Diazinon Runoff Management Plan

For Orchard Growers

In the Sacramento Valley:

2008 Annual Report

Sacramento Valley Water Quality Coalition

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A INTRODUCTION

In fulfillment of the requirements set forth in the Diazinon Runoff Management Plan, the Sacramento Valley Water Quality Coalition (Coalition) is submitting the Annual Report summarizing the 2007-2008 monitoring objectives, location and results, outreach efforts, and management practices effectiveness.

B BACKGROUND

The federal Clean Water Act requires each State to identify waters within its boundaries that are not currently meeting or maintaining water quality standards (33 USC 1313 (d)(1)). Water quality standards consist of the beneficial uses for which waterways are used and water quality objectives set at specified levels to maintain beneficial uses. The Sacramento and Feather Rivers were listed as impaired by diazinon in 1994 for the Sacramento and Feather Rivers by the Central Valley Regional Water Quality Control Board (Regional Board), in part due the an error in the data set used in the calculation of the water quality objective for diazinon.

Due to the 303(d) listing, the Regional Board adopted a total maximum daily load (TMDL) in accordance with the federal Clean Water Act (33 USC 1313 (d)(1)). Loads established in a TMDL are required to implement the applicable water quality standards with seasonal variations and a margin of safety (Id.). In addition to adopting a TMDL, the Regional Board also prepared and adopted a Basin Plan amendment that included new water quality objectives for diazinon and an implementation plan. The Basin Plan amendment was intended to establish an orchard runoff control program that focused on protecting the Sacramento and Feather Rivers from the impacts of diazinon.

More specifically, the Regional Board adopted (and the State Water Resources Control Board and federal EPA approved) diazinon water quality objectives of 0.080 µg/L as a 1-hour average (i.e. acute objective) and 0.050 µg/L as a 4-day average (i.e. chronic objective). At the time of adoption (and subsequently), questions were raised about the validity of the objectives and the studies from which the objectives were derived. As a result of subsequent litigation, the Regional Board committed to reviewing the objectives by July 1, 2007, and potentially amending the objectives by July 1, 2008.[1] The Regional Board has recently adopted new amendments to revise the diazinon objectives of 0.16 µg/L as a 1-hour average and 0.1 µg/L as a 4-day average (*Basin Plan Amendments to the Water Quality Control Plan For the Sacramento River and San Joaquin River Basins For The Control of Diazinon and Chlorpyrifos Runoff into the Sacramento and San Joaquin River Basins).* However, these amendments to the Basin Plan have not yet been

[1] The Regional Board's adoption and the State Water Resources Control Board's approval of the diazinon objectives were challenged in the Sacramento Superior Court by Makhteshim Agan of North America, Inc. (MANA). In its denial of MANA's petition, the Court relied on representations made by the Regional Board's Executive Officer, Thomas Pinkos, in an August 11, 2004 communication whereby the Regional Board committed to conducting a review of the diazinon program including recommending changes to the water quality objectives by June 20, 2007. It is understood that any amendments to the diazinon objectives would then occur prior to July 1, 2008 when compliance with the objectives as currently adopted is required by the Basin Plan. March 2007 Public Review Draft. Central Valley Region Water Quality Control Board (CVRWQCB), Rancho Cordova, California.

approved by the State or USEPA. In the meantime, the previously approved Basin Plan amendment contained requirements for an Orchard Pesticide Runoff and Diazinon Runoff Control Program. As part of the Control Program, the Regional Board required dischargers of diazinon to submit a management plan that "describes actions that the discharger will take to reduce diazinon discharges and meet the applicable allocations by the required compliance date." In lieu of individual plans, the Basin Plan amendment allows a discharger group or a coalition to submit management plans.

Monitoring Objectives

The purpose of the monitoring program is to determine whether numeric water quality objectives for diazinon contained in the *Basin Plan Amendment* are being met in the Sacramento and Feather Rivers. Specifically, the *Basin Plan Amendment* identifies the following goals for compliance monitoring for the TMDL:

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.

Water quality monitoring results presented Section C of this report address goals 1 and 2. Adequate data are not yet available to address goals 5 and 6. Results from the Coalition Irrigated Lands Program monitoring will be used to address these goals in the future. Goals 3, 4, and 7 are addressed in Sections D, and E of this report.

Sampling Site Descriptions

Selection of monitoring sites for the compliance monitoring program is detailed in the *Diazinon Runoff Management Plan for Orchard Growers in the Sacramento Valley* (SVWQC 2006). Monitoring sites for this program are consistent with those proposed in the *Basin Plan Amendment Staff Report* (CVRWQCB 2003) which identifies 6 compliance monitoring locations, and with subsequent monitoring guidance provided to the Coalition by the Regional Board (CVRWQCB letter to SVWQC, May 2, 2005). Five of these sites were selected for compliance monitoring by the Coalition. The sites for the Coalition's compliance monitoring program are Sacramento River at Colusa, Sacramento Slough, Colusa Basin Drain, Feather River at Yuba City, and Feather River at Verona. Compliance was assessed for a sixth site (Sacramento River at Verona) by mass-balance calculations with monitoring results for the other five sites.

All six sites and their contributing watersheds (as defined by the *Basin Plan Amendment*) are listed in Table 1 and also illustrated in Figure 1.

Table 1. Compliance Monitoring Sites for Diazinon Runoff Management Plan

Site	Site ID	Subwatershed	Lat	Long
Sacramento River at Colusa	SRCOL	Sacramento River above Colusa	39.2142	-121.9992
Colusa Basin Drain above Knight's Landing	COLDR	Colusa Basin	38.8121	-121.7741
Sacramento Slough	SACSL	Sutter/Butte	38.7833	-121.6338
Feather River above Yuba City	FRYUB	Drainage not defined	39.1384	-121.6058
Feather River near Verona	FRVON	Feather River	38.7903	-121.6266
Sacramento River at Verona	SRVON	Sum of Sacramento River above Colusa, Colusa Basin, Sutter/Butte, and Feather River subwatersheds	38.8875	-121.6097

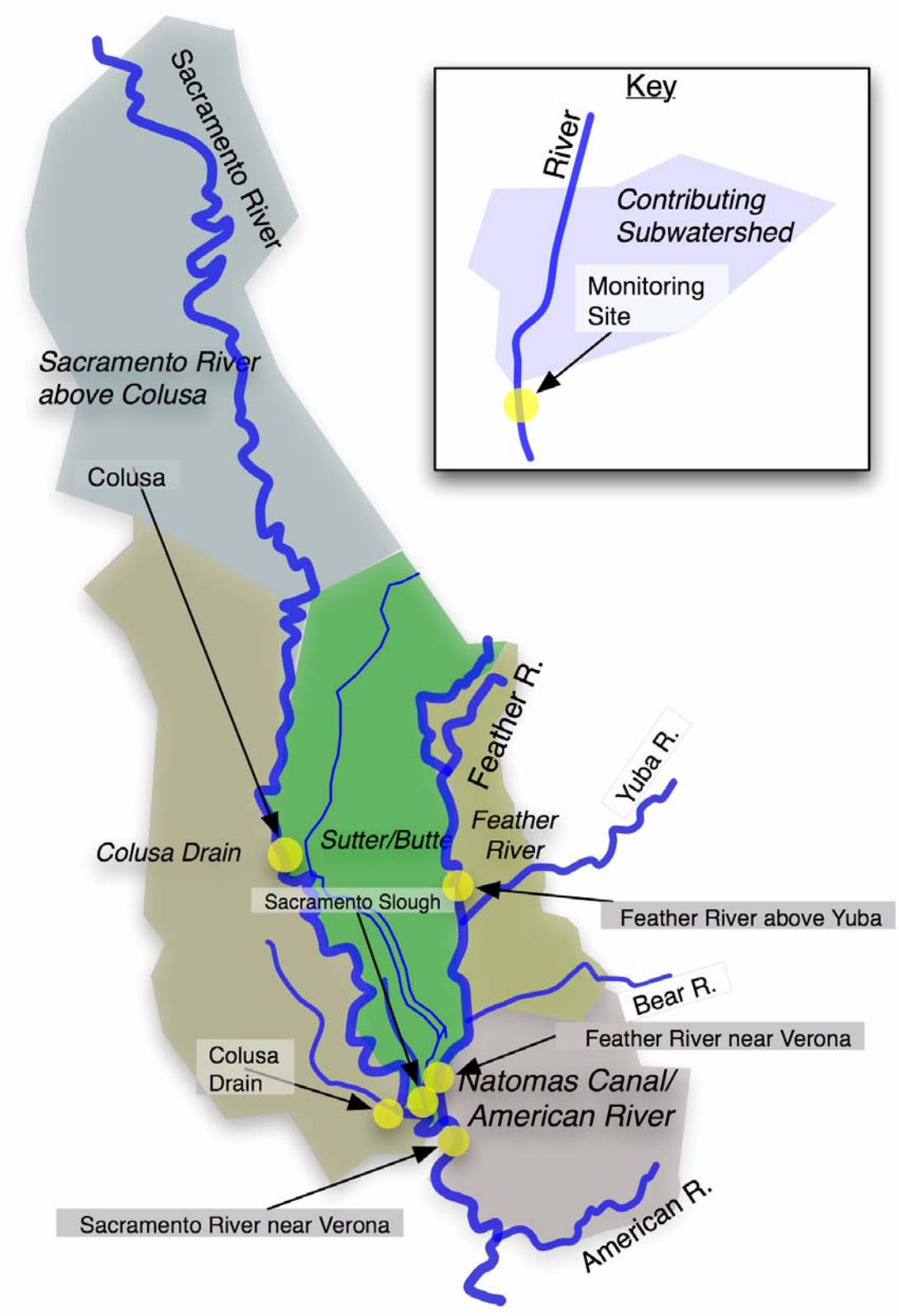

Figure 1. Compliance Monitoring Sites

Descriptions Of Sampling And Methods Used

Samples for each event were analyzed for diazinon, flow, pH, and conductivity (Table 2):

- Diazinon was analyzed in each daily sample to characterize concentrations and allow estimation of daily loads of diazinon from each subwatershed (monitoring goals 1 and 2). The analytical method used for diazinon is a modification of EPA Method 625.
- pH and conductivity were measured in the field for each sample collected and recorded on field log sheets. Flow data were acquired from USGS or DWR flow gauging stations (Sacramento River at Colusa, and Sacramento River at Verona) or measured in the field (all other sites). These parameters were measured to allow load calculation and to evaluate the length of storm impacts for each event.

Analytical methods were selected to provide adequate sensitivity, accuracy, and precision to address the monitoring goals. Sufficient numbers of quality assurance samples were planned and analyzed to ensure validity of the data for addressing the monitoring goals.

Table 2. Constituents Monitored

Parameter	Method Detection Limit	Quantitation Limit	Reporting Unit	Composite or Grab
Diazinon	0.005	0.01	ug/L	Depth-Width Integrated Samples
Flow	NA	NA	CFS (ft^3/sec)	Instream flow measurements or appropriate gauge data
pH	NA	0.1 [(a)]	-log[H^+]	Instream probe
Conductivity	NA	0.1 [(a)]	μmhos/cm	Instream probe

(a) Detection and reporting limits are not strictly defined. Value is required reporting precision.
(b) Limits are different for individual pesticides. Refer to Quantitation and Detection Limits.

C MONITORING RESULTS

Tabulated results of analyses

The results of the analyses of water quality samples collected in 2008 for the compliance monitoring program are presented in Table 3.

Table 3. Results For Field And Laboratory Analyses

Location	Date	Time	Matrix	Diazinon, µg/L	Conductivity, uS/cm	pH, -log[H+]
Colusa Drain at Knights Landing	01/23/08	17:20	Sample	0.0712	610	7.63
Colusa Drain at Knights Landing	01/23/08	17:20	Blank[a]	<0.002	nm[b]	nm
Colusa Drain at Knights Landing	01/24/08	16:20	Sample	0.006	571	6.94
Colusa Drain at Knights Landing	01/25/08	15:30	Sample	0.0197	598	7.78
Colusa Drain at Knights Landing	02/21/08	17:50	Sample	4.2863	896	7.80
Colusa Drain at Knights Landing	02/22/08	17:00	Sample[c]	0.7446	846	7.59
Colusa Drain at Knights Landing	02/22/08	17:00	Sample	0.7622	846	7.59
Colusa Drain at Knights Landing	02/23/08	16:15	Sample	<0.002	839	7.83
Colusa Drain at Knights Landing	02/24/08	16:00	Sample	0.1154	731	7.90
Feather River at Verona	01/23/08	15:30	Sample	0.0304	108	7.80
Feather River at Verona	01/24/08	15:20	Sample	0.0135	116	8.09
Feather River at Verona	01/25/08	14:30	Blank[a]	<0.002	nm[b]	nm
Feather River at Verona	01/25/08	14:30	Sample	<0.002	120	7.96
Feather River at Verona	02/21/08	15:45	Sample	<0.002	120	7.74
Feather River at Verona	02/22/08	14:40	Sample	<0.002	118	7.47
Feather River at Verona	02/23/08	14:10	Sample	<0.002	124	7.66
Feather River at Verona	02/24/08	13:50	Sample	<0.002	129	7.87
Feather River above Yuba City	01/23/08	12:20	Sample	<0.002	105	7.84
Feather River above Yuba City	01/24/08	11:45	Sample	<0.002	112	8.10
Feather River above Yuba City	01/25/08	11:15	Sample	<0.002	108	8.08
Feather River above Yuba City	02/21/08	13:00	Sample	<0.002	120	7.92
Feather River above Yuba City	02/22/08	11:50	Sample	<0.002	121	7.37
Feather River above Yuba City	02/23/08	11:35	Sample	<0.002	131	7.68
Feather River above Yuba City	02/23/08	11:35	Blank[a]	<0.002	nm[b]	nm
Feather River above Yuba City	02/24/08	11:10	Sample	<0.002	126	7.84
Sacramento Slough	01/23/08	13:45	Sample	0.0249	466	7.52
Sacramento Slough	01/24/08	13:50	Sample	0.0112	425	7.82
Sacramento Slough	01/25/08	13:30	Sample	<0.002	419	7.71
Sacramento Slough	02/21/08	16:15	Sample	<0.002	374	7.59
Sacramento Slough	02/22/08	15:30	Sample	<0.002	385	7.51
Sacramento Slough	02/23/08	14:45	Sample	0.0674	393	7.74
Sacramento Slough	02/24/08	14:30	Sample	0.0072	387	7.79
Sacramento River at Colusa	01/23/08	10:05	Sample	<0.002	175	7.99
Sacramento River at Colusa	01/24/08	10:00	Sample	<0.002	174	7.96
Sacramento River at Colusa	01/24/08	10:00	Sample[c]	<0.002	174	7.96
Sacramento River at Colusa	01/25/08	09:40	Sample	<0.002	170	8.02
Sacramento River at Colusa	02/21/08	10:30	Blank[a]	<0.002	nm[b]	nm
Sacramento River at Colusa	02/21/08	10:30	Sample	<0.002	195	7.56
Sacramento River at Colusa	02/22/08	10:00	Sample	<0.002	193	7.57
Sacramento River at Colusa	02/23/08	9:40	Sample	<0.002	206	7.73
Sacramento River at Colusa	02/24/08	9:40	Sample	<0.002	182	7.78

a field blank
b nm = not measured
c field replicate sample

Results Of Laboratory And Field Quality Assurance Analyses

The results of laboratory and field Quality Assurance (QA) analyses are presented in Table 4. Laboratory QA for diazinon analyses included method blanks, matrix spikes and matrix spike duplicates, and surrogate recoveries in samples matrices. All laboratory QA results met program data quality objectives. The laboratory achieved (and surpassed) the project target method detection limits and quantitation limits. Four field blanks and two sets of field replicate samples were also collected and analyzed for the two sample events. Diazinon was below the reported analytical detection limit (0.002 µg/L) in all field blanks, indicating that sample contamination was not adversely affecting sample results. The relative percent difference (RPD) for the first field replicate sample was 0% and met the data quality objective for this QA analysis (<25% RPD). The RPD for the second field replicate sample was 2% and also met the data quality objective for this QA analysis (<25% RPD).

Table 4. Field and Laboratory QA Results

QA Sample Type	Sample ID	Units	Diazinon	Result Qualifier	Data Quality Objective
Field Blank	COLDR-WB1P01-005.1	µg/L	<.002	ND	<.005
Field Blank	FRVON-WB1P01-005.3	µg/L	<.002	ND	<.005
Field Blank	SRCOL-WB1P01-006.1	µg/L	<.002	ND	<.005
Field Blank	FRYUB-WB1P01-006.3	µg/L	<.002	ND	<.005
Field Duplicate	SRCOL-WE1P01-005.2	µg/L	<.002	ND	NA
Field Duplicate	SRCOL-WE2P01-005.2	µg/L	<.002	ND	NA
Field Duplicate		RPD	0%		<25%
Field Duplicate	COLDR-WE1P01-006.2	µg/L	0.7622		NA
Field Duplicate	COLDR-WE2P01-006.2	µg/L	0.7446		NA
Field Duplicate		RPD	2%		<25%
Lab duplicate	FRYUB-WE1P01-005.2	µg/L	<.002	ND	NA
Lab duplicate		µg/L	<.002	ND	NA
Lab duplicate		RPD	0%		<25%
Lab duplicate	SACSL-WE1P01-006.2	µg/L	<.002	ND	NA
Lab duplicate		µg/L	<.002	ND	NA
Lab duplicate		RPD	0%		<25%
Method Blank	63602-B1	µg/L	<.002	ND	<.005
Method Blank	63602-B2	µg/L	<.002	ND	<.005
Method Blank	65779-B1	µg/L	<.002	ND	<.005
Method Blank	65779-B2	µg/L	<.002	ND	<.005
MS/MSD	FRYUB-WE1P01-005.2	% Recovery	77%		70-130
MS/MSD		% Recovery	92%		70-130
MS/MSD		RPD	18%		<25%
MS/MSD	SACSL-WE1P01-006.2	% Recovery	104%		70-130
MS/MSD		% Recovery	100%		70-130
MS/MSD		RPD	4%		<25%

Summary Of Precision And Accuracy

Based on the results of field and laboratory QA analyses, precision and accuracy met program data quality objectives and were adequate for the monitoring compliance program.

Data interpretation

Summary Of Sampling Conditions

Severe wind and rain were encountered throughout the first sample event (January 23 – 25, 2008). Relatively low flows were observed at all sites during the first two days of sampling, with a slight increase in water levels observed on the third day. Field pH values ranged from 6.94 to 8.10, and conductivity values ranged between 105 and 610 µS/cm. The boat engine began stalling irregularly on January 25 while collecting samples at FRVON. Due to unsafe wading conditions, we were unable to collect discharge information at this site.

Storm conditions prevailed for the duration of the second event (February 21 – 24, 2008). Flows increased daily at all sites. The ambient water pH values ranged from 7.37 to 7.92, and conductivity values ranged between 118 and 896 µS/cm. On day three while collecting samples at FRYUB, the flow meter malfunctioned, preventing the collection of velocities at FRYUB, FRVON, and SACSL. Velocities were estimated across channel. Due to safety issues associated with high winds and rough water, twenty flow measurements were not recorded at FRYUB on day four.

Assessment Of Data Quality Objectives

The data quality objectives for this monitoring effort are described in the QAPP for this program.

Completeness is defined as the percent of planned data that was successfully collected and analyzed. All planned diazinon and field-measured parameters were successfully collected and analyzed. Flow data was not collected at FRVON on January 23 and FRYUB on February 24, both due to unsafe conditions. Velocities were estimated for FRYUB, FRVON and SACSL on February 23 due to an equipment malfunction. Completeness for planned diazinon, pH, and conductivity analyses was 100%. Completeness for flow measurements was 94%.

Representativeness of the data collected was assured by selection of appropriate sampling and analytical methods. There was no deviation from the standard operating procedures specified in the QAPP, and the data are considered adequately representative for the purpose of the compliance monitoring program.

Analytical precision is assessed by analyzing laboratory-prepared matrix spike duplicates. Sampling precision is assessed by analyzing field-collected sample replicates. All field replicate results were within project data quality objectives (<25% Relative Percent Difference), and sampling precision is considered adequate for the purpose of the compliance monitoring program.

Analytical accuracy is assessed by routine calibration and analysis of laboratory-prepared matrix and by addition of surrogate organic compounds to sample matrices. All recoveries of matrix spikes and surrogate compounds were within acceptable limits, and analytical accuracy is considered adequate for the purpose of the compliance monitoring program.

Load Estimates

Mean daily flows for Sacramento River at Colusa, Sacramento River at Verona, and Colusa Basin Drain were acquired from the California Data Exchange Center (CDEC). Mean daily flows for Sacramento Slough, Feather River above Yuba City, and Feather River at Verona were set equal to instantaneous discharges measured instream at the time of sampling.

Daily diazinon loads were calculated for all compliance sites. Daily loads were calculated as:

$$Load = Q \times C \times UCF$$

Where, *Load* is the daily diazinon load in g/day,

Q = mean daily flow in CFS

C = sample diazinon concentration, in µg/L, and

UCF = a unit conversion factor of 2.4446.

Loads for Sacramento River at Verona were calculated as the sum of daily loads for Sacramento River at Colusa, Sacramento Slough, Colusa Basin Drain, and Feather River at Verona. The loads estimated for Sacramento River at Verona were also used to back-calculate estimated diazinon concentrations using the above equation for loads.

Compliance with load allocations was determined using the methodology outlined in the recently adopted Basin Plan Amendment for Control of Diazinon and Chlorpyrifos Runoff (Resolution No. R5-2007-0034). This methodology takes into account the additive effects of diazinon and chlorpyrifos. Compliance was calculated using the following equation:

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

Where the loading concentration may not exceed the *(S)um* of one (1.0),

C_D = diazinon concentration in µg/L; analytical results reported as "nondetectable" concentrations are considered to be zero

C_C = chlorpyrifos concentration in µg/L; analytical results reported as "nondetectable" concentrations are considered to be zero

WQO_D = 1-hour or 4-day average diazinon water quality objective in µg/L

WQO_C = 1-hour or 4-day average chlorpyrifos water quality objective in µg/L

Flow data, diazinon concentrations, loads and TMDL compliance results are presented in **Table 5**.

Table 5. Flow Data, Calculated Loads, and TMDL Compliance

Station Code[a]	Date	Mean daily flow	Diazinon Concentrations in Samples And Estimated Loads			Load Allocation Compliance[e]	
			Sample, µg/L	Est'd 4-day avg.	Load, g/day	1-Hour	4-Day Average
COLDR	1/23/08	1332	0.0712	0.032	232	0.45	0.30
COLDR	1/24/08	1489	0.006		22	0.04	
COLDR	1/25/08	1760	0.0197		85	0.12	
COLDR	2/21/08	543	4.2863	1.291	5693	26.79	7.44
COLDR	2/22/08	648	0.7622		1208	4.76	
COLDR	2/23/08	667	< 0.002		0	0.00	
COLDR	2/24/08	2292	0.1154		647	0.72	
FRVON	1/23/08	2150	0.0304	0.015	160	0.19	0.13
FRVON	1/24/08	2159	0.0135		71	0.08	
FRVON[d]	1/25/08	2749[d]	< 0.002		0	0.00	
FRVON[d]	2/21/08	2601[d]	< 0.002	<0.002	0	0.00	0.00
FRVON	2/22/08	3105	< 0.002		0	0.00	
FRVON	2/23/08	3392	< 0.002		0	0.00	
FRVON	2/24/08	3252	< 0.002		0	0.00	
FRYUB	1/23/08	1612	< 0.002	<0.002	0	0.00	0.00
FRYUB	1/24/08	1262	< 0.002		0	0.00	
FRYUB	1/25/08	1316	< 0.002		0	0.00	
FRYUB	2/21/08	1494	< 0.002	<0.002	0	0.00	0.00
FRYUB	2/22/08	1926	< 0.002		0	0.00	
FRYUB	2/23/08	1926[c]	< 0.002		0	0.00	
FRYUB	2/24/08	1319	< 0.002		0	0.00	
SACSL	1/23/08	1392	0.0249	0.013	85	0.16	0.11
SACSL	1/24/08	1343	0.0112		37	0.07	
SACSL	1/25/08	1711	< 0.002		0	0.00	
SACSL	2/21/08	902	< 0.002	0.020	0	0.00	0.14
SACSL[c]	2/22/08	902[c]	< 0.002		0	0.00	
SACSL	2/23/08	619	0.0674		102	0.42	
SACSL	2/24/08	982	0.0072		17	0.05	
SRCOL	1/23/08	7389	< 0.002	<0.002	0	0.00	0.00
SRCOL	1/24/08	6931	< 0.002		0	0.00	
SRCOL	1/25/08	7177	< 0.002		0	0.00	
SRCOL	2/21/08	8508	< 0.002	<0.002	0	0.00	0.00
SRCOL	2/22/08	9733	< 0.002		0	0.00	
SRCOL	2/23/08	14017	< 0.002		0	0.00	
SRCOL	2/24/08	16758	< 0.002		0	0.00	
SRVON	1/23/08	11063	0.019	0.010	477	0.11	0.09
SRVON	1/24/08	10933	0.0061		130	0.03	
SRVON	1/25/08	10796	0.0053		85	0.02	
SRVON[b]	2/21/08	17358	0.1355	0.047	5693	0.84	0.44
SRVON	2/22/08	16858	0.0309		1208	0.18	
SRVON	2/23/08	16725	0.0047		102	0.02	
SRVON	2/24/08	19546	0.0159		664	0.09	

a COLDR = Colusa Basin Drain; FRVON = Feather River at Verona; FRYUB = Feather River above Yuba City; SACSL = Sacramento Slough; SRCOL = Sacramento River at Colusa; SRVON = Sacramento River at Verona

b Sacramento River at Verona Loads are calculated as the sum of loads for SRCOL, FRVON, SACSL and COLDR. Sacramento River at Verona concentrations are calculated as: *Load ÷ (Flow x 2.446 Unit Conversion Factor)*

c Load for SACSL and FRYUB estimated from previous day's flows

d Loads were calculated based on the sum of flows from FRYUB, Yuba River above Marysville (CDEC site ID: MRY) and Bear River (CDEC site ID: BPG). Unsafe conditions and flow meter malfunction prevented the measurement of flow on 1/25 and 2/21, respectively.

e Compliance is assessed based on the sum of chlorpyrifos and diazinon toxic units. Exceedances are indicated for values greater than 1.0.(highlighted values).

Comparison with TMDL Objectives and Discussion of Exceedances

Compliance with Concentration-Based TMDL Objectives

Concentrations were compared to the recently adopted Basin Plan Amendment objectives for the Sacramento and Feather rivers[2] (0.16 µg/L as a 1-hour average, and 0.10 µg/L as a 4-day average), and USEPA's final National Water Quality Criterion[3] (0.17 µg/L as a 1-hour average and as a 4-day average). The newly-adopted Basin Plan objectives are based on the same data used to calculate the previous TMDL objective, with corrections made to erroneous data used in the original criterion. The USEPA National criterion also incorporates the data correction and additional recently published data.

- Two of the thirty-five samples collected at the 5 compliance monitoring locations exceeded the adopted Basin Plan Amendment 1-hour objective for diazinon (0.16 µg/L) and the USEPA national criterion for diazinon (0.17 ug/L). The exceedances occurred at Colusa Basin Drain on February 21 and 22, 2008 (4.28 and 0.76 µg/L, respectively).
- The average diazinon concentration for samples collected February 21-24 at Colusa Basin Drain (1.29 ug/L) exceeded the adopted TMDL 4-day average Basin Plan objective (0.1 µg/L).
- None of the samples exceeded the objectives for chlorpyrifos (0.025 µg/L and 0.015 µg/L). Chlorpyrifos was not detected above the analytical detection limit (0.001 ug/L) in any sample.

The adopted Basin Plan Amendment for Control of Diazinon and Chlorpyrifos Runoff[2] also implements measures designed to address the additive toxicity of diazinon and chlorpyrifos. The Colusa Basin Drain samples taken on February 21 and 22, 2008 exceeded the TMDL 1-hour average Load Allocation and the average concentration for February 21-24 also exceeded the 4-day average Load Allocation. No chlorpyrifos was detected in any sample, and the exceedances were due only to diazinon. The remainder of the samples complied with the TMDL Load Allocation and Load Capacity objectives.

Compliance with Load-Based TMDL Objectives

Daily diazinon and chlorpyrifos loads calculated for each site were compared to the Load Allocations and Loading Capacities as specified in the May 2007 Basin Plan Amendment. Loads for the Sacramento River and Feather River were compared to the TMDL Load Capacities for these sites. Loads for the Colusa Drain and Sacramento Slough were compared to TMDL Load Allocations for these sites. All loads, Loading Capacities and Load Allocations were calculated as specified in the TMDL Basin Plan Amendment adopted May 2007.

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[2] CVRWQCB 2007. *Basin Plan Amendments to the Water Quality Control Plan For the Sacramento River and San Joaquin River Basins For The Control of Diazinon and Chlorpyrifos Runoff into the Sacramento and San Joaquin River Basins.* RESOLUTION NO. R5-2007-0034. Adopted May 3, 2007. Central Valley Region Water Quality Control Board (CVRWQCB), Rancho Cordova, California.

[3] USEPA 2006. *Aquatic Life Ambient Water Quality Criteria: Diazinon. Final.* EPA-822-R-05-006. U.S. Environmental Protection Agency, Office of Water.

Comparisons of calculated loads to current TMDL load objectives for the two 2008 dormant spray season sample events indicate that the Colusa Basin Drain samples taken on February 21 and 22, 2008 exceeded the Load Allocation. The remainder of the samples were within the Load Allocation and Load Capacity objectives for the TMDL. Loads and applicable TMDL load allocations and capacities are presented in Table 5.

D OUTREACH EFFORTS

Outreach in 2007 was again directed through activities of the Coalition and its Subwatershed groups as part of the Irrigated Lands Regulatory Program. In the primary orchard growing region of Sacramento Valley (Butte, Colusa, Glenn, Sutter and Yuba counties), numerous workshops included information on the diazinon TMDL and management practices related to dormant orchard sprays. County Agricultural Commissioners in those counties also made available to orchard growers when applying for pesticide application permits the publication *"Diazinon Insecticides: Management Practices for Protecting Surface Water During Dormant Orchard Applications."* This publication is also included in a BMP Handbook distributed to orchard growers in Butte, Yuba, and Sutter counties in March 2008.

Table 6. Outreach Presentations

Date	Sponsors/Location	Meeting Subject
Monthly	Glenn County Farm Bureau	Exceedance Updates
7/26/07	UC Cooperative Extension	BMPs
11/1/07	Sutter Agricultural Department	Dormant Sprays
11/14/07	Sutter County Agricultural Department	Dormant Sprays
11/29/07	Sutter County Agricultural Department	Dormant Sprays
12/4/07	Colusa County Agricultural Department	Exceedances
12/06/07	Sutter County Agricultural Department	Dormant Sprays
12/13/07	Glenn County Agricultural Department	Exceedances

The following outreach materials were distributed (Table 7):

Table 7. Outreach Materials

Date	Sponsors/Location	Subject
9/2007	Colusa-Glenn Subwatershed - Newsletter	Diazinon, Simazine, Chlorpyrifos and other exceedances
5/2007	Butte-Yuba Sutter Subwatershed	BMP Handbook to 1,400 orchard growers

E MANAGEMENT PRACTICES EFFECTIVENESS

The best indication of management practice effectiveness is the trend of diazinon detections and exceedances in the TMDL listed waterways. As discussed above, there is a downward trend in total number of diazinon exceedances which could be considered a strong indication that BMPs being used in orchards are in fact effective at minimizing diazinon movement into Sacramento Valley waterways. A comprehensive analysis of diazinon water monitoring data from Central Valley waterways is currently being performed by Lenwood Hall on behalf of the diazinon registrant, Makhteshim-Agan. This report will be provided in the next annual report.

As for individual practices, a study to evaluate the effectiveness of native vegetation as a BMP for dormant diazinon in almonds was postponed due to lack of grass growth in the orchard because of low rainfall in the months prior to January 2008 when the study was scheduled. This San Joaquin based study should provide information useful to orchard growers in the Sacramento Valley. The study has been rescheduled for January 2009.

Another study was performed on the effectiveness of enzymes (LandGuard OP-A) for treating dormant orchard runoff where diazinon is applied (see attachment). LandGuard was applied to runoff leaving a plum orchard in the Yuba City area. In the study conducted by CURES, sprinklers were used to simulate a major rain event after applying Diazinon AG 500 to the orchard. At the lowest enzyme rate tested, diazinon residues were reduced by up to 99% immediately after dosing and could be further reduced with longer enzyme exposure times. Previous dormant studies performed by U.C. Davis showed the enzyme to be effective when applied to the orchard floor after a diazinon treatment. With this method, the enzyme degrades diazinon present on the soil surface before rain can wash off the insecticide. Such applications require treating all areas of an orchard where run-off could reach sensitive aquatic areas. Orica, the makers of LandGuard, are considering further studies using the enzyme.

F SUMMARY

The following conclusions can be made based on the results of the three years of TMDL compliance monitoring and management completed to date.

Two of the thirty-five samples collected at the 5 compliance monitoring locations in 2008 exceeded adopted concentration-based TMDL objectives for diazinon and load-based objectives for diazinon and chlorpyrifos, as well as the USEPA national criterion (exceedances occurred at Colusa Basin Drain on February 21 and 22, 2008). The average diazinon concentration for samples collected February 21-24 at Colusa Basin Drain (1.29 ug/L) also exceeded the adopted TMDL 4-day average Basin Plan objective for diazinon (0.1 µg/L), as well as the Load Allocation for the sum of diazinon and chlorpyrifos.

Although exceedances were observed in 2008, the majority of the 95 samples collected from 2006 through 2008 and all of the 21 concentrations estimated at the Sacramento River at Verona were in compliance with the TMDL objectives. The overall results indicate that the combination of changes in diazinon use patterns, changes in management practices and modifications to labeling have been successful in reducing instream ambient diazinon and chlorpyrifos concentrations and loads below the historically observed levels that resulted in listing these waters as impaired.

In spite of this success, the exceedances observed in 2008 indicate a need for continued outreach and education to promote awareness and the use of effective management practices. The Coalition proposes to perform the following action in response to the exceedances:

- Obtain a list of growers who applied diazinon in the Colusa Basin Drain watershed area;
- Determine source of the exceedance and whether applications were made according to label restrictions and DPR dormant spray regulations;
- Mail exceedance notices and grower management practice surveys to growers who applied diazinon;
- Meet with the growers or hold workshops to review management practices to prevent future diazinon runoff after dormant sprays.

Results of these activities will be included in the next annual report.

The Coalition and its Subwatershed groups continue to promote using management practices to reduce diazinon runoff after dormant orchard sprays. The outreach presentations prior to dormant season include information on the diazinon label changes, the finalized diazinon TMDL and the new dormant orchard spray regulations. Also included is information on available BMP options to protect surface waters from potential impacts of dormant season runoff of alternatives to diazinon, specifically pyrethroid insecticides.

Management practices continue to be evaluated for effectiveness in minimizing diazinon runoff from orchard sprays. A study set for winter 2007 was rescheduled for the winter 2008. The study will look at the impact of orchard floor vegetation on dormant runoff. The results from an enzyme study shows it can rapidly breakdown diazinon in drainage water. The company has begun to pursue marketing the enzyme as a dormant orchard treatment to runoff water at field edge. Use as an application to the orchard floor after a diazinon treatment is still being evaluated by the company. If successful, the effectiveness of the management practices will be shared at grower meetings and through distribution of newsletters.