apollo, Omite, Kelthane, Agri-Mek; 4) Yield for almonds: 1 ton per acre Price per ton: $2000 Data are for 2001; Yield for peaches: 22 tons per acre Price per ton: $210 Data are for 1998, a cost inflation rate of 3% was used to adjust costs to 2001: Yield for dried plums: 4 tons per acre Price per ton: $800 Data are for 2001. 5) The costs for the "Mix" of low risk and high risk scenarios assumes 20% of the growers use the Base Case with a cover crop and 80% of the growers use dormant oil with Bt at bloom.

a) Costs are from Zalom, et al., 1999; b) Estimated probability is based on CDPR Pesticide Use Report data, 1998-2001

c) Costs are from Thomas, F. CERUS Consulting. Personal Communication; d) Costs for typical practices are from University of California Cooperative Extension (UCCE 2001a,b; 1998)

"**Other Cultural Costs--Non Pest Management**" includes annual cost per acre for typical cultural practices such as winter sanitation, pruning, brush disposal, pollination, irrigation, fertilization, leaf analysis, vertebrate pest, weed, and disease control, vehicle use, and consultant fees. "**Harvest Costs**" include shaking, raking, sweeping, pickup and haul, hull and shell, bin distribution, hand picking, and field sorting, depending on the crop type. "**Advisory Board Assessment**" is a mandatory fee assessed on each ton harvested "**Interest on Operating Capital**" is based on cash operating costs and is calculated monthly until harvest at a nominal rate of 10.51% per year. "**Cash Overhead**" are expenses assigned to the whole farm, including property taxes, interest on operating capital, office expense, insurance, sanitation services, and equipment repairs. "**Annualized Planting Costs**" includes land preparation, tree cost, planting, and staking, divided by orchard lifespan (almonds and peaches 25 years; plums 30 years)

8.1.2 Cost Analysis of Scenario #1: All Growers Use Pest Management Materials that Pose Little or No Risk to Water Quality

In Scenario #1 all growers use pest management materials that pose little or no risk to water quality. Dormant oils, without OPs, pyrethroids, or carbamates, would be applied in the winter. Three options are considered: 1) use of dormant oil alone; 2) dormant oil with bloomtime applications of B*t* for PTB; and 3) addition of spinosad to dormant oil for control of PTB.

Scale, aphids, mites, and other pests would be controlled with biological control agents and/or in-season applications of pesticides with low environmental risk, such as Trilogy (neem oil). Cover crops or border strips would be planted with vegetation that harbors biological agents, and orchard sanitation practices that minimize pest problems would be followed.

8.1.2.1 First Option

Cultural costs per acre for the first option described under Scenario #1 (dormant oil without an additional pesticide) in almond, peach, and dried plum orchards are $1,046, $1,515, and $935, respectively, when a cover crop must be planted and maintained. The cultural costs per acre for almonds, peaches, and dried plums are $996, $1,465, and $885, respectively, when vegetated cover need not be planted and maintained. Costs vary because of different susceptibilities to pests not controlled by dormant oil alone. For the 1998/99 through 2000/01 dormant seasons, in-season applications occurred on approximately 20% of the almond crops, when B*t* was applied as a dormant spray, 10% of the peach crop, and 1% of the prune crop. For this cost analysis, it is assumed that two in-season applications of neem oil (Trilogy) would be used. The cost of the two applications has been multiplied by the specific probability for the crop and added to the agronomic cost. No other costs have been added to account for any potential need for any other in-season applications, and these agronomic costs do not account for the potential risk of pest damage that would lower crop yield or price. These considerations also apply to the Second and Third Options described below.

It is not possible to quantify the potential effectiveness of cover crops that harbor beneficial insects in controlling pest damage. This practice varies in effectiveness depending on pest pressure, orchard location, weather, and a variety of other site-specific factors. Because the focus is on reducing populations of pests over time, it is likely that these practices would increase in effectiveness each year. However, because of the difficulty of quantifying the potential benefits, this practice can add substantial cost ($50 per acre) without any quantifiable benefits and therefore the costs are probably skewed upward. These considerations also apply to the Second and Third Options described below.

The percentage change in total cost from the base case for scenario 1 -option 1 is 4% for almonds, 1% for peaches, and 1% for dried plums. The estimated increase in total cost per acre is $55 for almonds, $47 for peaches, and $32 for dried plums.

If there is no cost for maintenance of a vegetative cover, the change in total cost is negligible or 0% for almonds and peaches and (1)% for dried plums. The estimated change in total agronomic cost per acre is $3 for almonds, $(4) for peaches, and $(20)[21] for dried plums.

8.1.2.2 Second Option

Cultural costs per acre for the second option described under Scenario #1 (dormant oil with B*t* at bloomtime) in almonds, peaches, and plums are $1,114, $1,601, and $1,073, respectively, when a cover crop must be planted and maintained. The cultural costs per acre for almonds, peaches, and dried plums are $1,064, $1,551, and $1,023, respectively, when vegetated cover need not be planted and maintained. For the 1998/99 through 2000/01 dormant seasons, in-season applications occurred on approximately 20% of the almond crops, when B*t* was applied as a dormant spray, 20% of the peach crop, and 40% of the prune crop. For this cost analysis, it is assumed that two in-season applications of neem oil (Trilogy) would be used.

The percentage change in total cost from the base case for scenario 1-option 2 is 8% for almonds, 3% for peaches, and 7% for dried plums. The estimated increase in total agronomic cost per acre is $125 for almonds, $136 for peaches, and $174 for dried plums.

If there is no cost for maintenance of a vegetative cover, the change in total cost is 5% for almonds, 2% for peaches and 5% for dried plums. The estimated increase in total agronomic cost per acre is $73 for almonds, $84 for peaches, and $122 for dried plums.

[21] The use of ( ) around the dollar figures indicates a decrease in cost.

8.1.2.3 Third Option

Cultural costs per acre for the Third Option described under Scenario #1 (dormant oil with Success) in almonds, peaches, and plums are $1,112, $1,653, and $1,035, respectively, when a cover crop must be planted and maintained. The cultural costs per acre for almonds, peaches, and dried plums are $1,062, $1,603, and $985, respectively, when vegetated cover need not be planted and maintained. Probabilities of needing in-season treatments are 40%, 70%, and 40%. The probabilities of needing in-season treatments are estimated based on a review of information provided in Zalom and others (1999). The PUR database included so few applications of spinosad in the dormant season that a reliable estimate of the probability for in-season treatment could not be determined.

The percentage change in total cost from the base case for scenario 1-option 3 is 8% for almonds, 4% for peaches, and 5% for dried plums. The estimated increase in total agronomic cost per acre is $123 for almonds, $189 for peaches, and $135 for dried plums.

If there is no cost for maintenance of a vegetative cover, the change in total cost is 5% for almonds, 3% for peaches and 3% for dried plums. The estimated increase in total agronomic cost per acre is $71 for almonds, $138 for peaches, and $83 for dried plums.

8.1.3 Cost Analysis of Alternate Scenario #2: Some Growers Use Pest Management Materials that Pose Little or No Risk to Water Quality, Others Use Mitigation

In Alternate Scenario #2 some growers use pest management materials that pose little or no risk to water quality, as described above for Scenario #1. Whenever possible, scale, aphids, mites, and other pests would be controlled with biological control agents and/or in-season applications of pesticides with low environmental risk, such as Trilogy. Cover crops would also be used to harbor beneficial insects.

However, some orchards may still need pesticide treatments. Cover crops would be planted as mitigation to intercept runoff. Variations of Scenario #2 would be to apply diazinon in alternate years only, to apply it at the lowest rates that would provide adequate control, or apply it as early as possible in the dormant season to extend the time the pesticide is on the tree, and subject to degradation, before the rainy season begins.

The economic analysis for Scenario #2 is a weighted combination of costs for Scenario #1 (Second Option--DO and B*t* at bloomtime), and the Base Case Scenario (DO with diazinon). Added to the Base Case costs are cover crops and buffers to mitigate runoff. The assigned weighting is based on the pest pressure usually experienced by the crop, and recent (1993-2000) pesticide use patterns from the California Department of Pesticide Regulation (CDPR) database, as summarized in Karkoski and others (2002). For almonds, it is assumed that 80% of the orchards will be able to use Scenario #1, with no additional in-season treatments, but 20% of the orchards will need to use the Base

Case Scenario, with mitigation to reduce runoff and pest pressure. For peaches it is assumed 20% of the orchards would use Scenario #1 and 80% would use the Base Case with runoff mitigation. For dried plums the weighting is 40% using Scenario 1 and 60% using the Base Case with mitigation.

If diazinon or another OP were used in alternate years only, costs would be reduced by the cost of the pesticide (approximately $19 per acre for diazinon) but other costs would remain the same because DO would still be applied every year. Similarly, applications made at the lowest rates would reduce pesticide costs slightly, but other costs remain the same. Early season applications would have no effect on costs.

Cultural costs per acre for Scenario 2 in almonds, peaches, and dried plums are $1,100, $1,536, and $1,002, respectively. The percentage change in total cost from the base case for scenario 2 is 7% for almonds, 1% for peaches, and 4% for dried plums. The estimated increase in total agronomic cost per acre is $110 for almonds, $69 for peaches, and $100 for dried plums.

If there is no cost for maintenance of a vegetative cover, the total costs per acre are $1,050, $1,486, and $952 for almonds, peaches, and dried plums, respectively. The change in total cost is 4% for almonds, 0% for peaches and 2% for dried plums. The estimated increase in total agronomic cost per acre is $59 for almonds, $18 for peaches, and $49 for dried plums.

The previous discussion of the difficulty of quantifying the relative costs and benefits of cover crops that harbor beneficial insects apply to Scenario 2. Populations of beneficial insects may be reduced, with the extent of reduction depending on the pesticide and its frequency and season of use.

8.1.4 Cost Analysis of Alternate Scenario #3: No Growers Use Pest Management Materials that Pose Little or No Risk to Water Quality, All Use Mitigation to Reduce or Eliminate Runoff

In Alternate Scenario #3 growers would use DO with pyrethroids plus in-season pesticides, as needed, and would establish cover crops, buffers, and other measures to reduce or eliminate field runoff.

Cultural costs for Scenario 3 in almonds, peaches, and dried plums are $1,038, $1,518, and $941, respectively, when a cover crop must be planted and maintained. The cultural costs per acre for almonds, peaches, and dried plums are $988, $1,468, and $891, respectively, when vegetated cover need not be planted and maintained. For the 1998/99 through 2000/01 dormant seasons, in-season applications occurred on approximately 35% of the almond crops, when pyrethroids were applied as a dormant spray, 25% of the peach crop, and 5% of the prune crop. For this cost analysis, it is assumed that an in-season application of a miticide would be used. The least expensive pyrethroid and

miticide have been chosen for each crop; costs would increase slightly if more expensive pesticides are used.

The cost of cover crops used to mitigate potential runoff from these applications has also been included. Other considerations of risk and beneficial insect populations discussed in the previous Scenarios apply, although use of pyrethroids is likely to greatly reduce populations of beneficial insects and cover crops would be used to intercept runoff rather than harbor beneficial insects.

The percentage change in total cost from the base case for scenario 3 is 3% for almonds, 1% for peaches, and 1% for dried plums. The estimated change in total cost per acre is $46 for almonds, $51 for peaches, and $38 for dried plums. The percentages and costs would vary according to the factors discussed under the previous scenarios.

If there is no cost for maintenance of a vegetative cover, the change in total cost is negligible or 0% for almonds and peaches and (1)% for dried plums. The estimated change in total agronomic cost per acre is $(5) for almonds, $(1) for peaches, and $(13) for dried plums.

8.1.5 CONCLUSIONS

The cost analysis indicates that the change in cost to the grower for using an alternative to diazinon is relatively minor, but can range from a 1% cost decrease up to a 5% cost increase, depending on the pest control strategy chosen by the grower. If the grower must plant a cover crop (versus using native vegetation) to control runoff or harbor beneficial insects, the change in cost from the base case ranges from a 1% cost increase to an 8% increase, depending on pest control strategy.

It should be noted that it is difficult to quantify the potential effectiveness of cover crops that harbor beneficial insects in controlling pest damage. This practice varies in effectiveness depending on pest pressure, orchard location, weather, and a variety of other site-specific factors. Because the focus is on reducing populations of pests over time, it is likely that this practice would increase in effectiveness each year. The reduction in pest pressure would likely lead to a reduction in overall costs related to pesticide application. However, because of the difficulty of quantifying the potential benefits, cover crops are just shown as adding agronomic costs to orchard management without showing the likely reduction in cost that will come with reduced pest pressures. Similarly, the long term cost of pesticide resistance, which is common with pyrethroids, cannot be easily quantified, and therefore the benefits of their use are more apparent than the costs.

Orchards that have runoff leaving the field, or that are located along watercourses, have a much greater need for careful management of diazinon and other pesticides. This analysis does not consider orchard location, but presumably the costs for these orchards will be higher than for other orchards located in less sensitive areas. Therefore, in addition to crop susceptibility, pest pressure, and commodity price, orchard location must

be considered in choosing the best approach to pest management and water quality protection.

And finally, the cost of water pollution and its associated potential loss of the beneficial uses of the water body are not possible to quantify, as are the potential long-term benefits to agriculture to retain as many pest management options as possible. Current water quality impairments threaten both beneficial uses and future pest management options, and while this analysis does not attempt to quantify those impacts they must be kept in mind when considering the costs of the options described in this report.

8.2 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: 1) orchard growers participate in a watershed-wide group to meet the Basin Plan requirements; or 2) orchard growers work individually with the Regional Board to meet the Basin Plan requirements.

There are about 1,400 orchard growers (almonds, peaches, and dried plums) that report some pesticide use annually. For purposes of estimating the monitoring, planning, and evaluation costs, it is assumed that those 1,400 orchard growers would need to respond to this Basin Plan Amendment. The total cost for monitoring, planning, and evaluation would be $500,000 to $6,500,000 for a waiver-based program, depending on the approach used by growers. The total cost if waste discharge requirements are needed (assuming the only additional cost to growers are the filing fees) would be $3,300,000 to $9,300,000.

Watershed-wide approach

For the approach that uses a watershed-wide group, the estimated monitoring, planning, and evaluation cost is approximately $500,000 per year or a little more than $350 per grower.

It is assumed that monitoring (flow and water quality) would need to take place at ten sites in the watershed. The ten sites would include the outlets for the six sub-watersheds plus one additional site in each of the sub-watersheds contributing the greatest potential load (Sacramento River above Colusa, Colusa Basin Drain, Sutter/Butte, and the Feather River). Each site would be monitored ten times during the dormant season and five times during the irrigation season. The total monitoring cost would be approximately $90,000 annually. The monitoring cost could be substantially greater if the sample collection and flow monitoring were contracted out. The monitoring costs are associated with determining compliance with load allocations.

The cost for planning and implementation by the watershed-wide 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 is approximately $180,000 annually. The planning and implementation

costs are associated with ensuring management practices are implemented, determining the degree of implementation of management practices, 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

For the approach in which growers report directly to the Regional Board, the estimated monitoring, planning, and evaluation cost is about $6,500,000, or $4,600 per grower.

It is assumed that monitoring (flow and water quality) would need to take place at one site that represents the grower's discharge. Each site would be monitored up to six times during the irrigation or dormant season depending on when pesticides are applied relative to rain events or irrigation events. The total monitoring cost would be approximately $2,230 annually. 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. It is assumed that Regional Board staff would develop standard forms for reporting and monitoring purposes. The cost to the grower is for their time and is estimated at $360.

There is also an assumed cost associated with evaluating effectiveness of management practices. It is assumed that an independent assessment of the effectiveness of the grower's management practices would be required annually and that the cost of such an evaluation would be $2,000 per grower.

Waste Discharge Requirements

If waste discharge requirements are used, an additional filing fee must be provided by the discharger. Agricultural discharge to surface water would be considered a category II C discharge for purposes of determining the annual fee (Cal. Code Regs., title 23, div. 3, ch. 9, art. 1, § 2200). The current fee is $2,025 per year. The total cost for 1,400 growers would be approximately $2,800,000 per year.

8.3 Estimated Government Costs

For the purposes of this Basin Plan Amendment, it is assumed that any government cost would be a cost to the Regional Board. The total cost to the Regional Board would be from $160,000 to $660,000.

County Agricultural Commissioners, the Department of Pesticide Regulation, and other state, local, and federal agencies may have a significant role in the implementation of this Basin Plan Amendment, but no such role is defined. Costs to the County Agricultural Commissioners from grower inquiries about alternatives to diazinon are not considered to be significant enough to require additional staffing or resources. The annual meetings identified between Regional Board staff, the County Agricultural Commissioners, and the Department of Pesticide Regulation are not considered to be significant enough to require additional staff or resources.

Regional Board cost for working with a single watershed group is estimated to be $160,000 (or rounded to $0.2 million). It will likely require one person working full time to assist the watershed group in planning, monitoring, and implementation activities. Review and analysis of the watershed group's reports will be required. Spot inspections of growers for compliance with waiver conditions or waste discharge requirements may also occur (e.g. 1% per year). Regional Board staff may also monitor four sites total on the Sacramento and Feather Rivers.

Regional Board cost for working with individual growers through a waiver or general waste discharge requirement program is estimated to be $660,000 (or rounded to $0.7 million). This includes $100,000 for additional tributary monitoring and five staff to compile and review information provided by the estimated 1,400 growers. Spot inspections of growers for compliance with waiver or WDR conditions may also occur (e.g. 1% per year).

These costs would be offset if fees were collected from growers as part of a waiver or waste discharge requirement program (see Section 8.2 above). A general waiver may waive the requirement to file a report of waste discharge or the requirement to obtain waste discharge requirements, or both (CWC § 13269). Under AB1X 10 (2003 Cal. Legis. Serv. 1st Ex. Sess. Ch. 1), dischargers covered under a general waiver that does not waive the report of waste discharge requirement must pay a filing fee. The fees could be used to cover staff costs, increase inspection frequency, conduct additional monitoring, and support projects that evaluate the effectiveness of management practices.

8.4 Estimated Costs to NPDES Permittees

As discussed previously, urban uses of diazinon are being phased out. It is, therefore, not anticipated that NPDES permittees (municipal storm water permittees or publicly owned treatment works) will be required to implement additional management measures or treatment technologies to control diazinon.

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

8.5 Potential Sources of Financing

In general, the potential sources of funding for agricultural water quality programs do not change significantly depending on crop type. The sources of funding already identified in the Basin Plan for the agricultural subsurface drainage program and rice pesticide programs are also potential sources for this program. An additional source of funding to pay for Regional Board costs are annual fees required for waste discharge requirements or filing fees that may be required for waivers of waste discharge requirements.

8.6 Summary

In summary, dischargers will incur costs in two areas: 1) implementation of new management practices; and 2) reporting on compliance with the provisions in the Basin Plan. The actual costs incurred by dischargers will depend on how cost effectively they can minimize or eliminate diazinon runoff and runoff of other potentially harmful pesticides. Implementation of new management practices (pest control alternatives to diazinon or runoff mitigation practices) could result in an aggregate decrease in production cost of $260,000 up to an aggregate increase in cost of up to $3,850,000, 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 (the least cost to individual dischargers) or report individually to the Regional Board (the greatest cost). The cost to the dischargers for monitoring, planning, and evaluation are estimated to range from $500,000 to $9,300,000 per year.

Total costs to dischargers for both implementation and reporting could range from $0.2 million to $13.1 million per year.

The Regional Board will also incur some cost. This cost will vary depending on how growers organize in response to this Basin Plan Amendment. The more individuals or groups the Regional Board must interact with, the higher the cost. The estimated annual cost is from $0.2 million to $0.7 million. The cost to the Regional Board would either be paid from the State's General Fund or could be offset if the Regional Board were able to collect annual fees from dischargers through a waste discharge requirement program or from filing fees under a conditional waiver program.

9 California Environmental Quality Act (CEQA) Review

The proposed Basin Plan Amendment does not prescribe any particular changes in land use or require any specific changes in pesticide use. The analysis of potential environmental impacts is, therefore, based on the possible changes in pest management methods or possible approaches to controlling diazinon runoff. This CEQA review is based on the potential alternative strategies that agricultural users of diazinon could employ in response to the Regional Water Quality Control Board – Central Valley Region's (Regional Board) proposed Basin Plan Amendment.

Urban users of diazinon are not considered in detail in this analysis, since those uses are being phased out in the time frame for compliance with the proposed Basin Plan Amendment.

9.1 Environmental Checklist Form

9.1.1 Project title

Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins – Control of Orchard Pesticide Runoff and Diazinon Runoff into the Sacramento and Feather Rivers

9.1.2 Lead agency name and address

California Regional Water Quality Control Board, Central Valley Region
3443 Routier Road, Suite A
Sacramento, CA 95827-3098

9.1.3 Contact person and phone number

Joe Karkoski, Senior Water Resources Control Engineer
(916) 255-3368

9.1.4 Project location

Sacramento River Watershed and Feather River Watershed; Sacramento River from below Keswick Dam to the Delta Boundary; Feather River from below Oroville Dam to the Sacramento River

9.1.5 Project sponsor's name and address

California Regional Water Quality Control Board, Central Valley Region
3443 Routier Road, Suite
Sacramento, CA 95827-3098

9.1.6 General plan designation

Not applicable

9.1.7 Zoning

Not applicable

9.1.8 Description of project

The Regional Board is proposing to amend the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins. The purposes of the proposed amendment are to adopt water quality objectives for diazinon in the Sacramento River below Keswick Dam and the Feather River below Oroville Dam and to adopt an implementation strategy to bring dischargers of diazinon into compliance with the water quality objectives. The proposed amendment also establishes the maximum diazinon loading capacity, waste load allocations, and load allocations for the Sacramento and Feather Rivers as required by the Clean Water Act § 303(d)(1)(C).

9.1.9 Surrounding land uses and setting

The areas affected by this basin plan amendment include the Sacramento River watershed below Keswick Dam and the Feather River watershed below Oroville Dam. The land uses in the area include agriculture, urban, open space, and wildlife habitat.

9.1.10 Other public agencies whose approval is required

State Water Resources Control Board
Office of Administrative Law
U.S. Environmental Protection Agency

9.2 Environmental Factors Potentially Affected

Findings:

No potentially significant impacts from this proposed action were identified.

Original Signed by Jerry Bruns	*10/16/03*
Signature	Date
Jerry Bruns, Environmental Program Mgr.	Cal. Regional Water Quality Control Board
Printed Name	Central Valley Region

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:
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	Biological Resources
Hazards & Hazardous Materials	Mineral Resources
Public Services	Utilities/Service Systems
Agriculture Resources	Cultural Resources
Hydrology/Water Quality	Noise
Recreation	Mandatory Findings of Significance
Air Quality	Geology/Soils
Land Use Planning	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.

Original Signed by Jerry Bruns — *10/16/03*
Signature — Date

Jerry Bruns, Environmental Program Mgr. — Cal. Regional Water Quality Control Board
Printed Name — Central Valley Region

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	☐	☐	☐	☒

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
exceed quantitative thresholds for ozone 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?	☐	☐	☐	☒

THRESHOLDS OF SIGNIFICANCE

For the purposes of making impact determinations, potential impacts were determined to be significant if the Proposed Project 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.

9.3 Discussion of Environmental Impacts

The analysis of potential environmental impacts is based on the possible changes in pest management methods or possible approaches to controlling runoff of diazinon in response to the proposed Basin Plan Amendment. The evaluation is based on the alternative strategies described in Section 5.1 of this report and Karkoski and others (2002).

9.3.1 Aesthetics

The proposed Basin Plan Amendment will likely result in changes in pest management practices on orchard crops. Potential practices are described in Section 5.1 and Karkoski and others (2002). 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.

9.3.2 Agricultural Resources

The practices discussed in Section 5.1 and Karkoski and others (2002), or other potential strategies that could be pursued by growers, are unlikely to lead to a conversion of agricultural land to other uses.

The Regional Board has reviewed the potential cost of the proposed implementation program, as well as the potential cost of alternative pest management strategies that might be employed by growers. Growers have a wide range of options available to both

maintain control of pests and 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 cost and allow them to continue farming.

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

9.3.3 Air Quality

Implementation of some of the alternative pest management strategies described in Karkoski and others (2002), especially those that result in a reduction in diazinon use, 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 to other pesticides. In response to a Regional Board request, the Department of Pesticide Regulation (DPR) has evaluated those alternative pesticides to determine whether air quality could be impacted by use of the alternatives.

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) have monitored for chlorpyrifos, methidathion, azinphos-methyl, permethrin, and propargite. None of these pesticides were detected in concentrations of concern to DPR. All other pesticides discussed in Karkoski and others (2002) have lower priorities but will be monitored by DPR, except clofentezine. Due to its low application rate and vapor pressure, clofentezine air concentrations are unlikely to cause significant problems in air. None of the pesticides considered in Karkoski and others (2002) are likely to cause significant problems as airborne toxicants (R. Segawa, pers. comm., 2002).

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. The San Joaquin and Sacramento Valleys currently meet DPR's goals for reduction of VOC emissions from pesticides. It's unlikely that changes in use patterns due to regulatory action on diazinon will cause these goals to be exceeded (R. Segawa, pers. comm., 2002).

9.3.4 Biological Resources

The proposed Basin Plan Amendment is designed to reduce diazinon runoff to levels that are not toxic to organisms in the Sacramento and Feather Rivers. As described in Section 5.1 and Karkoski and others (2002), orchard growers currently use other pesticides that could have an effect on biological resources, including pyrethroid and carbamate insecticides. Orchard growers who currently use diazinon may choose to switch to these other products to control pests as a response to this Basin Plan Amendment.

While pyrethroid insecticides are extremely toxic to fish under laboratory conditions, in agricultural fields and aquatic systems pyrethroids quickly sorb to plants, sediment and particulate matter and are not bioavailable to fish except in pore water at very low concentrations. While at least one fish kill caused by a pyrethroid has been reported to DPR, the kill resulted from an illegal application directly to surface water (J. Shelgren, pers. comm., 2002). Pyrethroids are widely used for a variety of agricultural crops and under a wide range of conditions.

The information available on current diazinon concentrations and the percent of orchards applying diazinon does not indicate that significant shifts in pesticide use patterns would be required to attain the proposed water quality objectives. Therefore, no significant impact to biological resources is anticipated in response to this Basin Plan Amendment due to shifts to alternative pesticide products that are potentially harmful to the environment.

In addition, the Basin Plan Amendment includes monitoring requirements that should allow the Regional Board to identify any potential impacts of pesticides in orchard runoff. The Basin Plan Amendment also requires orchard dischargers to implement control measures to meet water quality objectives, if an alternative to diazinon has the potential to contaminate surface water. The Basin Plan (CRWQCB-CVR, 1998) contain water quality objectives that do not allow pesticides to impact beneficial uses and this proposed Basin Plan Amendment does nothing to change the applicability of those objectives.

9.3.5 Cultural Resources

Implementation of the proposed Basin Plan Amendment is not likely 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.

9.3.6 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 Karkoski and others (2002), growers may plant cover crops or buffer strips to increase soil infiltration and reduce runoff, which will likely reduce soil erosion.

9.3.7 Hazards and Hazardous Materials

The DPR examines hazards posed by pesticides to workers and the public during it 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 (S. Edmiston, pers. comm., 2002). 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 discussed in Karkoski and others (2002) as alternatives to diazinon, 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 (S. Edmiston, pers. comm., 2002). Implementation of this Basin Plan Amendment should not result in any increased exposure to hazards or hazardous material.

9.3.8 Hydrology and Water Quality

None of the potential options to reduce diazinon 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 runoff discussed in Section 5.1 and Karkoski and others (2002) is to increase the infiltration of stormwater into orchard soil, rather than allowing it to run off the end of the 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 Karkoski and others (2002), have very high soil adsorption coefficients which cause them to bind tightly to soils and therefore these pesticides would not be carried more than a few inches below the surface. Other pesticides breakdown quickly through microbial decomposition and therefore do not persist long enough to be carried to groundwater (J. Troiano, pers. comm., 2002).

The proposed Basin Plan Amendment includes a policy that requires orchard growers to consider whether an alternative to diazinon could potentially result in ground water contamination or violation of surface water quality objectives. The policy states that growers should pursue another alternative if ground water contamination is anticipated or reduce surface runoff if surface water quality objectives would be violated.

9.3.9 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, Section 9.4.2, above.

9.3.10 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.

9.3.11 Noise

The proposed Basin Plan Amendment could lead to changes in the way in which diazinon is applied. The alternative practices (see Section 5.1 and Karkoski and others (2002)) 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.

9.3.12 Population and Housing

The proposed Basin Plan Amendment will likely result in changes in pest management practices on orchards. 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.

9.3.13 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, County Agricultural Commissioners 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.

9.3.14 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.

9.3.15 Transportation/Traffic

The proposed Basin Plan Amendment will not have an impact on transportation/traffic. None of the potential alternative practices (see Section 5.1 and Karkoski and others (2002)) should result in changes in traffic or require changes in traffic infrastructure.

9.3.16 Utilities and Service Systems

The proposed Basin Plan Amendment will likely result in changes in pest management practices on orchards. No wastewater treatment requirements for diazinon runoff from orchards have been established by the Regional Water Quality Control Boards. No wastewater treatment requirements have been established for diazinon for other potential sources, such as urban runoff or municipal treatment plants in the project area. The proposed Basin Plan Amendment should not result in changes in wastewater treatment requirements.

None of the potential alternative practices (Section 5.1 and Karkoski and others (2002)) would cause the construction of new water or wastewater treatment plants or the

expansion of existing plants for control of diazinon runoff from agricultural fields. The phase-out of the residential use of diazinon makes it highly unlikely that diazinon 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 runoff for orchards are on-field practices. It is unlikely that alterations in storm drainage facilities would be an effective means of reducing diazinon 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 and other contaminants. The use of cover crops may require additional irrigation water, but may also result in reduced evaporation from soil surfaces, resulting in no or little net change in irrigation water needs.

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 5.1 and Karkoski and others (2002)) 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 5.1 and Karkoski and others (2002)) 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.

9.3.17 Mandatory Findings of Significance

The Basin Plan Amendment is designed to reduce diazinon concentrations in the Sacramento and Feather Rivers and to ensure that potential increased use of alternatives to diazinon will not degrade water quality. The water quality objectives established for the Sacramento and Feather Rivers are designed to eliminate diazinon impacts on those river systems. 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 practices on orchards. Growers may use other pesticides instead of diazinon, may apply pesticides at a different frequency, or may apply pesticides during the growing season. The Regional Board's Basin Plan Amendment, therefore, addresses the identified water quality impacts from diazinon runoff. Monitoring requirements are included to ensure there are no impacts from other pesticides applied to orchards.

The proposed Basin Plan Amendment represents the establishment of the Regional Board's first program to address pesticide runoff from orchards. 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.

10 Public Participation and Agency Consultation

Regional Board staff began formal public involvement in the development of this Basin Plan Amendment in February 2002, when a public workshop was held in Chico to discuss the Basin Plan Amendment process and background on diazinon issues (CRWQCB-CVR, 2002a).

In May 2002, a two-day workshop was held in Yuba City to discuss the alternatives that were to be analyzed in developing the Basin Plan Amendment (CRWQCB-CVR, 2002b). Two staff reports served as the basis for the workshop discussions (Karkoski, et al., 2002; McClure, et al., 2002).

In March 2003, a staff workshop and CEQA scoping meeting was held in Yuba City to discuss the Peer Review draft version of the staff report, as well as the scope of the Amendment. (CRWQCB-CVR, 2003a).

In June 2003, a Regional Board workshop was held in Sacramento to discuss the draft Staff Report and Basin Plan Amendment released on May 5, 2003 (CRWQCB-CVR, 2003b).

These formal public meetings and workshops included representatives from the general public, commodity groups, local and county government, and environmental and agricultural interests. State and federal agencies participating in one or more of the workshops included: California Department of Fish and Game, California Department of Pesticide Regulation, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service.

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