

**A Summary of the 2004 TMDL Monitoring for Selected  
Pesticides in the Sacramento-San Joaquin Delta, California**

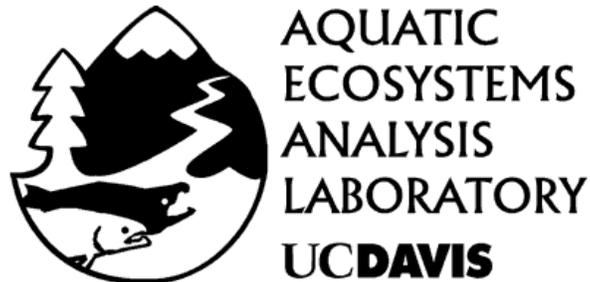
**March - April 2004**

**Prepared by**

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## **Introduction**

This report describes the results of pesticide monitoring at twelve locations in California's Sacramento-San Joaquin Delta during March and April 2004. Monitoring was conducted by staff of the Aquatic Ecosystems Analysis Laboratory (AEAL) of the John Muir Institute of the Environment, University of California, Davis, as authorized under Contract No. 02-210-150 from the Central Valley Regional Water Quality Control Board (CVRWQCB).

## **Objective**

The primary objective of this project was to monitor twelve sites in the Sacramento-San Joaquin River Delta during the 2004 spring irrigation season to characterize the sources of diazinon, chlorpyrifos and other pesticides that can cause surface water contamination and toxic conditions to aquatic life. The results of this study will be used to support the development of diazinon and chlorpyrifos TMDLs in the Sacramento-San Joaquin Delta.

## **Monitoring Overview**

Five sites (Figure 1, Table 1) were monitored once per week from 3 March to 28 April 2004 for a total of nine times each. Seven sites were monitored once per week from 3 March to 7 April 2004 for a total of six times each.

The measured field parameters included pH, water temperature and electrical conductivity (EC). Stream discharge was measured at three sites (Delt01, Delt09 and Delt10) using standard USGS methods and a Swoffer Model 2100 current meter. Discharge estimates at one site (Delt06) were obtained from the California Department of Water Resources (CDWR).

Water samples were delivered to the California Department of Food and Agriculture (CDFA) laboratory in Sacramento, California for chemical analysis using gas chromatography and mass spectrometry (GC-MS). The CDFA laboratory analyzed for 17 chemical compounds in each water sample. The list of compounds is provided in Table 2. The detection frequencies, concentrations and calculated daily loading rates for diazinon

and chlorpyrifos are presented in Table 3. The detection frequencies and concentrations of the other 15 compounds are listed in Appendix A.

**Figure 1.** The twelve sampling sites in the Sacramento-San Joaquin Delta monitored for pesticides during the 2004 spring irrigation season.

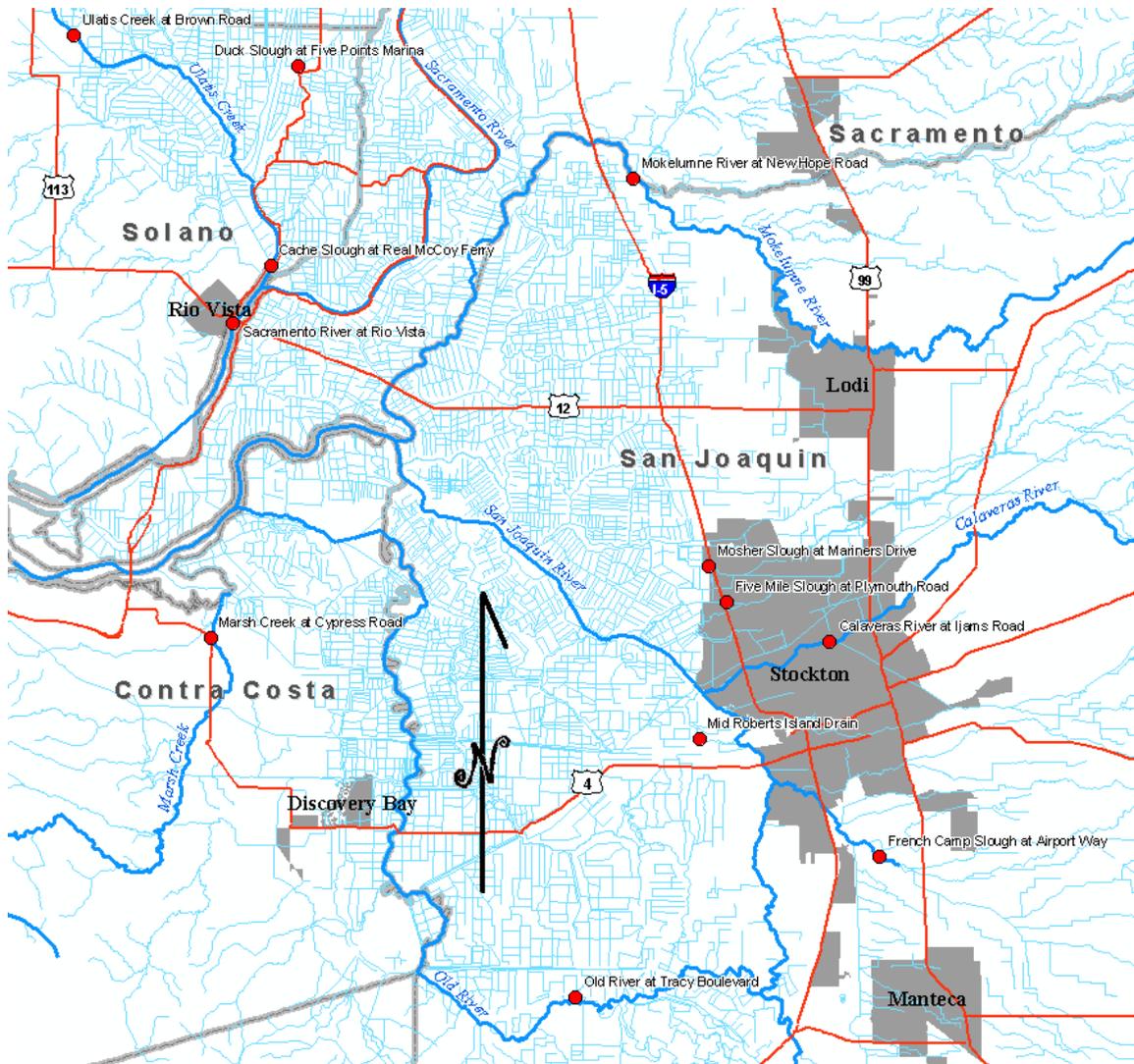


Table 1. Sample sites, locations, collection methods and sampling dates

Site #	Site Name	Latitude	Longitude	Sample collection Method	Sampling Dates (every 7 days)
Delt01	Mokelumne River at New Hope Road	38.2365	-121.4179	Integrated grab from bridge	3 March through 7 April 2004
Delt02	Mosher Slough at Mariners Drive	38.0327	-121.3639	Grab from bank	3 March through 28 April 2004
Delt03	Five Mile Slough at Plymouth Road	38.0139	-121.3514	Grab from bank	3 March through 28 April 2004
Delt04	Calaveras River at Ijams Road	37.9938	-121.2825	Grab from bank	3 March through 7 April 2004
Delt05	Mid Roberts Island Drain	37.9417	-121.3683	Grab from bank	3 March through 28 April 2004
Delt06	French Camp Slough at Airport Way	37.9119	-121.2902	Grab from bank	3 March through 28 April 2004
Delt08	Old River at Tracy Road	37.8049	-121.4486	Grab from bank	3 March through 7 April 2004
Delt09	Marsh Creek at Cypress Road	37.9910	-121.6951	Grab from bank	3 March through 7 April 2004
Delt10	Ulatis Creek at Brown Road	38.3069	-121.7938	Integrated grab from bridge/Grab from bank	3 March through 28 April 2004
Delt11	Duck Slough at Five Points Marina	38.2931	-121.6435	Grab from bank	3 March through 7 April 2004
Delt13	Cache Slough at Real McCoy Ferry	38.1874	-121.6594	Grab from bank	3 March through 7 April 2004
Delt14	Sacramento River at Rio Vista	38.1572	-121.6836	Integrated grab from pier	3 March through 7 April 2004

### Sample Collection Methods

All samples were collected by either grab or integrated grab methods (Table 1). Grab samples were collected by harnessing a 1-liter amber glass bottle to a pole sampler and dipping the bottle into the stream as close to the center of the channel as possible. Integrated grab samples were collected by lowering a 3-liter PTFE (polytetrafluoroethylene) bottle, strapped in a weighted cage, from a bridge at three equally spaced verticals. At each vertical the bottle was filled approximately  $\frac{1}{4}$  full. The composite sample was then thoroughly agitated and poured into a 1-liter amber glass sample bottle. Sampling methods were adapted from Azimi-Gaylon and Reyes (2002) and can be found in Appendix D of this report: *Standard Operating Procedures for Collecting Water Samples in the Sacramento-San Joaquin Delta*.

### Discharge Methods

At Marsh Creek and Ulatis Creek discharge was measured using a Swiffer Model 2100 current meter while wading. At the Mokelumne River, and at Ulatis Creek during high flows, discharge was measured from a bridge using a bridgeboard, sounding reel and Swiffer Model 2100 current meter. All measurements were made using standard USGS current-meter methods (Nolan, et al. 2001). Discharge estimates for French Camp

Slough at Airport Way were provided courtesy of John Tingle of the California Department of Water Resources (CDWR) from the CDWR gage located on site. No discharge measurements were made at any of the other sites due to tidal influences, safety considerations and site logistics.

### **Loading Rate Calculations**

Daily loading rates of diazinon and chlorpyrifos were calculated by multiplying the stream discharge at the time of sample collection by the measured concentrations of each pesticide by the number of seconds (86,400) in one day. Loading rates were only calculated when the pesticide concentration was above the limit of detection and a discharge estimate was available. The loading rate was assumed to be zero for all samples where pesticide concentrations were below the limit of detection.

### **Laboratory Analysis Methods**

Upon arrival at the CDFR laboratory, the environmental samples were weighed then spiked with 500 $\mu$ L of 1.0  $\mu$ g/ml chlorpyrifos methyl (0.5 $\mu$ g/mL) surrogate spiking solution. Each sample was emptied into a 2-liter separatory funnel and approximately 10-15g of granular sodium chloride was added. Sixty ml of methylene chloride were added and the sample was then mixed for three minutes. The organic fraction was filtered through a bed of granular anhydrous sodium sulfate (approx. 20g). The extraction process was repeated three times and the resultant sample was evaporated to 5-7 ml at 40° C and then evaporated to dryness with an N-evaporator. One ml of methylene chloride and 10 $\mu$ L of a 5.0 $\mu$ g/mL internal standard solution were added to each sample. Samples were stored in a -5°C freezer until analysis. Samples were analyzed with an Agilent Model 5973 GC-MSD using a HP-5MS or equivalent GC column. Analysis was performed in the selective ion-monitoring mode (CCAC, 2003).

Each sample was analyzed for seventeen compounds. The compounds and their respective method detection limit (MDL) and reporting limit (RL) are listed in Table 2. The lab reported estimated values when the values were below the RL but above the MDL. To ensure the accuracy and precision of the sample analysis, lab spikes, lab blanks,

and a surrogate standard (chlorpyrifos methyl) were used. If the recovery of a spike sample was out of the control range, the water sample was re-analyzed.

Table 2. CDFA method detection limits and reporting limits for select pesticides

Compound	Method Detection Limit (MDL in µg/L)	Reporting Limit (RL in µg/L)
Azinphos methyl	0.007	0.050
Bifenthrin	0.007	0.050
Carbaryl	0.007	0.020
Chlorpyrifos	0.004	0.010
Cyanazine	0.007	0.050
Cyfluthrins	0.070	0.200
Cypermethrins	0.070	0.200
Dacthal (DCPA)	0.007	0.050
Diazinon	0.007	0.020
Disulfoton	0.007	0.020
EPTC (Eptam)	0.020	0.050
Esfenvalerate	0.007	0.050
l-Cyhalothrin	0.030	0.100
Methidathion	0.010	0.030
Metolachlor	0.007	0.020
Propargite	0.150	0.500
Simazine	0.005	0.200

### Quality Assurance Objectives

Sampling during the 2003-04 winter storm season was conducted under the guidance of a draft Quality Assurance Project Plan (QAPP): *San Joaquin River TMDL Quality Assurance Project Plan Azimi-Gaylon and Reyes (2002)*.

Sampling precision and variability were measured through the use of field duplicates. The draft QAPP stated the Quality Assurance Objective (QAO) for precision was a relative percent difference (RPD) of less than 25%. No QAO was stated for accuracy in the draft QAPP. Accuracy was measured by determining the percent recovery of known concentrations of analytes and surrogate analytes spiked into environmental samples or reagent water prior to extraction. No QAO for surrogate recovery was established in the draft QAPP, so a commonly accepted standard of 70-130% surrogate recovery (D. McClure, personal communication September 2005) was used as the QAO for accuracy in laboratory analytical measurements when evaluating data for this report.

All results outside of the QAO for accuracy (70-130% surrogate recovery) were flagged as follows: BH = results should be viewed as biased high due to high surrogate recovery in sample. No samples had recoveries below the accuracy QAO. Concentrations below the reporting limit were flagged with the letter “J” to identify them as estimates.

## **Results**

A total of 87 environmental samples (Table 3) and 11 quality control (QC) samples (Table 4) were collected and analyzed.

### *Environmental samples*

Concentrations of diazinon and chlorpyrifos ranged from below detection to 0.087 parts per billion (ppb) of diazinon in Mosher Slough on 3 March 2004 and 0.24 parts per billion (ppb) of chlorpyrifos in Mid Roberts Island Drain on 17 March 2004 (Table 3).

The highest calculated daily loading rates for diazinon were in Ulatis Creek and Marsh Creek, respectively. The highest calculated daily loading rates for chlorpyrifos were in Ulatis Creek (Table 3).

Other pesticides detected in the environmental samples were Carbaryl, Cyanazine, Dacthal (DCPA), Eptam (EPTC), Metolachlor and Simazine (Appendix A).

Sixteen environmental samples in which at least one pesticide was detected had surrogate recoveries above the QAO acceptance limits – see footnotes in Table 3 and Appendix A.

### *Environmental Quality Control Samples*

Sample quality control was measured through collection of sequential and split duplicates (n=1)\*, field blanks (n=6) and matrix spikes (n=4). Duplicate samples provided a measure of analytical precision; field blanks were used to evaluate possible introduction of contaminants during sample collection, handling and transport to the lab; matrix spikes were used to evaluate the accuracy of extracting spiked chemicals from the

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\* In April the monitoring schedule was abbreviated due to budgetary reasons. The quality control sampling schedule was not modified at that time resulting in a disproportionate ratio of duplicate samples to field blanks and matrix spikes. A duplicate sample scheduled for March 17 was mistakenly collected as a field blank further compounding the discrepancy in sample ratios.

sample matrix; surrogate recoveries provided a measure of analytical accuracy for individual samples.

The procedures used for collecting the QA/QC samples were based on the draft San Joaquin River TMDL Quality Assurance Project Plan (QAPP) (Azimi-Gaylon and Reyes, 2002).

The QAO for duplicate samples was a relative percent difference (RPD) of < 25% between the duplicate and the corresponding environmental sample concentrations. No pesticides were detected in the single duplicate sample and corresponding environmental sample (Table 4).

The QAO acceptance limit for field blanks was “less than the reporting limit”. One field blank poured at the Duck Slough site on 17 March had a detected concentration of 0.18 parts per billion (ppb) of the herbicide Simazine. The sample was not flagged because the detection was below the reporting limit. The other five field blanks met the acceptance limits with no detections of any pesticides (Table 4).

The QAO acceptance limit for matrix spikes was a 70-130% recovery rate for both chlorpyrifos and diazinon. Each of the four matrix spikes met the QAO objective for recovery. Recoveries ranged from 87-118% for chlorpyrifos and 91-107% for diazinon (Table 4).

No environmental quality control samples in which at least one pesticide was detected had surrogate recoveries outside of the QAO acceptance limits.

#### *Laboratory Quality Control Samples*

Fifteen lab blanks and 15 lab control spikes were analyzed with the environmental samples. The QAO acceptance limits for lab blanks and lab control matrix spikes were recoveries of 70-130% each for bifenthrin, chlorpyrifos, diazinon and the surrogate (chlorpyrifos methyl). All laboratory quality control samples met the quality assurance objectives.

Recoveries in lab blanks ranged from 79-122% (Appendix B). Recoveries in lab control matrix spikes ranged from 72-123%, 86-113%, 86-110% and 80-130% for bifenthrin, chlorpyrifos, diazinon and chlorpyrifos methyl, respectively (Appendix C).

## **Overall Data Quality Assessment**

Sixteen primary samples had surrogate recoveries outside of the 70-130% QAO for accuracy. Those recoveries ranged from 131-148%. The method blanks and lab control spikes processed in the same batches as those samples met all of the quality assurance objectives. The 16 samples with high surrogate recovery are considered usable data with the results biased high.

The field blank poured at the Duck Slough site on 17 March had a detected concentration of 0.18 parts per billion (ppb) of the herbicide Simazine. The sample was most likely contaminated in the field through improper handling or in the lab from unclean glassware. Because the other five field blanks had no detections of any pesticides the single contamination is considered an anomaly unique to that one sample. The data from the contaminated blank are considered usable because the purpose of the blank was to detect contamination not to measure pesticide concentrations. Because all of the results were classified as usable, the data completeness for this project was 100%.

Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. March - April 2004.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BH: result should be viewed as biased high due to high surrogate recovery in sample.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt01	Mokelumne River at New Hope Road	3/04/2004	08:30	220.36	ND	NA	ND	NA
		3/11/2004	09:20	215.77	ND	NA	ND	NA
		3/18/2004	09:30	264.15	ND	NA	ND	NA
		3/25/2004	09:30	206.24	ND	NA	ND	NA
		4/01/2004	09:20	236.26	ND	NA	ND	NA
		4/08/2004	10:20	205.88	ND	NA	ND	NA
Delt02	Mosher Slough at Mariners Drive	3/03/2004	09:40	NA	ND	NA	0.087	NA
		3/10/2004	11:30	NA	ND	NA	0.039	NA
		3/17/2004	07:50	NA	0.025	NA	0.029	NA
		3/24/2004	17:30	NA	ND	NA	(0.018 J)	NA
		3/31/2004 <sup>1</sup>	15:20	NA	BH (0.011)	NA	BH (0.037)	NA
		4/07/2004	10:00	NA	(0.008 J)	NA	(0.018 J)	NA
		4/14/2004 <sup>2</sup>	08:20	NA	BH (0.007 J)	NA	BH (0.020 J)	NA
		4/21/2004	09:10	NA	(0.006 J)	NA	0.046	NA
4/28/2004	08:00	NA	ND	NA	(0.013 J)	NA		
Delt03	Five Mile Slough at Plymouth Road	3/03/2004	10:00	NA	ND	NA	0.021	NA
		3/10/2004	11:40	NA	ND	NA	0.036	NA
		3/17/2004	08:20	NA	0.022	NA	0.027	NA
		3/24/2004	17:10	NA	ND	NA	(0.017 J)	NA
		3/31/2004 <sup>3</sup>	15:30	NA	ND	NA	BH (0.014 J)	NA

<sup>1</sup> Surrogate recovery (135%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>2</sup> Surrogate recovery (143%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>3</sup> Surrogate recovery (136%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. March - April 2004.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BH: result should be viewed as biased high due to high surrogate recovery in sample.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt03	Five Mile Slough at Plymouth Road <i>continued</i>	4/07/2004	10:20	NA	ND	NA	(0.011 J)	NA
		4/14/2004	08:50	NA	ND	NA	ND	NA
		4/21/2004	09:40	NA	ND	NA	ND	NA
		4/28/2004	08:20	NA	ND	NA	ND	NA
Delt04	Calaveras River at Ijams Road	3/03/2004	10:20	NA	ND	NA	ND	NA
		3/10/2004	12:10	NA	0.017	NA	0.080	NA
		3/17/2004	09:00	NA	0.013	NA	(0.017 J)	NA
		3/24/2004	16:40	NA	ND	NA	ND	NA
		3/31/2004 <sup>4</sup>	16:00	NA	ND	NA	BH (0.074)	NA
		4/07/2004	10:50	NA	NA	NA	NA	NA
Delt05	Mid Roberts Island Drain	3/03/2004	12:10	NA	ND	NA	ND	NA
		3/10/2004	14:40	NA	ND	NA	ND	NA
		3/17/2004	09:40	NA	0.240	NA	ND	NA
		3/24/2004	15:40	NA	0.039	NA	ND	NA
		3/31/2004 <sup>5</sup>	18:20	NA	BH (0.023)	NA	ND	NA
		4/07/2004	11:50	NA	(0.009 J)	NA	ND	NA
		4/14/2004 <sup>6</sup>	09:20	NA	BH (0.180)	NA	BH (0.082)	NA
		4/21/2004	10:10	NA	0.017	NA	ND	NA
4/28/2004	09:30	NA	0.030	NA	ND	NA		
Delt06	French Camp Slough at Airport Way	3/03/2004	11:10	575	ND	NA	(0.008 J)	11.25

<sup>4</sup> Surrogate recovery (139%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>5</sup> Surrogate recovery (132%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>6</sup> Surrogate recovery (142%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. March - April 2004.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BH: result should be viewed as biased high due to high surrogate recovery in sample.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt06	French Camp Slough at Airport Way <i>continued</i>	3/10/2004	13:40	40.30	ND	NA	ND	NA
		3/17/2004	11:20	27.00	0.230	15.19	(0.015 J)	0.99
		3/24/2004	15:10	43.00	0.022	2.31	ND	NA
		3/31/2004	17:10	33.80	ND	NA	(0.013 J)	1.07
		4/07/2004	13:00	60.00	(0.006 J)	0.88	ND	NA
		4/14/2004 <sup>7</sup>	10:00	43.00	BH (0.014)	1.47	ND	NA
		4/21/2004	10:50	14.70	0.170	6.11	ND	NA
		4/28/2004	10:00	41.40	0.016	1.62	ND	NA
Delt08	Old River at Tracy Boulevard	3/03/2004	11:40	NA	(0.006 J)	NA	(0.016 J)	NA
		3/10/2004	14:10	NA	(0.008 J)	NA	(0.010 J)	NA
		3/17/2004	10:50	NA	0.023	NA	ND	NA
		3/24/2004	14:30	NA	ND	NA	ND	NA
		3/31/2004	17:40	NA	ND	NA	ND	NA
		4/07/2004	12:20	NA	ND	NA	ND	NA
Delt09	Marsh Creek	3/04/2004	11:20	21.90	ND	NA	ND	NA
		3/11/2004	12:20	8.83	ND	NA	ND	NA
		3/18/2004	12:50	7.42	ND	NA	(0.018 J)	0.33
		3/25/2004	12:50	5.30	ND	NA	(0.008 J)	0.10
		4/01/2004 <sup>8</sup>	11:40	9.18	ND	NA	BH (0.011 J)	0.25
		4/08/2004	12:50	9.89	ND	NA	(0.011 J)	0.27

<sup>7</sup> Surrogate recovery (148%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>8</sup> Surrogate recovery (132%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. March - April 2004.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BH: result should be viewed as biased high due to high surrogate recovery in sample.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt10	Ulatis Creek at Brown Rd	3/04/2004	13:50	441.08	0.042	45.32	(0.012 J)	12.95
		3/11/2004	14:10	66.74	0.011	1.80	ND	NA
		3/18/2004	14:50	54.38	(0.006 J)	0.80	ND	NA
		3/25/2004 <sup>9</sup>	14:40	59.68	ND	NA	BH (0.009 J)	1.31
		4/01/2004	13:50	62.15	ND	NA	ND	NA
		4/08/2004	14:40	8.48	ND	NA	(0.009 J)	NA
		4/14/2004 <sup>10</sup>	12:40	18.01	BH (0.020)	0.88	ND	NA
		4/21/2004 <sup>11</sup>	13:30	37.08	BH (0.018)	1.63	ND	NA
		4/28/2004	11:40	26.49	ND	NA	ND	NA
Delt11	Duck Slough at Five Points Marina	3/03/2004	15:30	NA	0.086	NA	ND	NA
		3/10/2004	09:40	NA	0.030	NA	ND	NA
		3/17/2004	15:40	NA	0.025	NA	ND	NA
		3/24/2004	20:10	NA	ND	NA	ND	NA
		3/31/2004	12:30	NA	ND	NA	ND	NA
		4/07/2004	08:30	NA	ND	NA	ND	NA
Delt13	Cache Slough at Real McCoy Ferry	3/03/2004	15:00	NA	ND	NA	(0.008 J)	NA
		3/10/2004	10:10	NA	ND	NA	ND	NA
		3/17/2004	15:10	NA	ND	NA	ND	NA
		3/24/2004	18:20	NA	ND	NA	ND	NA
		3/31/2004	13:00	NA	ND	NA	ND	NA
		4/07/2004	08:50	NA	ND	NA	ND	NA

<sup>9</sup> Surrogate recovery (138%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>10</sup> Surrogate recovery (131%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>11</sup> Surrogate recovery (132%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. March - April 2004.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BH: result should be viewed as biased high due to high surrogate recovery in sample.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt14	Sacramento River at Rio Vista	3/03/2004	14:30	NA	ND	NA	ND	NA
		3/10/2004	10:30	NA	ND	NA	ND	NA
		3/17/2004	14:30	NA	ND	NA	(0.008 J)	NA
		3/24/2004	18:40	NA	ND	NA	ND	NA
		3/31/2004	13:20	NA	ND	NA	ND	NA
		4/07/2004	09:20	NA	ND	NA	ND	NA

Table 4. Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the Sacramento-San Joaquin River Delta, California, March - April 2004.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: micrograms per liter; J: the reported concentrations were below the quantitative limit and are considered estimates; <: less than

Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Relative percent difference (chlorpyrifos)	Diazinon (ug/L)	Relative percent difference (diazinon)
<b>DUPLICATES</b>						
Delt13	Cache Slough at Real McCoy Ferry	3/24/2004 18:20	<0.004	NA	<0.007	NA
		3/24/2004 18:25	<0.004		<0.007	
<b>BLANKS</b>						
Delt01	Mokelumne River at New Hope Road	3/18/2004 09:35	<0.004		<0.007	
Delt04	Calaveras River at Ijams Road	3/03/2004 10:25	<0.004		<0.007	
Delt05	Mid Roberts Island Drain	4/07/2004 11:55	<0.004		<0.007	
Delt06	French Camp Slough at Airport Way	4/28/2004 10:05	<0.004		<0.007	
Delt11	Duck Slough at Five Points Marina	3/17/2004 15:45	<0.004		<0.007	
Delt14	Sacramento River at Rio Vista	3/31/2004 13:25	<0.004		<0.007	
Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Percent recovery (chlorpyrifos)	Diazinon (ug/L)	Percent recovery (diazinon)
<b>SPIKES<sup>2,3</sup></b>						
Delt03	Five-mile slough at Plymouth Rd	4/14/2004 08:50	<0.004	87%	<0.007	91%
		4/14/2004 08:50				
Delt06	French Camp Slough at Airport Way	3/10/2004 13:40	<0.004	101%	<0.007	98%
		3/10/2004 13:40				
Delt09	Marsh Creek	4/01/2004 11:40	<0.004	118%	(0.011 J)	107%
		4/01/2004 11:40				
Delt10	Ulatis Creek at Brown Rd	3/04/2004 13:50	0.042	102%	(0.012 J)	104%
		3/04/2004 13:50				

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## Appendix A



## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. NA: Not available; ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BH: result should be viewed as biased high due to high surrogate recovery in sample. Each sample was also analyzed for Azinphos methyl, Bifenthrin, Cyfluthrins, Cypermethrins, Disulfoton, Esfenvalerate, Methidathion, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Metolachlor	Simazine
Mokelumne River at New Hope Road	3/04/2004	08:30	ND	ND	ND	ND	ND	(0.120 J)
Mokelumne River at New Hope Road	3/11/2004	09:20	ND	ND	ND	ND	ND	(0.044 J)
Mokelumne River at New Hope Road	3/18/2004	09:30	ND	ND	ND	ND	ND	(0.038 J)
Mokelumne River at New Hope Road	3/25/2004	09:30	ND	ND	ND	ND	ND	(0.031 J)
Mokelumne River at New Hope Road	4/01/2004	09:20	ND	ND	ND	ND	ND	(0.037 J)
Mokelumne River at New Hope Road	4/08/2004	10:20	ND	ND	ND	ND	ND	(0.030 J)
Mosher Slough at Mariners Drive	3/03/2004	09:40	ND	ND	(0.008 J)	ND	ND	1.000
Mosher Slough at Mariners Drive	3/10/2004	11:30	0.069	ND	ND	ND	ND	0.810
Mosher Slough at Mariners Drive	3/17/2004	07:50	0.056	ND	ND	ND	(0.007 J)	0.760
Mosher Slough at Mariners Drive	3/24/2004	17:30	0.570	ND	ND	ND	ND	0.490
Mosher Slough at Mariners Drive	3/31/2004 <sup>1</sup>	15:20	BH (0.053)	ND	ND	ND	BH (0.010 J)	BH (0.360)
Mosher Slough at Mariners Drive	4/07/2004	10:00	(0.017 J)	ND	ND	ND	ND	0.280
Mosher Slough at Mariners Drive	4/14/2004 <sup>2</sup>	08:20	BH (0.067)	ND	ND	ND	BH (0.019 J)	BH (0.210)
Mosher Slough at Mariners Drive	4/21/2004	09:10	0.069	ND	ND	ND	ND	(0.065 J)
Mosher Slough at Mariners Drive	4/28/2004	08:00	0.074	ND	ND	ND	(0.012 J)	(0.077 J)
Five Mile Slough at Plymouth Road	3/03/2004	10:00	ND	ND	ND	ND	ND	(0.180 J)
Five Mile Slough at Plymouth Road	3/10/2004	11:40	ND	ND	ND	ND	(0.008 J)	0.540
Five Mile Slough at Plymouth Road	3/17/2004	08:20	ND	ND	ND	ND	(0.008 J)	0.610
Five Mile Slough at Plymouth Road	3/24/2004	17:10	ND	ND	ND	ND	ND	0.530
Five Mile Slough at Plymouth Road	3/31/2004 <sup>3</sup>	15:30	ND	ND	ND	ND	BH (0.015 J)	BH (0.500)
Five Mile Slough at Plymouth Road	4/07/2004	10:20	ND	ND	ND	ND	(0.012 J)	0.560

<sup>1</sup> Surrogate recovery (135%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>2</sup> Surrogate recovery (143%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>3</sup> Surrogate recovery (136%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. NA: Not available; ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BH: result should be viewed as biased high due to high surrogate recovery in sample. Each sample was also analyzed for Azinphos methyl, Bifenthrin, Cyfluthrins, Cypermethrins, Disulfoton, Esfenvalerate, Methidathion, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Metolachlor	Simazine
Five Mile Slough at Plymouth Road	4/14/2004 <sup>4</sup>	08:50	ND	ND	ND	ND	BH (0.021)	BH (0.340)
Five Mile Slough at Plymouth Road	4/21/2004	09:40	ND	ND	ND	ND	(0.018 J)	0.220
Five Mile Slough at Plymouth Road	4/28/2004	08:20	ND	ND	ND	ND	0.032	(0.130 J)
Calaveras River at Ijams Road	3/03/2004	10:20	ND	ND	ND	ND	ND	0.270
Calaveras River at Ijams Road	3/10/2004	12:10	0.034	ND	ND	ND	ND	0.370
Calaveras River at Ijams Road	3/17/2004	09:00	ND	ND	ND	ND	ND	0.710
Calaveras River at Ijams Road	3/24/2004	16:40	ND	ND	ND	ND	ND	0.660
Calaveras River at Ijams Road	3/31/2004 <sup>5</sup>	16:00	ND	ND	BH (0.008 J)	ND	BH (0.045)	BH (0.590)
Calaveras River at Ijams Road	4/07/2004 <sup>6</sup>	10:50	NA	NA	NA	NA	NA	NA
Mid Roberts Island Drain	3/03/2004	12:10	ND	ND	ND	ND	0.120	0.270
Mid Roberts Island Drain	3/10/2004	14:40	ND	ND	ND	ND	0.066	(0.120 J)
Mid Roberts Island Drain	3/17/2004	09:40	ND	ND	ND	ND	0.063	(0.140 J)
Mid Roberts Island Drain	3/24/2004	15:40	ND	ND	ND	ND	0.360	0.340
Mid Roberts Island Drain	3/31/2004 <sup>7</sup>	18:20	ND	ND	ND	ND	BH (0.170)	BH (0.210)
Mid Roberts Island Drain	4/07/2004	11:50	(0.007 J)	ND	ND	ND	0.083	(0.100 J)
Mid Roberts Island Drain	4/14/2004 <sup>8</sup>	09:20	ND	ND	ND	ND	BH (0.820)	BH (0.090 J)
Mid Roberts Island Drain	4/21/2004	10:10	12.000	ND	ND	0.200	3.100	(0.100 J)
Mid Roberts Island Drain	4/28/2004	09:30	0.059	ND	ND	0.180	1.600	(0.072 J)
French Camp Slough at Airport Way	3/03/2004	11:10	ND	ND	ND	ND	(0.011 J)	0.610

<sup>4</sup> Surrogate recovery (138%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>5</sup> Surrogate recovery (139%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>6</sup> There was no water in the Calaveras River at Ijams Road on 7 April 2004.

<sup>7</sup> Surrogate recovery (132%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>8</sup> Surrogate recovery (142%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. NA: Not available; ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BH: result should be viewed as biased high due to high surrogate recovery in sample. Each sample was also analyzed for Azinphos methyl, Bifenthrin, Cyfluthrins, Cypermethrins, Disulfoton, Esfenvalerate, Methidathion, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Metolachlor	Simazine
French Camp Slough at Airport Way	3/10/2004	13:40	ND	ND	ND	ND	(0.009 J)	(0.150 J)
French Camp Slough at Airport Way	3/17/2004	11:20	ND	ND	ND	ND	ND	0.220
French Camp Slough at Airport Way	3/24/2004	15:10	ND	ND	ND	ND	ND	(0.180 J)
French Camp Slough at Airport Way	3/31/2004	17:10	ND	ND	ND	ND	ND	0.620
French Camp Slough at Airport Way	4/07/2004	13:00	(0.014 J)	ND	ND	ND	(0.016 J)	(0.089 J)
French Camp Slough at Airport Way	4/14/2004 <sup>9</sup>	10:00	BH (0.007 J)	ND	BH (0.016 J)	ND	BH (0.018 J)	BH (0.190 J)
French Camp Slough at Airport Way	4/21/2004	10:50	(0.019 J)	ND	ND	ND	(0.013 J)	(0.190 J)
French Camp Slough at Airport Way	4/28/2004	10:00	0.096	0.330	ND	ND	0.023	0.510
Old River at Tracy Boulevard	3/03/2004	11:40	ND	ND	ND	ND	(0.017 J)	0.460
Old River at Tracy Boulevard	3/10/2004	14:10	ND	ND	ND	ND	(0.015 J)	(0.110 J)
Old River at Tracy Boulevard	3/17/2004	10:50	ND	ND	ND	ND	(0.009 J)	(0.076 J)
Old River at Tracy Boulevard	3/24/2004	14:30	ND	ND	ND	ND	(0.011 J)	(0.047 J)
Old River at Tracy Boulevard	3/31/2004 <sup>10</sup>	17:40	BH (0.014 J)	ND	ND	ND	BH (0.011 J)	BH (0.070 J)
Old River at Tracy Boulevard	4/07/2004	12:20	ND	ND	ND	2.400	0.034	(0.051 J)
Marsh Creek at Cypress Road	3/04/2004	11:20	ND	ND	ND	ND	ND	(0.063 J)
Marsh Creek at Cypress Road	3/11/2004	12:20	ND	ND	ND	ND	ND	(0.059 J)
Marsh Creek at Cypress Road	3/18/2004	12:50	0.160	ND	ND	ND	ND	(0.053 J)
Marsh Creek at Cypress Road	3/25/2004	12:50	ND	ND	ND	ND	0.054	(0.052 J)
Marsh Creek at Cypress Road	4/01/2004 <sup>11</sup>	11:40	ND	ND	ND	ND	BH (0.034)	BH (0.063 J)
Marsh Creek at Cypress Road	4/08/2004	12:50	(0.007 J)	ND	ND	ND	0.360	(0.019 J)
Ulatis Creek at Brown Road	3/04/2004	13:50	ND	ND	ND	ND	(0.007 J)	0.290

<sup>9</sup> Surrogate recovery (148%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>10</sup> Surrogate recovery (137%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>11</sup> Surrogate recovery (132%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. NA: Not available; ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BH: result should be viewed as biased high due to high surrogate recovery in sample. Each sample was also analyzed for Azinphos methyl, Bifenthrin, Cyfluthrins, Cypermethrins, Disulfoton, Esfenvalerate, Methidathion, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Metolachlor	Simazine
Ulatis Creek at Brown Road	3/11/2004	14:10	ND	ND	ND	ND	ND	(0.120 J)
Ulatis Creek at Brown Road	3/18/2004	14:50	ND	ND	ND	ND	ND	(0.058 J)
Ulatis Creek at Brown Road	3/25/2004 <sup>12</sup>	14:40	ND	ND	ND	ND	BH (0.008 J)	BH (0.110 J)
Ulatis Creek at Brown Road	4/01/2004	13:50	ND	ND	ND	ND	0.039	(0.180 J)
Ulatis Creek at Brown Road	4/08/2004	14:40	ND	ND	ND	ND	(0.014 J)	(0.140 J)
Ulatis Creek at Brown Road	4/14/2004 <sup>13</sup>	12:40	ND	ND	ND	ND	BH (0.027)	BH (0.140 J)
Ulatis Creek at Brown Road	4/21/2004 <sup>14</sup>	13:30	ND	ND	ND	ND	BH (2.000)	BH (0.062 J)
Ulatis Creek at Brown Road	4/28/2004	11:40	ND	ND	ND	(0.030 J)	2.800	(0.082 J)
Duck Slough at Five Points Marina	3/03/2004	15:30	ND	ND	ND	ND	ND	0.430
Duck Slough at Five Points Marina	3/10/2004	09:40	ND	ND	ND	ND	(0.007 J)	(0.190 J)
Duck Slough at Five Points Marina	3/17/2004	15:40	ND	ND	ND	ND	ND	(0.180 J)
Duck Slough at Five Points Marina	3/24/2004	20:10	ND	ND	ND	ND	0.040	(0.051 J)
Duck Slough at Five Points Marina	3/31/2004	12:30	ND	ND	ND	ND	ND	(0.048 J)
Duck Slough at Five Points Marina	4/07/2004	08:30	ND	ND	ND	ND	(0.009 J)	(0.066 J)
Cache Slough at Real McCoy Ferry	3/03/2004	15:00	ND	ND	ND	ND	ND	(0.050 J)
Cache Slough at Real McCoy Ferry	3/10/2004	10:10	ND	ND	ND	ND	ND	(0.036 J)
Cache Slough at Real McCoy Ferry	3/17/2004	15:10	ND	ND	ND	ND	ND	(0.027 J)
Cache Slough at Real McCoy Ferry	3/24/2004	18:20	ND	ND	ND	ND	ND	(0.026 J)
Cache Slough at Real McCoy Ferry	3/31/2004 <sup>15</sup>	13:00	ND	ND	ND	ND	ND	BH (0.036 J)
Cache Slough at Real McCoy Ferry	4/07/2004	08:50	ND	ND	ND	ND	ND	(0.022 J)

<sup>12</sup> Surrogate recovery (138%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>13</sup> Surrogate recovery (131%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>14</sup> Surrogate recovery (132%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>15</sup> Surrogate recovery (143%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. NA: Not available; ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BH: result should be viewed as biased high due to high surrogate recovery in sample. Each sample was also analyzed for Azinphos methyl, Bifenthrin, Cyfluthrins, Cypermethrins, Disulfoton, Esfenvalerate, Methidathion, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Metolachlor	Simazine
Sacramento River at Rio Vista	3/03/2004	14:30	ND	ND	ND	ND	ND	(0.057 J)
Sacramento River at Rio Vista	3/10/2004	10:30	ND	ND	ND	ND	ND	(0.026 J)
Sacramento River at Rio Vista	3/17/2004	14:30	ND	ND	ND	ND	ND	(0.028 J)
Sacramento River at Rio Vista	3/24/2004 <sup>16</sup>	18:40	ND	ND	ND	ND	BH (0.008 J)	BH (0.039 J)
Sacramento River at Rio Vista	3/31/2004 <sup>17</sup>	13:20	ND	ND	ND	ND	ND	BH (0.032 J)
Sacramento River at Rio Vista	4/07/2004	09:20	ND	ND	ND	ND	ND	(0.024 J)

<sup>16</sup> Surrogate recovery (132%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

<sup>17</sup> Surrogate recovery (140%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

## Appendix B. Lab blank data

(No pesticides were present at detectable levels. The pesticides include azinphos methyl, bifenthrin, carbaryl, chlorpyrifos, cyanazine, cyfluthrins, cypermethrins, dacthal (DCPA), diazinon, disulfoton, EPTC (Eptam), esfenvalerate, methidathion, metolachlor, propargite, l-Cyhalothrin and simazine)

<b>Date Extracted</b>	<b>Chlorpyrifos Methyl (Surrogate) Recovery</b>
3/4/2004	95%
3/8/2004	81%
3/11/2004	84%
3/12/2004	92%
3/18/2004	109%
3/22/2004	107%
3/25/2004	109%
3/26/2004	98%
4/1/2004	107%
4/2/2004	104%
4/8/2004	119%
4/13/2004	93%
4/15/2004	126%
4/22/2004	102%
4/29/2004	104%

## Appendix C. Recovery rates in lab control matrix spikes

<b>Date Extracted</b>	<b>Bifenthrin</b>	<b>Chlorpyrifos</b>	<b>Diazinon</b>	<b>Chlorpyrifos methyl (surrogate)</b>
3/4/2004	120%	103%	98%	80%
3/8/2004	114%	86%	92%	98%
3/11/2004	115%	102%	92%	98%
3/12/2004	99%	102%	86%	82%
3/18/2004	96%	99%	100%	104%
3/22/2004	115%	99%	91%	107%
3/25/2004	94%	95%	93%	112%
3/26/2004	119%	101%	91%	103%
4/1/2004	72%	110%	108%	120%
4/2/2004	107%	105%	101%	112%
4/8/2004	123%	109%	105%	116%
4/13/2004	98%	104%	91%	104%
4/15/2004	116%	109%	110%	124%
4/22/2004	102%	113%	102%	130%
4/29/2004	93%	100%	98%	112%

Appendix D: Standard Operating Procedures for Collecting Water Samples in the  
Sacramento-San Joaquin Delta

# Standard Operating Procedure for Collecting Water Samples in the Sacramento-San Joaquin Delta

(September 2003 AW)

## Overview of the sampling sites and sampling methods:

**D** = Discharge measurements are taken at these sites

<b>Delta 1</b>	Mokelumne River at New Hope Road	BRIDGE / 3L Teflon <b>D</b>
<b>Delta 2</b>	Mosher Slough at Mariners Drive	BRIDGE / 3L Teflon
<b>Delta 3</b>	Five-Mile Slough at Plymouth Road	BANK—grab sample
<b>Delta 4</b>	Calaveras River at Ijams Road	BRIDGE / 3L Teflon
<b>Delta 5</b>	Mid Roberts Island Drain	BANK—grab sample
<b>Delta 6</b>	French Camp Slough at S Manthey Road	BANK—grab sample
<b>Delta 7</b>	Paradise Cut at Paradise Road	BRIDGE / 3L Teflon
<b>Delta 8</b>	Old River at Tracy Road	BANK—grab sample
<b>Delta 9</b>	Marsh Creek at Cypress Road	BANK—grab sample <b>D</b>
<b>Delta 10</b>	Ulatis Creek at Brown Road	BRIDGE / 3L Teflon <b>D</b>
<b>Delta 11</b>	Duck Slough	BANK—grab sample
<b>Delta 12</b>	Steamboat Slough	BANK—grab sample
<b>Delta 13</b>	Cache Slough before Sac River	BANK—grab sample
<b>Delta 14</b>	Sac River at Rio Vista	BRIDGE / 3L Teflon

## 1. Labeling the sample bottles

- Use preprinted labels. The sample ID should have the following format:

### **DP YYMMDD-nn**

DP (=Delta Pesticides)

YYMMDD-nn = Year, Months, Day

nn = sample number in sampling order (01, 02, 03...)

Example: first sample taken on 8/20/02: ID = DP020820-01; a duplicate would be DP020820-02; a spike on the same site would be DP020820-03 Spike

Date 09/10/03 \_\_\_\_\_



Time 10:50 Initials AW \_\_\_\_\_

I.D. **DP030910-01** \_\_\_\_\_

- The label should include the sample ID, date, sample time, and your initials

- Complete the printed label with an extra-fine-point Sharpie. Cover the entire label with a piece of clear tape to prevent peeling.
- Use 24-hour military time for the sample time; round to the nearest 10 minutes. For example: a sample collected at 09:52 would have the sample time on the label and Chain of Custody (COC) form rounded off to 09:50; a sample collected at 09:57 would be rounded up to 10:00; 09:55 would also be rounded up to 10:00. Use the following format for the date: mm/dd/yy

## 2. Check the Quality Control Schedule to see if a QC sample is scheduled for the site

If so, label an additional 1L amber glass bottle according to the instructions in Step 5 below. Read the QC sampling procedure before sampling.

## 3. Fill out Field Sheet at each sampling site

### How to fill out the field sheet:

- Station ID: for example Delta01
- Station Name: Mokelumne River at New Hope Road
- Sampling time: rounded 24-hour military time (e.g. 14:00)

#### Sampling Information

- Sampling bottle: 1L amber bottles are glass, 3L bottles are Teflon
- Sample type: integrated grab is from bridge, grab is from bank
- Stage: will become apparent with experience, also can be researched later on web or read from a staff gage, if present

#### Sample Collected

- Write the sample ID for the environmental sample next to 'Field Sample'
- If a quality control sample is scheduled, place a check beside the sample type required and record the sample ID for the QC

Always double check sample ID's on the field sheet, COC, and label. Sample ID's on the field sheets are the only way to identify the samples!

#### Field Measurements

Use Oakton pH/conductivity/temp meters; allow the probe to soak in native water for a few minutes for the reading to stabilize. Note the values for temperature, pH and EC on the field sheet along with appropriate units (e.g. mS, uS, °C).

- BANK: measure directly from river edge
- BRIDGE: after pouring off sample use excess water from 3L Teflon bottle for the field measurements; rinse probe and plastic container with that native water

- before pouring another portion out of 3L bottle into the measuring container. Measure test parameters immediately after pouring off sample so that conditions (temperature) do not change
- Flow and stage fields will be completed in the lab by getting information from CDEC or USGS web sites; please note source, date of receiving the information and your initials on the field sheet

At the end of the day fill the electrode storage cap with electrode storage solution before placing the meter in its case.

Note anything significant or unusual under Observations on the field sheet; for example waste disposal, irrigation runoff, foam on water surface, dead fish, etc.

Original forms stay with UC Davis in a prepared folder at the IOE. At the end of each sampling day, field sheets are faxed to Jamie Lu (916) 255-3015

Recalibrate Oakton pH/conductivity/temp meters once a month. Record recalibration date on a piece of labeling tap and affix to inside panel of meter case.

## 4. How to collect a sample

*Always wear clean gloves during sampling procedure!*

### BANK

a) Using bungee cord, affix 1L amber glass bottle to sampling pole.

To attach 250mL ELISA bottle:

- (i) slide bungee through grating with blue ball on the bottom
  - (ii) loop through grating
  - (iii) slip pre-attached white cord over bottle top
  - (iv) slip bungee over bottle top
- b) Check to insure the bottle is secure
- c) Remove the cap (wear clean glove!)
- d) Immerse the bottle until bubbles stop. Fill completely; do not leave any headspace
- e) Replace the cap (still wearing the clean glove!)
- f) Rinse the outside of the bottle with deionized water
- g) Slip the bottle into a foam sleeve
- h) Place sample directly into a cooler (up to 15 1L bottles can be placed in one cooler).  
Make sure there is no glass-to-glass contact.

### BRIDGE SAMPLE

1. Put on your orange safety vest. Always be aware of traffic and use caution while sampling from a bridge
2. At the van, put the 3L Teflon bottle into the TECHMA cage, secure it with the bungee cord (you will lose the bottle, if the bungee cord is not strapped around the bottle!), and remove the cap

1. Wearing leather gloves, carefully lower the bottle from the bridge railing to the water surface. Do not lower too fast or the bottle may be propelled from the cage upon impact. Perform a triple rinse with native water. Fill the bottle at least ¼ full for each rinse
2. To collect the sample, fill the bottle 1/4<sup>th</sup> at each of three equally spaced verticals (submerge for about 3-5 seconds), being careful to avoid contact between the bottle and anything but river water, especially when moving between verticals
3. Return to the van
4. Remove the 3L bottle from the TECHMA cage and swirl the water until completely mixed
5. The second person has already labeled the sample bottle. While wearing clean gloves the second person removes the bottle cap and holds the sample bottle as the sampler pours from the 3L Teflon bottle into the sample bottle. After the sample bottle is completely filled the second person then recaps the sample bottle
6. Rinse the outside of the sample bottle with deionized water, place the bottle in a protective sleeve and store it in the cooler.

The last thing to do before filling any amber glass sample bottle, regardless of method, is to remove the lid. The first thing to do after filling any amber glass sample bottle, regardless of method, is to replace the lid. If you have more than one sample bottle to fill, remove each lid just prior to filling the bottle

Clean the 3L bottle after sampling with the following procedure:

- While wearing clean gloves, add 10% liquinox soap mixture (2-3 squeezes) and approximately 50ml of deionized water to the Teflon bottle. Place the cap on the bottle and swirl the soap around inside the bottle until the entire inside surface has been covered with suds. Un-cap the bottle and pour the soap onto the ground. Rinse the bottle and cap using deionized water until no suds remain inside the bottle or on the cap
- Pour 5-10ml of methanol into the bottle and swirl, with the cap on, until methanol has covered the entire inside surface of the bottle. Carefully pour the waste methanol into the methanol waste container. Seal the methanol bottle and waste container with Parafilm to prevent fume leakage. *Methanol is dangerous—do not inhale or touch!*
- The 3L bottle is ready for the next sampling and should be stored, with the cap on, inside the TECHMA cage

## 5. If scheduled collect a quality control sample

View the QC Schedule to find out which type of QC sample you should collect that day

-- -- Field duplicate:

- a) Collect both samples simultaneously. If using a pole sampler place two bottles in the sampler. If using the TECHMA fill the 3L Teflon bottle with enough water for both the environmental and duplicate samples

- a) Mark the sampling time of the duplicate sample by adding **5 minutes** to the time of the environmental sample (e.g. environmental sample collected at 14:00 then duplicate time is 14:05). **Do not** indicate *duplicate* on the label or on the COC!

-- Matrix spike:

For the matrix spike sample record the same sampling time as the environmental sample. Mark as “matrix spike” on the **COC and label**. It should be made obvious so that the lab knows that this sample needs to be spiked.

BRIDGE SAMPLE

- a) From the single 3L Teflon filled using the procedure above pour the collected water into two 1L bottles; one for the environmental sample and one for the matrix spike.

BANK SAMPLE

Fill two 1L bottles with one reach of the pole sampler; one for the environmental sample and one for the matrix spike.

-- Blank sample:

**Do not** indicate blank on label or on COC. Time offset: add **5 minutes** to the time of the environmental sample (e.g. environmental sample collected at 14:00 then blank time is 14:05).

BRIDGE SAMPLE

*BEFORE TAKING ENVIRONMENTAL SAMPLE:*

- a) Rinse the clean 3L Teflon bottle three times with deionized water (approximately 50ml for each rinse)
- b) Fill the 3L bottle 2/3 full with deionized water and pour into a 1L bottle for the blank.

BANK SAMPLE

- a) Fill one 1L bottle with deionized water for the blank.

-- Equipment blank:

**One** Equipment Blank needs to be taken the first time you use a new sampling pole. Clean a large bucket with 10% liquinox soap and deionized water (methanol is not necessary). Put the clean bucket under the pole, rinse the pole using >2 liters deionized water. With the water collected in the bucket, fill a 1L bottle. Do not indicate “field blank” on the label or COC, however indicate this on the field sheet. No time offset necessary.

6. Whoever did not fill out the field sheet and COC should double check all of the recorded times for

completeness and error at the end of the sampling day

## 7. Check ice level

The temperature of the ice chest should be around 4°C. Make sure to add ice if necessary.

## 8. Deliver the samples within 48 hours

### **Samples need to be dropped off at:**

- **(1L amber glass bottles)** *open from 8 am to 5 pm* after hours call Stephen Siegel, California Department of Food and Agriculture, Center for Analytical Chemistry, 3292 Meadowview Road, Sacramento, Ca 95832 Responsible Person: Stephen Siegel, (916) 275-3735 or [ssiegel@cdfa.ca.gov](mailto:ssiegel@cdfa.ca.gov)  
No drop off on weekends or on holidays unless pre-arranged! (For storage in our facility or somewhere else over the weekend make sure that there is enough ice in the cooler and the temperature stays around 4 degrees C)

## 9. Complete Chain of Custody forms

Complete Chain of Custody forms for each sampling day

- The original COC's will stay in the CDFA Lab. Be sure to have Steve Siegel (or other lab recipient) make you a copy of the COC. Upon return to the IOE fax a copy of the COC and the field sheets to Jamie Lu within 24 hours (FAX: (916) 255-3015) and one copy will be staying with UC Davis in a prepared folder at the IOE. After faxing, put your name, date, and time of fax on our copy and file it

Sample transfer between field staff and laboratory is documented by **signing and dating** “relinquished by” and “received by” blocks whenever sample possession changes. The document must have both yours **and** the lab’s signature before faxing it to Jamie.

### **Discharge Measurements:**

Discharge will be measured using a Swoffer Velocity Meter Model 2100 by the Delta Team at Delta 01, Delta 09, and Delta 10. Use the bridgeboard and sounding reel at Delta 01 and (when flows are too high to safely wade) at Delta 10. Use the wading rod at Delta 09 and Delta 10. For details see *Standard Operating Procedure for Velocity Measurement and Discharge Calculation Using the Swoffer Model 2100 Current Meter*.

Pumping station records and gauge data need to be documented on the field sheets. Pumping records need to be documented for Delta 05 and Delta 10. Gauge data should be documented for Delta 08 and Delta 14. In addition, precipitation data should be documented for Thornton, Brentwood, and Dixon, California. Also storm patterns and rainfall data should be documented as accurately as possible to create a detailed record of the event.