

MAY 2015

SACRAMENTO VALLEY
WATER QUALITY COALITION

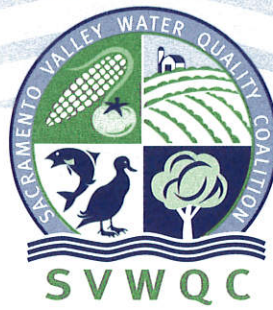
Management of Chlorpyrifos and Diazinon Discharges to the Sacramento and Feather Rivers and the Sacramento-San Joaquin Delta: 2014 TMDL Compliance Monitoring Report

Prepared by

LARRY WALKER ASSOCIATES



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May 1, 2015

Pamela Creedon, Executive Officer
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive
Rancho Cordova, CA 95670-6114

RE: 2014 Annual Monitoring Report, 2014 Management Plan Progress Report, and 2014 Chlorpyrifos Diazinon TMDL Compliance Monitoring Report

Dear Ms. Creedon:

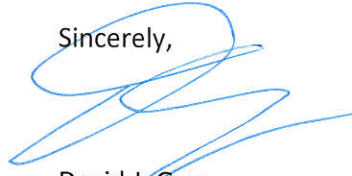
Attached are three annual reports for the Sacramento Valley Water Quality Coalition (Coalition):

- **The 2014 Annual Monitoring Report (AMR) for the Coalition's Monitoring and Reporting Program (MRP).** The Coalition has developed and implemented a MRP to meet the requirements of the *Waste Discharge Requirements General Order for Growers within the Sacramento River Watershed that are Members of a Third-Party Group (R5-2014-0030)* (WDR). The scope of the MRP and the sampling and analytical methods used in the 2014 Coalition Monitoring have been approved by the Central Valley Regional Water Quality Control Board. The AMR summarizes the sampling results and analysis, provides interpretation of the data, and documents the outreach to Coalition landowners.
- **The 2014 Management Plan Progress Report (MPPR).** The Coalition has implemented the monitoring, reporting, outreach, analysis, and evaluations needed to assess our progress toward the goals of the Coalition's approved Management Plan. The MPPR summarizes this information and the progress toward meeting these goals.
- **The Management of Chlorpyrifos and Diazinon Discharges to the Sacramento and Feather Rivers and the Sacramento-San Joaquin Delta: 2014 TMDL Compliance Monitoring Report (TMDL Compliance Monitoring Report).** The Coalition has implemented the monitoring approved to meet the requirements of the TMDL and conducted analysis and evaluations to assess progress toward the goals of the TMDL. The TMDL Compliance Monitoring Report summarizes the monitoring results and analyses, presents our evaluations and interpretations of the data, and provides our conclusions about progress toward meeting the TMDL's goals.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment for violations."

If you or your staff have questions on these reports, please contact me or Bruce Houdesheldt at (916) 442-8333.

Sincerely,

A handwritten signature in blue ink, appearing to read "David J. Guy", with a large, stylized flourish extending to the right.

David J. Guy
President
Northern California Water Association

Cc: Sue McConnell
Susan Fregien
Lynn Coster
Gurbinder Dhaliwal
Claus Suverkropp
Bruce Houdesheldt

M A Y 2 0 1 5

SACRAMENTO VALLEY WATER QUALITY COALITION

Management of Chlorpyrifos and Diazinon Discharges to the Sacramento and Feather Rivers and the Sacramento-San Joaquin Delta: 2014 TMDL Compliance Monitoring Report

Prepared by

L A R R Y
W A L K E R



ASSOCIATES

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Introduction

The Sacramento Valley Water Quality Coalition (Coalition) submitted their Management Plan in December 2008 to address specific water quality impairments within the Coalition area. A requirement of the Management Plan is to document monitoring and management activities conducted on behalf of members of the Coalition and required by the Central Valley Regional Water Quality Control Board (Regional Board)'s Basin Plan amendments for the Control of Diazinon and Chlorpyrifos Runoff into the Sacramento and Feather Rivers (Resolution No. R5-2007-0034) and the Sacramento-San Joaquin Delta (Delta) (R5-2006-0061). The Basin Plan amendments set forth Total Maximum Daily Load (TMDL) requirements for dischargers and require that dischargers comply with the monitoring and management criteria defined in the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (Basin Plan). An Addendum¹ to the Coalition's approved Management Plan addresses the Coalition's planned activities to comply with the TMDL requirements specific to chlorpyrifos and diazinon. Beginning in 2009, the Addendum for TMDL compliance monitoring was developed in collaboration with the Irrigated Lands Regulatory Program (ILRP) staff and it was formally submitted to the Regional Board on April 30, 2010 as part of the *Management Plan Progress Report*. At the request of ILRP staff, the Addendum was resubmitted as a separate document on December 7, 2010.

In fulfillment of the requirements set forth in the Management Plan, the Coalition is submitting this annual TMDL Compliance Report summarizing the 2014 monitoring objectives, locations of sampling sites, and compliance results.

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 as well as water quality objectives set at specified levels to maintain the beneficial uses. In 1994, the Sacramento and Feather Rivers were listed as impaired by diazinon by the Regional Board. As a result of the 303(d) listing, the Regional Board adopted a 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, considering 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, as well as 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.

¹ *Addendum to Sacramento Valley Water Quality Coalition Management Plan: Chlorpyrifos and Diazinon TMDLs*. Sacramento Valley Water Quality Coalition, Sacramento, California. April 2010.

More specifically, the Regional Board adopted (and the State Water Resources Control Board and U.S. 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. The Regional Board adopted new amendments to revise the diazinon objectives to 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*). 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.

The Basin Plan amendments (R5-2007-0034 and R5-2006-0061) require dischargers, either individually or as a coalition, to submit a management plan that describes the actions that they will take to reduce chlorpyrifos and diazinon discharges and meet the applicable allocations by the required compliance dates. The Coalition’s Management Plan (SVWQC 2009) includes a process for source identification and identification of additional management practices that may be needed to achieve additional reductions in chlorpyrifos and diazinon discharges. Quarterly meetings are held with the Regional Board in order to evaluate progress in meeting these reductions, and revisions to the Management Plan will be made if sufficient progress is not being achieved.

The Coalition continues to monitor chlorpyrifos and diazinon according to the Coalition’s approved monitoring schedules and the SVWQC 2010-2014 MRP Order (CVRWQCB 2009). The monitoring locations are representative of agricultural discharges to the Sacramento River, Feather River, and Delta. This monitoring will continue to provide information on the wide range of discharges and hydrologic conditions likely to occur in the Sacramento Valley watershed and Delta. The Coalition’s Addendum to the Management Plan presents the technical rationale for selecting the representative monitoring locations for the TMDL compliance monitoring and for the schedule for chlorpyrifos and diazinon monitoring.

Monitoring to augment the routine ILRP Core and Assessment monitoring is conducted at existing Coalition monitoring sites in water bodies where at least one exceedance has occurred and that are directly tributary to the affected TMDL water bodies. Coalition efforts in these subwatersheds include, but are not limited to: (1) continued monitoring during time periods when peak pesticide application use occurs, (2) analysis of Pesticide Use Report (PUR) data, (3) holding subwatershed grower meetings, (4) continuing to encourage and evaluate implementation of management practices, and (5) addressing the seven compliance components described in the Basin Plan and listed below in conjunction with other entities identified as potential sources of discharges. Additional activities addressing Basin Plan and MRP Order requirements for source identification, outreach, and management practice evaluation are described in the Coalition’s Management Plan.

The Coalition’s monitoring frequency and locations for chlorpyrifos and diazinon will be evaluated and updated annually for the Management Plan, subject to approval by the Executive Officer of the Regional Board.

MONITORING OBJECTIVES

The purpose of the TMDL monitoring is to determine whether numeric water quality objectives for chlorpyrifos and diazinon contained in the Basin Plan are continuing to be met in the Sacramento and Feather Rivers. Specifically, the Basin Plan identifies the goals listed in **Table 1** for compliance monitoring for the TMDL. These goals are addressed in the Compliance Monitoring Report.

Table 1. Basin Plan Amendment TMDL Compliance Monitoring Goals

Compliance Monitoring Goal	Report Section Heading(s)	Page(s)
1. Determine compliance with established water quality objectives for chlorpyrifos and diazinon in the Sacramento and Feather Rivers and the Sacramento-San Joaquin Delta	Monitoring Results	5-13
2. Determine compliance with established waste load allocations and load allocations for chlorpyrifos and diazinon	Discussion	14-28
3. Determine the degree of implementation of management practices to reduce off-site migration of chlorpyrifos and diazinon	Outreach and Follow-Up Regarding TMDL Exceedances	25-26
4. Determine the effectiveness of management practices and strategies to reduce off-site migration of chlorpyrifos and diazinon	Outreach and Follow-Up Regarding TMDL Exceedances	25-26
5. Determine whether alternatives to chlorpyrifos and diazinon are causing surface water quality impacts	Toxicity and Additional Pesticide Results	27-28
6. Determine whether the discharge causes or contributes to a toxicity impairment due to additive or synergistic effects of multiple pollutants	Compliance with Load Allocations in the TMDL Receiving Water Bodies; Toxicity and Additional Pesticide Results	17-24; 27-28
7. Demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable	Summary	29

SAMPLING SITES

Locations within the Coalition area for monitoring of chlorpyrifos and diazinon to satisfy the TMDL requirements are presented in **Table 2**. Compliance with TMDL objectives and loading capacity concentrations is assessed at the 14 sites identified as compliance monitoring sites. These specific sites were selected because they are within the TMDL watersheds, are tributary to the TMDL water bodies, and have minimal non-agricultural influences. The schedule of monitoring for organophosphate pesticides at these compliance sites is documented in the Coalition's annual monitoring plans. The seasonal timing of the Coalition's ILRP pesticide monitoring at individual sites is based on pesticide use patterns in each subwatershed, as characterized in the Coalition's approved 2009 MRPP. These schedules were retained for the TMDL monitoring in 2010 and 2011, and updated in 2012, 2013, and 2014 for current pesticide use patterns.

Table 2. Compliance Monitoring Sites for Chlorpyrifos and Diazinon Runoff Management Plan

Subwatershed	Location	Site ID	Lat.	Long.	Delta, Sacramento, or Feather River Basin Subarea
ButteYubaSutter	Gilsizer Slough at George Washington Rd.	GILSL	39.0090	-121.6716	Lower Feather River, Sac. River
ButteYubaSutter	Lower Honcut Creek at Hwy 70	LHNCT	39.3092	-121.5954	Feather River
ButteYubaSutter	Lower Snake R. at Nuestro Rd.	LSNKR	39.1853	-121.7036	Feather River
ButteYubaSutter	Pine Creek at Nord Gianella Rd.(1)	PNCGR	39.7811	-121.9877	Sac. River
ButteYubaSutter	Pine Creek at Highway 32 (1)	PNCHY	39.7534	-121.9712	Sac. River
ButteYubaSutter	Sacramento Slough Bridge near Karnak	SSKNK	38.7850	-121.6533	Sac. River, Northern Delta
ColusaGlenn	Colusa Basin Drain above Knight's Landing	COLDR	38.8121	-121.7741	Sac. River
ColusaGlenn	Rough and Ready Pumping Plant (RD 108)	RARPP	38.8621	-121.7927	Sac. River, NW Delta
ColusaGlenn	Walker Creek near 99W and CR33	WLKCH	39.6242	-122.1965	Sac. River
PNSSNS	Coon Creek at Striplin Rd.	CCSTR	38.8661	-121.5803	Sac. River
SacramentoAmador	Cosumnes River at Twin Cities Rd.	CRTWN	38.2910	-121.3804	Eastern Delta
SacramentoAmador	Grand Island Drain near Leary Rd.	GIDLR	38.2399	-121.5649	Northern Delta
SolanoYolo	Shag Slough at Liberty Island Bridge	SSLIB	38.3068	-121.6934	NW Delta
SolanoYolo	Ulatis Creek at Brown Road	UCBRD	38.3070	-121.7940	NW Delta
SolanoYolo	Willow Slough Bypass at Pole Line	WLSPL	38.5902	-121.7306	NW Delta

Note:

(1) Beginning February 2014, the Pine Creek monitoring site was moved downstream from PNCGR to PNCHY.

Monitoring Results

All TMDL data through September 2014 have been previously submitted to the Regional Board as required by the ILRP. A complete set of relevant monitoring data for compliance sites for 2005 through September 2014 is also provided in **Appendix A**.

DATA INTERPRETATION

Assessment of Data Quality Objectives

The data quality objectives for the TMDL monitoring effort are described in the Coalition's Quality Assurance Project Plan (QAPP) for the ILRP. All quality assurance (QA) for TMDL compliance monitoring is integrated into the Coalition's ILRP monitoring program. These results have been submitted to the Regional Board on a quarterly basis, as required by the ILRP.

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, and sampling precision is assessed by analyzing field-collected sample replicates. Analytical accuracy is assessed by routine calibration and analysis of a laboratory-prepared matrix and by addition of surrogate organic compounds to sample matrices. Based on the results of field and laboratory QA analyses, precision and accuracy met program data quality objectives and were adequate for the purposes of the monitoring compliance program.

Completeness is defined as the percent of planned data that was successfully collected and analyzed. Approximately 96% of samples planned for October 2013 through September 2014 were successfully collected and analyzed. Based on the total number of planned and analyzed samples, overall completeness for planned chlorpyrifos and diazinon analyses for January 2009 through September 2014 was 101% (**Table 3**). All planned 2014 TMDL compliance parameters have been successfully collected and analyzed, with the following exceptions.

- One sample for Lower Snake River (LSNKR) was not collected due to an error in sample plan preparation.
- Two of the three samples planned for Cosumnes River (CRTWN) were not collected because the site was dry in October of 2013 and September of 2014.
- One of the five samples planned for Walker Creek near 99W and CR33 (WLKCH) was not collected in September of 2014 because the site was dry.
- Flow measurements could not be collected for all sites and events due to site access or site conditions during some events. This prevented calculation of loads for two chlorpyrifos detections at Pine Creek at Highway 32 (PNCHY²) and two chlorpyrifos detections at Lower Honcut Creek at Highway 70 (LHNCT) (**Table 6**). In 2014, loads were successfully characterized for 133 of 136 total TMDL compliance results (98%).

² The flow measurement during one of the Pine Creek events was estimated visually to be 0 cfs.

Table 3. TMDL Compliance Sampling Completeness Summary

Compliance Site	JAN 2009 – SEP 2013		OCT 2013 – SEP 2014		JAN 2009 – SEP 2014		Note
	Planned	Collected	Planned	Collected	Planned	Collected	
Colusa Basin Drain above KL	28	29	5	5	33	34	
Coon Creek at Striplin Road	17	17	4	4	21	21	
Cosumnes River at Twin Cities Road	17	13	3	1	20	14	(2)
Gilsizer Slough at George Washington Road	19	21	6	6	25	27	
Grand Island Drain near Leary Road	19	21	9	9	28	30	
Lower Honcut Creek	25	26	5	5	30	31	
Lower Snake River at Nuestro Road	23	26	6	5	29	31	(3)
Pine Creek (1)	20	18	4	4	24	22	
Rough and Ready Pumping Plant (RD 108)	22	23	6	6	28	29	
Sacramento Slough bridge near Karnak	20	21	4	4	24	25	
Shag Slough at Liberty Island Bridge	28	29	3	3	31	32	
Ulatis Creek at Brown Road	27	27	6	7	33	34	
Walker Creek near 99W and CR33	27	25	5	4	32	29	(4)
Willow Slough Bypass at Pole Line	27	30	5	5	32	35	
Totals	319	326	71	68	390	394	
Percent Completeness		102%		96%		101%	

Notes:

(1) Beginning Event 96, the Pine Creek monitoring site was moved from Nord Gianella Road (PNCGR) to Highway 32 (PNCHY).

(2) Samples were not collected in October of 2013 and August 2014 because the site was dry.

(3) The June 2014 sample for Lower Snake River was inadvertently omitted from the sample plan.

(4) Samples were not collected in September 2014 because the site was dry.

Comparison with TMDL Objectives and Discussion of Exceedances

A summary of the results of the analyses of water quality samples collected January 2009 through September 2014 for TMDL compliance monitoring is presented in **Table 4** and **Table 5**. Instantaneous loads were also calculated for all compliance sites. Loads were calculated as:

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

Where, *Load* is the instantaneous load expressed in g/day,

Q = instantaneous discharge in CFS

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

UCF = a unit conversion factor of 2.4446.

Loads for all detected concentrations are provided in **Table 6**.

Table 4. Summary of 2009-2014 TMDL Monitoring Results for Chlorpyrifos

Compliance Site	JAN 2009 – SEP 2013		OCT 2013 – SEP 2014		JAN 2009 – SEP 2014	
	>WQO	Samples	>WQO	Samples	Total >WQO	Total Samples
Colusa Basin Drain above KL		29		5		34
Coon Creek at Striplin Rd.	1	17		4	1	21
Cosumnes River at Twin Cities Rd.		13		1		14
Gilsizer Slough at George Washington Rd.		21	1	6	1	27
Grand Island Drain near Leary Rd.	1	21	1 ⁽³⁾	9	2	30
Lower Honcut Creek		26		5		31
Lower Snake R. at Nuestro Rd.		26		5		31
Pine Creek ⁽¹⁾	5 ⁽²⁾	18	1	4	6	22
Rough and Ready Pumping Plant (RD 108)		23		6		29
Sacramento Slough bridge near Karnak		21		4		25
Shag Slough at Liberty Island Bridge	1	29		3	1	32
Ulatis Creek at Brown Rd.	4	27		7	4	34
Walker Creek near 99W and CR33	1	25		4	1	29
Willow Slough Bypass at Pole Line	2	30		5	2	35
<i>Totals</i>	15	326	3	68	18	394

Note:

- (1) Beginning Event 96, the Pine Creek monitoring site was moved from Nord Gianella Road (PNCGR) to Highway 32 (PNCHY).
- (2) Exceedances at Pine Creek occurred in isolated ponded water with no flow. Review of data indicates that 3 “exceedances” reflect degradation of the original elevated concentration and not additional discharges of chlorpyrifos.
- (3) The associated field replicate result (0.16 µg/L) collected on 2/10/2014 also exceeded the WQO.

Table 5. Summary of 2009-2014 TMDL Monitoring Results for Diazinon

Compliance Site	JAN 2009 – SEP 2013		OCT 2013 – SEP 2014		JAN 2009 – SEP 2014	
	>WQO	Samples	>WQO	Samples	Total >WQO	Total Samples
Colusa Basin Drain above KL		29		5		34
Coon Creek at Striplin Road		17		4		21
Cosumnes River at Twin Cities Rd		13		1		14
Gilsizer Slough at George Washington Rd	2	21		6	2	27
Grand Island Drain near Leary Rd	1 ⁽²⁾	21	1 ⁽³⁾	9	2	30
Lower Honcut Creek		26		5		31
Lower Snake R. at Nuestro Rd		26		5		31
Pine Creek ⁽¹⁾		18		4		22
Rough and Ready Pumping Plant (RD 108)		23		6		29
Sacramento Slough bridge near Karnak		21		4		25
Shag Slough at Liberty Island Bridge		29		3		32
Ulatis Creek at Brown Rd		27		7		34
Walker Creek near 99W and CR33		25		4		29
Willow Slough Bypass at Pole Line		30		5		35
<i>Totals</i>	3	326		68	4	394

Notes:

(1) Beginning Event 96, the Pine Creek monitoring site was moved from Nord Gianella Road (PNCGR) to Highway 32 (PNCHY).

(2) Exceedance occurred in one of two field replicate samples

(3) The associated field replicate result (0.1672 µg/L) collected on 10/29/2013 also exceeded the WQO.

Compliance with Concentration-Based and Load-Based TMDL Objectives

Concentrations of chlorpyrifos and diazinon were compared to the adopted Basin Plan amendment objectives for the Sacramento and Feather Rivers and Delta. All detected concentrations are presented in **Table 6**.

Chlorpyrifos

In 2014, chlorpyrifos was detected in 18 of 68 samples (26%) collected at the 14 compliance monitoring locations. A total of three samples (4.4% of samples) exceeded the adopted Basin Plan amendment 4-day objective for chlorpyrifos (0.015 µg/L) and the 1-hour objective (0.025 µg/L). The exceedances occurred at Grand Island Drain (February 10, 2014), Pine Creek (June 18, 2014), and Gilsizer Slough (July 15, 2014).

Grand Island Drain (Event 96)

There were 8 reported applications of chlorpyrifos in the month prior to the February 10, 2014 exceedance. Chlorpyrifos was applied to approximately 174 acres of apples in the Grand Island Drain drainage during the month of February 2014. All of the applications were made on February 7, 2014, three days prior to the observed exceedance, and all were ground applications. Although standing water was present in the drain, there was no observable or detectable flow at this site. The area received approximately 2.8 inches of rain³ in the month preceding the exceedance, 2.64 inches of which occurred in the five days preceding the exceedance. Toxicity tests for *Ceriodaphnia*, *Pimephales*, and *Selenastrum* were performed with this sample, and no toxicity was observed.

Pine Creek (Event 100)

There were 56 reported applications of chlorpyrifos in the month prior to the June 18, 2014 exceedance. Chlorpyrifos was applied to approximately 8,288 acres of walnuts in the Pine Creek drainage during that time. Although standing water was present in the creek, there was no observable flow at this site. The area received only trace amounts of rain⁴ in the month preceding the exceedance. Approximately 424 acres of walnuts were treated aerially [239 on May 18, 2014 (average wind speed = 14 mph) and 185 on June 16, 2014 (two days before the exceedance) (average wind speed = 14 mph)]. Due to the lack of precipitation and flow at this site, the detected chlorpyrifos in this sample was likely due to residual drift from the aerial applications. Toxicity tests for *Ceriodaphnia*, *Pimephales*, and *Selenastrum* were performed with this sample, and no toxicity was observed.

Gilsizer Slough (Event 101)

There were 11 reported applications of chlorpyrifos in the month prior to the July 15, 2014 exceedance. Chlorpyrifos was applied to approximately 291 acres of walnuts in the Gilsizer Slough drainage during the months of June and July. Although standing water was present in the

³ Based on precipitation data from CDEC site “Georgiana Slough (GGS)” (<http://cdec.water.ca.gov/cdecstation/?staid=ggs>)

⁴ Based on precipitation data from CDEC site “Chico (CHI)” (<http://cdec.water.ca.gov/cdecstation/?staid=chi>)

creek, there was no observable flow at this site. The area received no rain⁵ in the month preceding the exceedance. No aerial applications were performed. No toxicity tests were performed for these samples.

Diazinon

In 2014, diazinon was detected in 1 of 68 samples (1.5%) collected at the 14 compliance monitoring locations. The detected concentration exceeded the adopted Basin Plan amendment 4-day objective for diazinon (0.10 µg/L) but did not exceed the 1-hour objective (0.16 µg/L).

Grand Island Drain (Event 92)

There were 22 reported applications of diazinon in the month prior to the October 29, 2013 exceedance. Diazinon was applied to approximately 897 acres of pears in the Grand Island Drain drainage during the month of October 2013. The majority of the applications (1,902 pounds to 714 acres) were made between October 23 and 29, just prior to the observed exceedance. All were ground applications. Although standing water was present in the drain, there was no observable or detectable flow at this site. The general Sacramento area did not receive any rain⁶ in the month preceding the exceedance. Toxicity tests for *Ceriodaphnia* and *Pimephales* were performed with this sample, and no toxicity was observed.

The Basin Plan TMDL amendments also implement measures designed to address the additive toxicity of chlorpyrifos and diazinon. Compliance with the TMDL Load Allocations for nonpoint sources was determined using the methodology outlined in the Basin Plan amendments for the Control of Diazinon and Chlorpyrifos Runoff (Resolutions R5-2007-0034 and R5-2006-0061). This methodology takes into account the additive effects of chlorpyrifos and diazinon.

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 *Sum(S)* of one (1.0):

C_D = diazinon concentration in µg/L; analytical results reported as “non-detected” concentrations are considered to be zero

C_C = chlorpyrifos concentration in µg/L; analytical results reported as “non-detected” 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

⁵ Based on precipitation data from CDEC site “Bear River Near Wheatland (BRW)” (<http://cdec.water.ca.gov/cdecstation/?staid=brw>)

⁶ Preliminary monthly climate data (temperature and precipitation) for Sacramento Executive Airport weather station available at: <http://www.weather.gov/climate/index.php?wfo=sto>. The preliminary precipitation data available from nearby CDEC sites “Georgiana Slough (GGS)” (<http://cdec.water.ca.gov/cdecstation/?staid=ggs>) and “Correctional Ctr (CRT)” (<http://cdec.water.ca.gov/cdecstation/?staid=crt>) contain outliers and are not reliable.

In 2014, the three of the four samples that exceeded the individual TMDL concentration objectives also exceeded the 4-day TMDL Load Allocation and 1-hour TMDL Load Allocation based on combined (i.e., additive) chronic toxic units (TUc) (**Table 7**).

Table 6. Load Estimates for Detected Chlorpyrifos and Diazinon, October 2013 – September 2014

Site ID	Water Body	Sample Date	Discharge, CFS	Concentrations, µg/L		Instantaneous Loads, g/day		Notes
				Chlorpyrifos	Diazinon	Chlorpyrifos	Diazinon	
CCSTR	Coon Creek	9/16/2014	2.28	0.0017	ND	0.01	0.00	(1)
GILSL	Gilsizer Slough	7/15/2014	0	0.091	ND	0.00	0.00	(2,3)
GILSL	Gilsizer Slough	8/20/2014	0	0.0142	ND	0.00	0.00	(1,3)
GIDLR	Grand Island Drain	10/29/2013	0	ND	0.1557	0.00	0.00	(2,3)
GIDLR	Grand Island Drain	2/10/2014	0	0.11	ND	0.00	0.00	(2,3)
GIDLR	Grand Island Drain	5/20/2014	0	0.0034	ND	0.00	0.00	(1,3)
GIDLR	Grand Island Drain	6/17/2014	0	0.0028	ND	0.00	0.00	(1,3)
GIDLR	Grand Island Drain	7/15/2014	0	0.0058	ND	0.00	0.00	(1,3)
LHNCT	Lower Honcut Creek	7/16/2014	NM	0.0015	ND	NM	0.00	(1,4)
LHNCT	Lower Honcut Creek	8/20/2014	NM	0.0049	ND	NM	0.00	(1,4)
LSNKR	Lower Snake River	7/16/2014	51.38	0.0029	ND	0.36	0.00	(1)
LSNKR	Lower Snake River	8/20/2014	110.4	0.0076	ND	2.05	0.00	(1)
PNCHY	Pine Creek	6/18/2014	NM ⁽⁵⁾	0.1867	ND	0.00	0.00	(2,4,5)
PNCHY	Pine Creek	7/17/2014	NM	0.0077	ND	NM	0.00	(1,4)
RARPP	Sycamore Slough	7/15/2014	0	0.001	ND	0.00	0.00	(1,3)
RARPP	Sycamore Slough	8/20/2014	0	0.0008 DNQ	ND	0.00	0.00	(1,3)
UCBRD	Ulatis Creek	5/20/2014	44.37	0.0095	ND	1.03	0.00	(1)
UCBRD	Ulatis Creek	6/17/2014	46.33	0.0024	ND	0.27	0.00	(1)
WLKCH	Walker Creek	7/17/2014	0	0.0029	ND	0.00	0.00	(1,3)

Notes: Exceedances of TMDL concentration objectives are highlighted in the table.

NM = Not Measured

ND = Not Detected

(1) Concentrations were below WQO; No contribution to exceedances

(2) Concentrations exceeded WQO

(3) No measureable flow

(4) Unable to measure flows at this site during this event.

(5) Unable to measure flows, zero flow was visually estimated

Table 7. Compliance with Load Capacity Objectives for Detected Chlorpyrifos and Diazinon, October 2013 – September 2014

Site ID	Water Body	Sample Date	Discharge, CFS	Concentrations, µg/L		Load Allocation Compliance ⁽⁸⁾		
				Chlorpyrifos	Diazinon	1-Hour	4-Day Average	Notes
CCSTR	Coon Creek	9/16/2014	2.28	0.0017	ND	0.07	0.11	(1)
GILSL	Gilsizer Slough	7/15/2014	0	0.091	ND	3.64	6.07	(2,3,6,7)
GILSL	Gilsizer Slough	8/20/2014	0	0.0142	ND	0.57	0.95	(1,3)
GIDLR	Grand Island Drain	10/29/2013	0	ND	0.1557	0.97	1.56	(2,3)
GIDLR	Grand Island Drain	2/10/2014	0	0.11	ND	4.40	7.33	(2,3,6,7)
GIDLR	Grand Island Drain	5/20/2014	0	0.0034	ND	0.14	0.23	(1,3)
GIDLR	Grand Island Drain	6/17/2014	0	0.0028	ND	0.11	0.19	(1,3)
GIDLR	Grand Island Drain	7/15/2014	0	0.0058	ND	0.23	0.39	(1,3)
LHNCT	Lower Honcut Creek	7/16/2014	NM	0.0015	ND	0.06	0.10	(1,4)
LHNCT	Lower Honcut Creek	8/20/2014	NM	0.0049	ND	0.20	0.33	(1,4)
LSNKR	Lower Snake River	7/16/2014	51.38	0.0029	ND	0.12	0.19	(1)
LSNKR	Lower Snake River	8/20/2014	110.4	0.0076	ND	0.30	0.51	(1)
PNCHY	Pine Creek	6/18/2014	NM	0.1867	ND	7.47	12.45	(2,5,6,7)
PNCHY	Pine Creek	7/17/2014	NM	0.0077	ND	0.31	0.51	(1,4)
RARPP	Sycamore Slough	7/15/2014	0	0.001	ND	0.04	0.07	(1,3)
RARPP	Sycamore Slough	8/20/2014	0	0.0008 DNQ	ND	0.03	0.05	(1,3)
UCBRD	Ulatis Creek	5/20/2014	44.37	0.0095	ND	0.38	0.63	(1)
UCBRD	Ulatis Creek	6/17/2014	46.33	0.0024	ND	0.10	0.16	(1)
WLKCH	Walker Creek	7/17/2014	0	0.0029	ND	0.12	0.19	(1,3)

Notes: Exceedances of TMDL concentration objectives are highlighted

NM = Not Measured

ND = Not Detected

(1) Concentrations were below WQO; No contribution to exceedances

(2) Concentrations exceeded WQO

(3) No measureable flow, therefore no loads to downstream TMDL receiving waters

(4) Unable to measure flows at this site during this event.

(5) Unable to measure flows, zero flow was visually estimated

(6) Concentrations exceeded 4-day average based Load Allocation

(7) Concentrations exceeded 1-hour average based Load Allocation

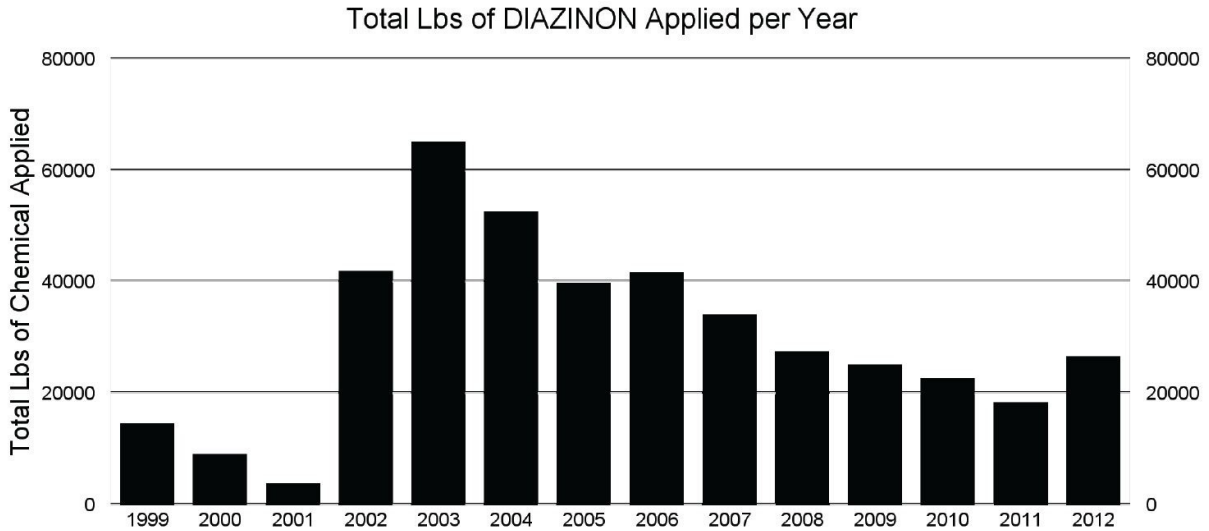
(8) Compliance is assessed based on the sum of chlorpyrifos and diazinon TUc; Exceedances are indicated for values greater than 1.0 (highlighted values).

Discussion

The California Department of Pesticide Regulation has documented the decline in use of insecticide organophosphate chemicals, including chlorpyrifos and diazinon, for nearly every year since 1995. Statewide diazinon use decreased by 88% and chlorpyrifos use decreased by 53% from 1996 to 2010.^{7,8} In the five Coalition subwatersheds in the TMDL compliance region (Butte-Yuba-Sutter; Glenn-Colusa; Placer-Nevada-South Sutter-North Sacramento; Sacramento-Amador; Solano-Yolo), substantial decreases are also evident for diazinon, but the pattern is somewhat different for chlorpyrifos. As illustrated in **Figure 1**, agricultural diazinon use decreased by about 60% in these five subwatersheds from 2003-2012. In contrast, chlorpyrifos use in the region increased from 2001 to 2005, but has since decreased from these peak levels (**Figure 2**), although less consistently than diazinon. The recent period of decreasing trend in chlorpyrifos use coincides with the monitoring timeframe of the ILRP.

⁷ <http://www.cdpr.ca.gov/docs/pur/pur06rep/trends06.pdf>, California Department of Pesticide Regulation, 2007

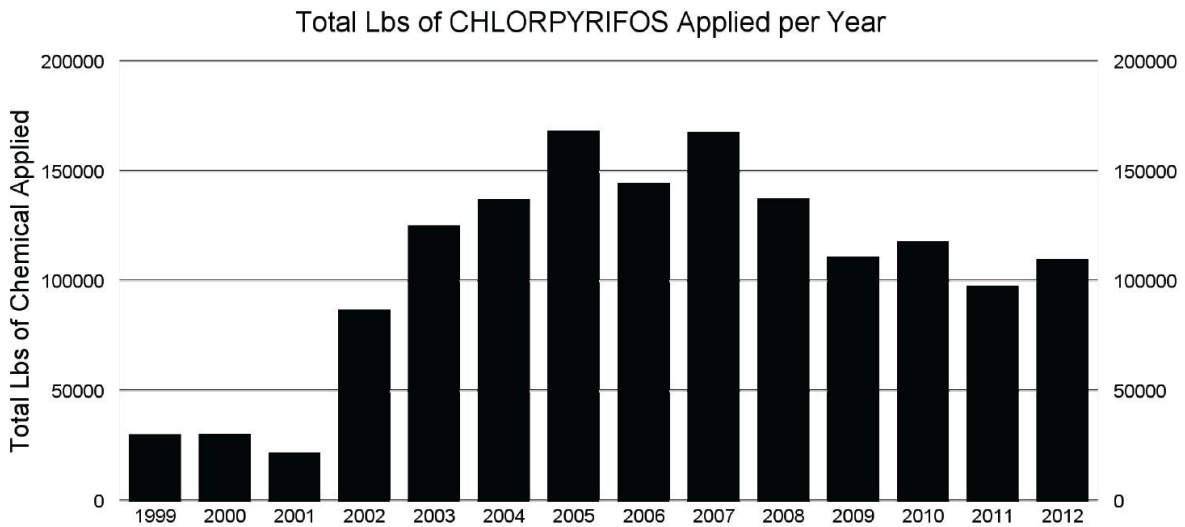
⁸ <http://www.cdpr.ca.gov/docs/pur/pur10rep/tables/table8.pdf>, California Department of Pesticide Regulation, 2011



Source Category: IRR AG

Figure 1. Trends in Agricultural Use of Diazinon

Data are for the five Coalition subwatersheds in the TMDL compliance region (Butte-Yuba-Sutter; Glenn-Colusa; Placer-Nevada-South Sutter-North Sacramento; Sacramento-Amador; Solano-Yolo) from California Department of Pesticide Regulation PUR Database.



Source Category: IRR AG

Figure 2. Trends in Agricultural Use of Chlorpyrifos

Data are for the five Coalition subwatersheds in the TMDL compliance region (Butte-Yuba-Sutter; Glenn-Colusa; Placer-Nevada-South Sutter-North Sacramento; Sacramento-Amador; Solano-Yolo) from California Department of Pesticide Regulation PUR Database.

From January 2005 through September 2014, there have been 568 samples collected for the ILRP and analyzed for chlorpyrifos and diazinon at the 14 compliance sites. Results for Coalition ILRP monitoring at TMDL compliance sites are summarized in **Table 8**.

Table 8. Summary of Chlorpyrifos and Diazinon Exceedances in Coalition ILRP Monitoring at TMDL Compliance Sites, 2005-2014

Data for Coalition subwatersheds in the TMDL region (Butte-Yuba-Sutter, Colusa-Glenn, Placer-Nevada-South Sutter-North Sacramento, Sacramento-Amador, Solano, Yolo)

Constituent	Exceedances	Non-Exceedances	Total Samples
Chlorpyrifos	28	539	567
Diazinon	7	560	567

There have been a total of 35 exceedances of chlorpyrifos and diazinon (approximately 6% of all samples) observed in Coalition ILRP monitoring at the TMDL compliance sites. Of the 35 total exceedances, 28 have been for chlorpyrifos (~5% of total samples) and six have been for diazinon (~1.2% of total samples). These exceedances have been observed at nine of 14 compliance sites, with seven sites having more than one exceedance. At five of the sites identified as compliance sites, there have been no exceedances observed in ILRP monitoring. In the 68 samples collected and analyzed for 2014 TMDL compliance monitoring, there were four exceedances at three sites. The rates of exceedance have been highly variable from year to year, but the longer trend appears to be a decrease in exceedances at the compliance sites (**Figure 3**).

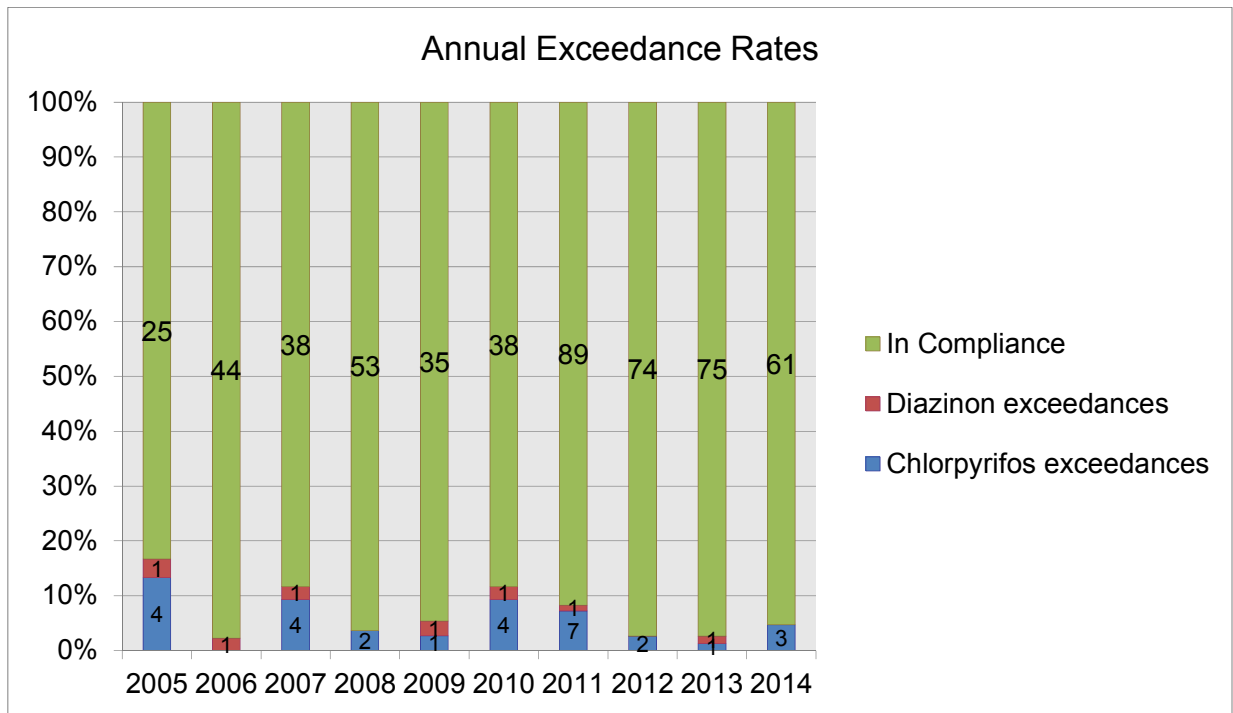


Figure 3. Annual Exceedance Rates at TMDL Compliance Sites, 2005-2014

Annual exceedance rates are calculated as the number of exceedances for each pesticide divided by the total number of samples analyzed for the year. Value labels indicate actual number of samples in compliance or exceedances for each pesticide.

COMPLIANCE WITH LOAD ALLOCATIONS IN THE TMDL RECEIVING WATER BODIES

In separate TMDL monitoring conducted previously from 2006 to 2008 by the Coalition, there were two diazinon exceedances observed at one of the compliance sites (Colusa Drain) in 2008,⁹ and there were no exceedances observed in 2006 and 2007. Chlorpyrifos was not detected in any TMDL sample collected from the five TMDL monitoring locations sampled from 2006-2008 (Sacramento River at Colusa, Colusa Basin Drain above Knight’s Landing, Sacramento Slough, Feather River above Yuba City, and Feather River near Verona). Although two diazinon 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 monitoring results for the Sacramento and Feather River diazinon TMDL indicate that the combination of outreach and education, the increased awareness and the resulting changes in diazinon use patterns and management practices, and the modifications to labeling have been successful in reducing instream ambient chlorpyrifos and diazinon concentrations and loads below the historically observed levels that resulted in listing the Sacramento River and Feather River as impaired for chlorpyrifos and diazinon. The relatively low rate of exceedances observed in the current TMDL compliance

⁹ Diazinon Runoff Management Plan for Orchard Growers in the Sacramento Valley: 2008 Annual Report. Sacramento Valley Water Quality Coalition. June 2008.

monitoring of the tributaries to these water bodies further indicates that the TMDL objectives will continue to be met.

The TMDL compliance monitoring conducted from 2006-2008 in the named TMDL water bodies indicated that conditions have improved and that these water bodies are generally in compliance with the TMDL. After 2008, continued compliance with the TMDL in the named TMDL water bodies has been assessed indirectly through analysis of monitoring conducted primarily in tributary water bodies (see **Table 2**). The TMDL compliance monitoring from 2009-2014 was conducted at Coalition monitoring sites that were selected to be representative of the larger drainage areas that contribute flows and pollutant loads to the receiving water bodies specifically identified for compliance in the TMDL.

Data from the compliance sites monitored from 2009 to 2014 can be used in a number of ways to evaluate whether compliance in named TMDL water bodies is continuing and/or improving. The following scenarios were evaluated for TMDL receiving waters for all cases where compliance monitoring site concentrations exceeded or equaled the 1 TUc concentration-based Load Allocation.

Scenario 1: No Upstream Receiving Water Loads

The first level of evaluation is to determine whether the loads observed in the individual monitored water bodies were sufficient to *directly cause* exceedances in the named TMDL receiving water bodies. This was accomplished by simple mass load calculations based on the measured loads in the compliance sites and a conservative estimate of the receiving water discharge volume. The receiving water discharges were based on measured flows in Delta tributaries and tidal fluxes for the Delta (Liberty Island) reported by the Department of Water Resources California Data Exchange Center (CDEC)¹⁰. The relationship between all monitoring sites and receiving water flow sites is illustrated in **Figure 4**.

This initial evaluation assumes no chlorpyrifos or diazinon loads (TUc = 0) in the upstream receiving water. This analysis estimated that dilution of loads from the monitored TMDL compliance sites with an exceedance in 2014 (GILSL, GIDLR, and PNCHY) would result in TMDL receiving water concentrations of 0.00 TUc (**Table 9**, Scenario 1) because there was no measurable flow associated with each exceedance.

¹⁰ CDEC Historical Data Selector available at: <http://cdec.water.ca.gov/selectQuery.html>

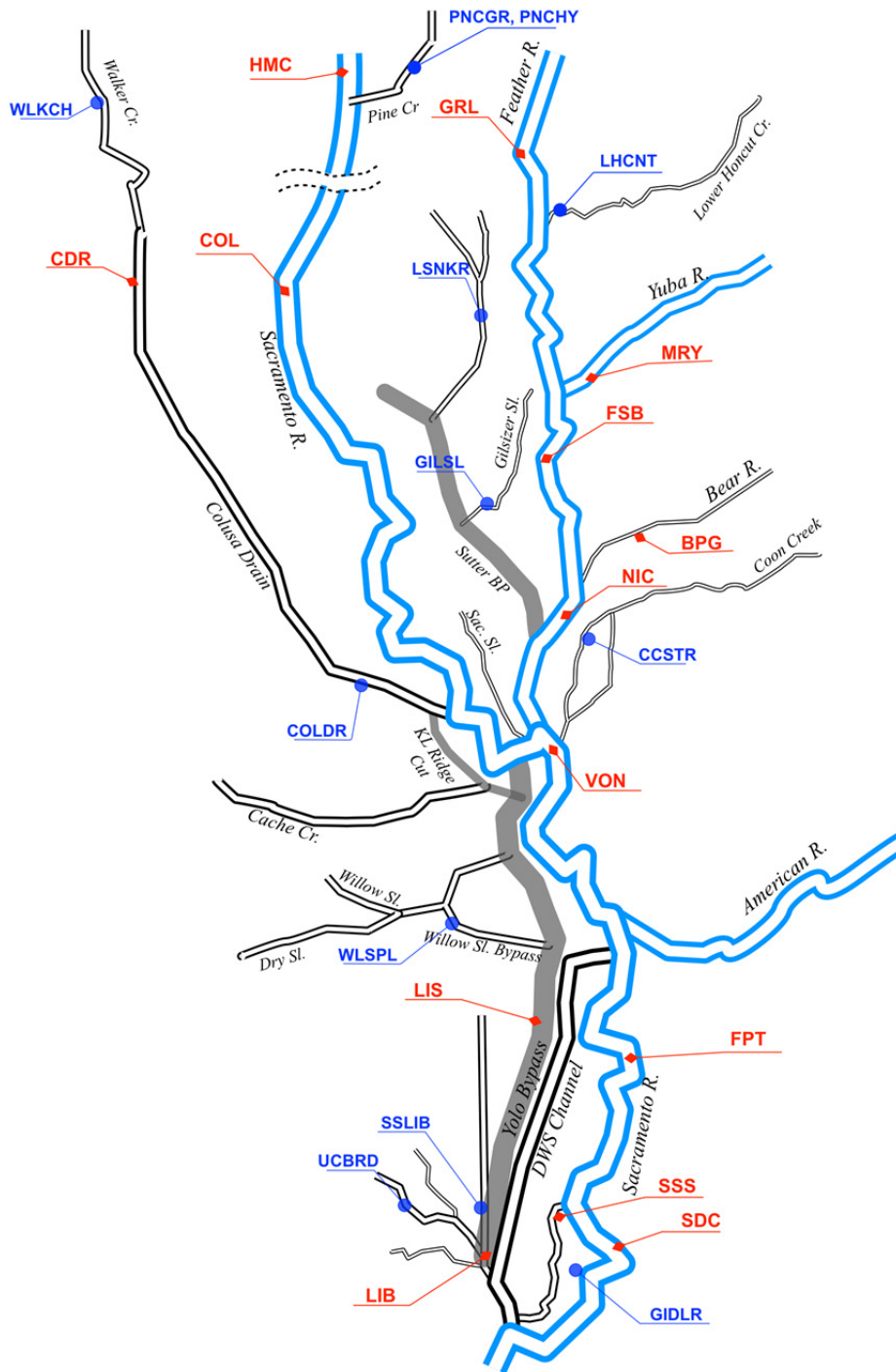


Figure 4. Compliance and Flow Monitoring Sites used for Analysis of Receiving Water Impacts
 (Key to sites on following page)

Feature	KEY	Description
Monitoring Sites	WLKCH	Walker Creek at 99W and CR33
	PNCGR	Pine Creek at Nord Gianella Rd.
	PNCHY	Pine Creek at Highway 32
	LHCNT	Lower Honcut Creek at Hwy 70
	LSNKR	Lower Snake River at Nuestro Rd.
	GILSL	Gilsizer Slough at G. Washington Rd.
	CCSTR	Coon Creek at Striplin Rd.
	COLDR	Colusa Basin Drain above Knight's Landing
	WLSPL	Willow Slough Bypass at Pole Line
	SSLIB	Shag Slough at Liberty Island Bridge
	UCBRD	Ulatis Creek at Brown Road
	GIDLR	Grand Island Drain near Leary Rd.
Flow Sites	HMC	Sac. R. at Hamilton City
	COL	Sac. R. at Colusa
	VON	Sac. R. at Verona
	FPT	Sac. R. at Freeport
	SDC	Sac. R. at the Delta Cross-Channel
	CDR	Colusa Drain at Highway 20
	LIS	Yolo Bypass at Lisbon
	LIB	Liberty Island at S. Center End
	SSS	Steamboat Slough between Sutter Slough and Sac. River
	GRL	Feather River at Gridley
	FSB	Feather River above Star Bend
	MRY	Yuba River at Marysville
	BPG	Bear River at Pleasant Grove

Scenario 2: Upstream Receiving Water Loads Equivalent to Additional Represented Loads Extrapolated From Compliance Site

This evaluation uses the same methods as Scenario 1 above, but assumes that the loads in the *upstream* receiving waters are equal to the additional loads from the irrigated acreage represented by the compliance site where the exceedance was observed. The additional loads from the represented irrigated acres were extrapolated from the compliance site loads using the following extrapolation factor:

$$\left(\frac{\text{Represented Irrigated Acres}}{\text{Compliance Drainage Irrigated Acres}} \right) \times \text{Compliance Site Frequency of Exceedance}$$

... where the ratio of irrigated acres accounts for that additional represented acreage, and the frequency of exceedance (for 2009 through the current reporting year) accounts for the probability of individual represented drainages exceeding the concentration-based Load Allocation.

This analysis also estimates that dilution of loads from the monitored TMDL compliance sites (GILSL, GIDLR, and PNCHY) and represented irrigated acres would result in TMDL receiving water concentrations less than 0.001 TUc (**Table 9**, Scenario 2).

Scenario 3: Reasonable “Worst Case,” Upstream Receiving Water Loads Approaching Load Allocation

This evaluation also uses the same methods as Scenarios 1 and 2, but assumes that the cumulative loads in the *upstream* receiving waters are 90% of the TMDL concentration-based Load Allocation (i.e., 0.9 TUc). This scenario represents a reasonable “worst case” scenario for receiving water conditions coinciding with exceedances in the compliance sites. The addition of the observed load from the compliance sites (GILSL, GIDLR, and PNCHY) would not cause the receiving waters to exceed the concentration-based TMDL Load Allocation of 1 TUc under this scenario.

Summary of Evaluation of Compliance with Load Allocations

Continued compliance in the TMDL named water bodies with the TMDL concentration-based Load Allocations can also be inferred from several lines of evidence:

- Past compliance in TMDL water bodies has been demonstrated through direct monitoring of the named TMDL water bodies.
- Use of diazinon and chlorpyrifos in the Sacramento Valley watersheds that drain to these TMDL water bodies continues to decrease or remain constant.
- There is a decreasing trend in the frequency of exceedances for chlorpyrifos and diazinon at the currently monitored TMDL compliance monitoring sites.
- In 2010, the Feather River was removed from the 303(d) list for impairment due to diazinon.
- Loads represented by exceedances observed at individual Coalition TMDL compliance monitoring sites are not sufficient to directly cause an exceedance in the named TMDL water bodies under reasonably expected receiving water conditions (**Table 9**, Scenario 1).

- Loads and exceedance rates extrapolated from representative compliance sites to larger represented regions are also extremely unlikely to cause exceedances in the named TMDL water bodies (**Table 9**, Scenario 2).
- Loads represented by exceedances observed at individual Coalition TMDL compliance monitoring sites are not sufficient to directly cause an exceedance in the named TMDL water bodies under reasonably worst-case upstream receiving water conditions (**Table 9**, Scenario 3).

Additional qualitative evidence supporting continued compliance is represented by the ongoing outreach and education efforts to address chlorpyrifos and diazinon exceedances throughout the Coalition area. Outreach specific to the exceedances observed in 2014 is discussed below (Outreach and Follow-Up Regarding TMDL Exceedances). As these efforts continue, it is reasonable to assume that management of pesticide applications and runoff will continue to improve and that exceedances in contributing tributaries and named TMDL receiving waters will continue to decrease in frequency and magnitude.

Changes that were implemented in Yolo County to classify chlorpyrifos and diazinon as restricted materials have also proven successful in further increasing compliance. ILRP monitoring conducted at Yolo County sites since the implementation in 2007 of these additional label and use restrictions have resulted in only five additional exceedances in a total of 102 samples at the compliance site sampled in the Yolo subwatershed (Willow Slough).

In 2015, chlorpyrifos will also be regulated statewide as a restricted material, with similar restrictions to those in Yolo County. The new state-restricted status requires that that all chlorpyrifos products registered for production agricultural use must adhere to the additional requirements for all California restricted materials:

- Applications must be made or supervised by a certified applicator.
- Purchase, possession, or use requires the property operator to obtain a permit from the county agricultural commissioner.
- Businesses require a recommendation from a DPR licensed pest control adviser.

Additionally, the Coalition submitted formal requests to the Executive Officer of the Regional Board for completion of chlorpyrifos management plans in two drainages (Walker Creek and Lower Snake River) in 2013 on the basis that these drainages are meeting water quality objectives. The Walker Creek management plan was approved as complete in January 2014, and the Lower Snake River management plan was approved as complete in March 2015.

Table 9. Estimated TMDL Receiving Water Body Loads From Compliance Sites and Represented Areas

Compliance Site Water Body	Sample Date	4-Day Average TUC for Compliance Site	TMDL Receiving Water	Receiving Water Discharge Estimate, cfs ⁽¹⁾	Basis for Receiving Water Discharge Estimate	Compliance site drainage irrigated acres	Represented total irrigated acres	Frequency of Exceedance for compliance monitoring site (2009-2012)	Load extrapolation factor ⁽²⁾	Represented additional load ⁽³⁾ , TUC	TMDL Receiving Water Estimation Scenarios ⁽⁴⁾		
											1. Estimated TMDL RW Concentration when upstream load is 0, TUC	2. Estimated downstream TMDL RW Concentration including additional represented load, TUC	3. Estimated downstream TMDL RW Load when upstream concentration assumed to be 0.9, TUC
Gilsizer Slough at George Washington Road	7/15/2014	6.07	Feather River (via Sutter Bypass)	4289	Feather River above Star Bend + Bear River	22655	179576	3.7%	0.256	1.555	0.00	0.00036	0.90
Grand Island Drain near Leary Road	10/29/2013	1.56	Delta (Sacramento River at Cross channel)	5000	Measured in Sac. River	102443	1024434	6.67%	0.6	0.935	0.00	0.00019	0.90
Grand Island Drain near Leary Road	2/10/2014	7.33	Delta (Sacramento River at Cross channel)	10500	Measured in Sac. River	102443	1024434	6.67%	0.6	4.402	0.00	0.00042	0.90
Pine Creek at Highway 32	6/18/2014	12.45	Sacramento River at Hamilton City	6423	Measured at Hamilton City	28384	77641.3	27.3%	0.474	5.897	0.00	0.00092	0.90

Notes:

- (1) Receiving Water Discharge Estimate = measured or estimated instantaneous discharge for the receiving water
- (2) Load Extrapolation Factor = (Represented area irrigated acres + Compliance site irrigated acres) X compliance site exceedance percentage
- (3) Represented Additional Load = Monitoring site load X Load Extrapolation Factor
- (4) Estimates of TUC concentration in the TMDL Receiving Water Body, calculated using standard mass balance methods, for comparison to TUC Load Allocation of 1 TU.
 Scenario 1 assumes a concentration of 0 TUC in the upstream TMDL Receiving Water Body. The resulting RW TU concentration is thus based on dilution of Compliance site load only.
 Scenario 2 assumes TUC load in the upstream TMDL Receiving Water Body is based on the represented additional load extrapolated from the compliance site. This scenario represents the most realistic RW TU concentration estimate.
 Scenario 3 assumes (very conservatively) a concentration of 0.9 TUC in the upstream TMDL Receiving Water Body. This scenario represents a "worst-case" RW TU concentration estimate.

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OUTREACH AND FOLLOW-UP REGARDING TMDL EXCEEDANCES

Follow-up actions and source evaluations for exceedances in the TMDL water bodies and tributaries have been reported in past annual monitoring reports, Management Plan Progress Reports, or will be reported in future versions of these reports. Typically, the first step taken is to analyze the pesticide application data from the California Department of Pesticide Regulation (CDPR) Pesticide Use Reporting database. All users that were considered to have the potential to contribute to observed chlorpyrifos or diazinon exceedances were contacted directly to inform them of the exceedances and of appropriate management practices to reduce the risk of future exceedances.

Descriptions of the outreach and education activities conducted by the Coalition's subwatersheds in 2014 are provided in Appendix F (*SVWQC Outreach Materials*) of the Coalition's 2014 Annual Monitoring Report.

Butte Yuba Sutter Water Quality Coalition (Gilsizer Slough and Pine Creek)

Targeted outreach was conducted by the Butte Yuba Sutter Water Quality Coalition in response to the chlorpyrifos exceedances in Gilsizer Slough and Pine Creek. Specific actions taken in 2014 to address the exceedances include the following:

- In response to the June 18, 2014 chlorpyrifos exceedance, the Butte Yuba Sutter Water Quality Coalition conducted the following outreach:
 - September 11, 2014 and November 10, 2014: Letters were mailed to four members and PCAs serving members of the Butte Yuba Sutter Water Quality Coalition notifying them of the exceedance and reminding them to be mindful of the weather and other conditions when planning to apply chemicals, to follow all instructions on the label, and to apply only what is necessary. The letters also provided details on the December outreach meeting.
 - December 10, 2014: An outreach meeting was held at the Butte County Agricultural Commissioner's Office in Oroville to discuss appropriate BMPs to prevent future exceedances. Three members and one PCA attended this meeting.
- In response to the July 15, 2014 chlorpyrifos exceedance, the Butte Yuba Sutter Water Quality Coalition conducted the following outreach:
 - September 16, 2014 and December 8, 2014: Letters were mailed to four members notifying them of the exceedance and reminding them to be mindful of the weather and other conditions when planning to apply chemicals, to follow all instructions on the label, and to apply only what is necessary.

Sacramento Amador Water Quality Coalition (Grand Island Drain)

Targeted outreach was conducted by the Sacramento Amador Water Quality Coalition in response to the chlorpyrifos and diazinon exceedances in Grand Island Drain. Specific actions taken in 2014 to address the exceedances include the following:

- In response to the February 10, 2014 chlorpyrifos exceedance, the Sacramento Amador Water Quality Coalition conducted the following outreach:
 - February 28, 2014: A meeting was held in Herald, California, where overall monitoring results, including the chlorpyrifos exceedance, and appropriate BMPs were discussed with 15 attendees.
 - April 11, 2014: A Spring 2014 newsletter was sent to 715 members notifying them of the 2013 pesticide exceedances and reminding them to implement appropriate BMPs for pesticide application.
 - March 20, 2014: A meeting was held in Wilton, California, where overall monitoring results, including the chlorpyrifos exceedance, and appropriate BMPs were discussed with 20 attendees.
 - June 18, 2014: A monthly report summarizing the overall monitoring results, including the chlorpyrifos exceedance, was presented at the Amador Resource Conservation District to six attendees.
 - December 2014: A Farm Evaluation Plan reminder letter was sent to 715 members that also included a note regarding the chlorpyrifos exceedance and a request to review and implement appropriate BMPs.
 - December 11, 16, and 17, 2014: Meetings were held in Amador County where overall monitoring results, including the chlorpyrifos exceedance, and appropriate BMPs were discussed with 30 attendees (at each meeting).
 - March 2015: An Irrigated Lands Program Update was sent to 2,765 members reminding them of the chlorpyrifos exceedance and asking them to continue to implement appropriate BMPs.
- In response to the October 29, 2013 diazinon exceedance, the Sacramento Amador Water Quality Coalition conducted the following outreach:
 - January 14, 2014: A monthly report summarizing the overall monitoring results, including the diazinon exceedance, was presented at the Amador Resource Conservation District to six attendees.
 - April 11, 2014: A Spring 2014 newsletter was sent to 715 members notifying them of the diazinon exceedance and reminding them to implement appropriate BMPs.
 - December 11, 16, and 17, 2014: Meetings were held in Amador County where overall monitoring results, including the diazinon exceedance, and appropriate BMPs were discussed with 30 attendees (at each meeting).

TOXICITY AND ADDITIONAL PESTICIDE RESULTS

The results of pesticide monitoring in 2014 are reported in the Coalition's 2014 Annual Monitoring Report. There were 4,251 individual pesticide results analyzed in 185 water column samples (including 28 duplicates) collected from 22 different sites during 2014 Coalition Monitoring. Analyses were conducted for organophosphates, carbamates, organochlorines, benzophenyls, pyrethroids, and a variety of herbicides. Approximately 70% of samples had no detected pesticides, and more than 98.2% of all pesticide results were below detection.

Determine Whether the Discharge Causes or Contributes to a Toxicity Impairment Due to Additive or Synergistic Effects of Multiple Pollutants (Goal 6)

Pesticides detected in 2014 that have modes of action that are potentially additive to chlorpyrifos and diazinon included dimethoate and malathion. These pesticides are typically detected much less frequently than chlorpyrifos or diazinon. In 2014, the insecticide dimethoate was detected in seven samples from three sites (Cosumnes River, Grand Island Drain, and Rough and Ready Pumping Plant) and none of the detections exceeded the California Department of Public Health Notification Level (1.0 µg/L). The insecticide malathion was detected in one sample (Middle Creek) which was an exceedance of the Basin Plan prohibition.

There were 24 reported applications of malathion to more than 253 acres of walnuts and 1,230 acres of wild rice in the Middle Creek drainage in the month prior to the exceedance observed on September 16, 2014. The area received no rain¹¹ in the month preceding the exceedance, and all applications were made by ground. The detected concentration (0.0115 µg/L) is below concentrations expected to cause toxicity to sensitive invertebrates (0.5 µg/L *Daphnia magna* 2-day EC50, USEPA ECOTOX database). Toxicity tests for *Ceriodaphnia* and *Pimephales* were performed with this sample, and no toxicity was observed. Based on the method of the TMDL for estimating additive toxicity, and since both chlorpyrifos and diazinon were not detected in this particular sample, the combined effects of detected pesticides were determined not to cause toxicity.

Reviewing the results of the past four monitoring years indicates that toxicity due to additive or synergistic effects with chlorpyrifos or diazinon is extremely rare. Of the 67 samples (including 9 field duplicates) tested in the 2014 monitoring year (October 2012-September 2013), there were no samples with significant toxicity to *Ceriodaphnia*, i.e., 100% of the samples collected for 2014 were demonstrably free of additive or synergistic toxic effects. Previously, of the 22 and 29 sample events in the 2013 and 2012 monitoring years, respectively, there were also no samples with significant toxicity to *Ceriodaphnia*. Of the 119 samples tested with *Ceriodaphnia* for the 2011 monitoring year, 113 were not toxic, and of the remaining six (6) significantly toxic samples, three (3) were confirmed to have no detectible concentrations of chlorpyrifos or diazinon, for a total of 116 samples free of significant additive or synergistic toxic effects. Of the remaining three samples, one was determined to have been caused solely by chlorpyrifos based on detected concentrations, the second had detected chlorpyrifos and oxyfluorfen below effect concentrations, and the third had no associated pesticide analyses. None of these three significantly toxic samples for 2011 can definitively be determined (or excluded) to be the result of synergistic toxic effects with chlorpyrifos and diazinon. However, we can reasonably and

¹¹ Based on precipitation data from CDEC site "High Glade (HYG)" (<http://cdec.water.ca.gov/cdecstation/?staid=hvg>)

definitively conclude that 167 out of 170 samples collected since 2011 did not have additive or synergistic toxicity associated with chlorpyrifos or diazinon (98.2%) and three or fewer samples (<2%) had toxicity that *may potentially* have been attributable to additive or synergistic effects with chlorpyrifos and diazinon.

Determine Whether Alternatives to Diazinon and Chlorpyrifos are Causing Surface Water Quality Impacts (Goal 5)

Based on our evaluation of the relative risks of current use pesticides, most potential alternatives to chlorpyrifos and diazinon have a much lower risk of causing adverse impacts to surface waters and have not been prioritized for monitoring. One exception to this finding is the category of pyrethroid pesticides, which have been identified as having significant potential to cause toxicity in sediments. The potential impacts of pyrethroid pesticides are assessed by the Coalition through toxicity and chemical monitoring of sediment. The Coalition has observed several cases of pyrethroid-caused sediment toxicity and has addressed these cases through Management Plans and other targeted outreach mechanisms. However, our longer-term monitoring indicates that sediment toxicity is not a widespread or common problem in the Coalition's watersheds. Out of 190 sediment toxicity sample events, there have been only 14 cases (7.4%) of significant toxicity with survival less than 80% compared to lab controls, and sediment toxicity has proven to be a recurrent problem at only one site (Z-Drain in Solano County).

Summary

Based on the results of ILRP and TMDL monitoring, compliance with the TMDL water quality objectives and load allocations is achieved in the overwhelming percentage of samples. These results demonstrate that outreach and education, the resulting changes in diazinon use patterns and changes in management practices, and modifications to labeling have been successful in reducing instream ambient concentrations of chlorpyrifos and diazinon to the degree required by the TMDL. The relatively low rate of exceedances since the beginning of the ILRP suggests that many of the changes were successfully implemented prior to or soon after 2005. Although exceedances are still occasionally observed, the overall trend from 2005-2014 has been a decrease in the rate of annual exceedances (**Figure 3**). Exceedances observed in the TMDL tributaries monitored for compliance were determined unlikely to cause exceedances of the TMDL Load Allocations in the named TMDL receiving water bodies under any reasonably probable scenario (**Table 9**).

Continuing efforts to further reduce exceedances are being implemented through the Coalition Management Plans for sites that have triggered a Management Plan requirement for these pesticides. Additionally, the Coalition aggressively investigates all exceedances and conducts follow-up contacts with growers reporting applications with the potential to cause specific observed exceedances. These combined efforts and the implementation of statewide restricted status for chlorpyrifos are expected to result in continuation of the decreasing trend in the number of exceedances for these pesticides.

Demonstrating that management practices are achieving the lowest “technically and economically achievable” pesticide concentrations is fundamentally addressed through the TMDL compliance monitoring (Goal 7). The high level of compliance discussed extensively within this Compliance Report is empirical evidence that this goal is being achieved on a broad geographic scale through the practices employed in the Coalition’s watersheds. Further evidence is provided by the progress toward completion of the seven Coalition management plans for chlorpyrifos and diazinon. Furthermore, achieving the level of compliance required for completion of the management plans is direct evidence that the combination of practices employed are effective at reducing and eliminating discharges of chlorpyrifos and diazinon. Three management plans have already been approved for completion (Coon Creek in the Placer-Nevada-South Sutter-North Sacramento subwatershed, Walker Creek in the Colusa-Glenn subwatershed, and Lower Snake River in the Butte-Yuba-Sutter subwatershed).

Appendix A

Chlorpyrifos and Diazinon TMDL Monitoring Results, January 2009 – September 2014

Please see attached Excel file