Monitoring Results

Sample Details

Full monitoring results from the 2008 storm season are included in Appendix I. The results include field parameters, organics, inorganics including metals and *E. coli*, toxicity and calculated loads for any detectable analyte with corresponding site flow. Loads have been calculated for all detections (Table I-6) according to the following formula:

Instantaneous Load (µg/sec) = Discharge (cfs) X 28.317L x Concentration (milligram/L x 1,000 or µg/L).

The load values calculated and presented for pesticides or other constitutents in this report represent instantaneous loads only. These values should not be used to extrapolate loading over any period of time (e.g. weekly, monthly, seasonal or annual). The primary purpose for reporting instantaneous loads is to provide the Regional Water Board with a context for the concentrations of various constituents at the time that samples were collected.

Monitoring results include results from samples taken for normal monitoring and sediment toxicity monitoring including resampling due to toxicity. Each sampling location, sampling date, sampling time and type of monitoring is listed in Table 10.

Table 10. Sample details for all 2008 storm season sorted by station name, sample date and monitoring event.

NM = Normal Monitoring (water column) including resampling due to toxicity. Sediment = Sediment sampling including resampling due to toxicity.

Station Name	Station Code	Monitoring Event	Season	Sample Date	Sample Time	Failure Reason	Sample Comments
Ash Slough @ Ave 21	545XASAAT	NM	Storm1	01/25/08	12:10	Dry	
Ash Slough @ Ave 21	545XASAAT	NM	Storm2	02/25/08	12:30	Dry	
Ash Slough @ Ave 21	545XASAAT	Sediment	Storm2	03/04/08	10:52	Dry	
Bear Creek @ Kibby Rd	535XBCAKR	NM	Storm1	01/24/08	16:00	none	
Bear Creek @ Kibby Rd	535XBCAKR	NM	Storm2	02/25/08	13:50	none	
Bear Creek @ Kibby Rd	535XBCAKR	Sediment	Storm2	03/04/08	15:30	none	
Berenda Slough along Ave 18 1/2	545XBSAAE	NM	Storm1	01/25/08	11:48	Dry	
Berenda Slough along Ave 18 1/2	545XBSAAE	NM	Storm2	02/25/08	12:10	Dry	
Berenda Slough along Ave 18 1/2	545XBSAAE	Sediment	Storm2	03/04/08	10:40	Dry	
Black Rascal Creek @ Yosemite Rd	535BRCAYR	NM	Storm1	01/24/08	17:00	none	
Black Rascal Creek @ Yosemite Rd	535BRCAYR	NM	Storm2	02/25/08	14:10	none	
Black Rascal Creek @ Yosemite Rd	535BRCAYR	NM	Storm2	03/04/08	12:20	none	Resampling event due to *Selenastrum* toxicity on 02/25/2008.
Black Rascal Creek @ Yosemite Rd	535BRCAYR	Sediment	Storm2	03/04/08	12:20	none	
Cottonwood Creek @ Rd 20	545XCCART	NM	Storm1	01/25/08	9:50	none	
Cottonwood Creek @ Rd 20	545XCCART	NM	Storm1	01/30/08	9:30	none	Resampling event due to *Pimephales* toxicity on 01/25/2008.
Cottonwood Creek @ Rd 20	545XCCART	NM	Storm2	02/25/08	9:40	none	
Cottonwood Creek @ Rd 20	545XCCART	Sediment	Storm2	03/04/08	9:20	none	
Cottonwood Creek @ Rd 20	545XCCART	Sediment	Storm2	03/28/08	9:06	Dry	Resampling event due to *Hyalella* toxicity on 03/04/08.
Deadman Creek (Dutchman) @ Gurr Rd	535XDCAGR	NM	Storm1	01/25/08	10:50	none	
Deadman Creek (Dutchman) @ Gurr Rd	535XDCAGR	NM	Storm2	02/25/08	9:50	none	

Station Name	Station Code	Monitoring Event	Season	Sample Date	Sample Time	Failure Reason	Sample Comments
Deadman Creek (Dutchman) @ Gurr Rd	535XDCAGR	NM	Storm2	03/04/08	11:30	none	Resampling event due to *Selenastrum* toxicity on 02/25/2008.
Deadman Creek (Dutchman) @ Gurr Rd	535XDCAGR	Sediment	Storm2	03/04/08	11:30	none	
Deadman Creek @ Hwy 59	535DMCAHF	NM	Storm1	01/25/08	12:00	none	
Deadman Creek @ Hwy 59	535DMCAHF	NM	Storm1	01/30/08	13:50	none	Resampling event due to *Selenastrum* toxicity on 01/25/2008.
Deadman Creek @ Hwy 59	535DMCAHF	NM	Storm2	02/25/08	10:50	none	
Deadman Creek @ Hwy 59	535DMCAHF	Sediment	Storm2	03/04/08	14:20	none	
Dry Creek @ Rd 18	545XDCARE	NM	Storm1	01/25/08	11:10	none	Experienced *S. capricornutum* toxicity; site not resampled on 01/30/08 due to a laboratory communication error.
Dry Creek @ Rd 18	545XDCARE	NM	Storm2	02/25/08	11:10	none	
Dry Creek @ Rd 18	545XDCARE	NM	Storm2	03/04/08	10:00	none	Resampling event due to *Selenastrum* toxicity on 02/25/2008.
Dry Creek @ Rd 18	545XDCARE	Sediment	Storm2	03/04/08	10:00	none	
Dry Creek @ Wellsford Rd	535XDCAWR	NM	Storm1	01/24/08	9:10	none	
Dry Creek @ Wellsford Rd	535XDCAWR	NM	Storm1	01/30/08	13:40	none	Site inadvertently resampled due to a laboratory communication error.
Dry Creek @ Wellsford Rd	535XDCAWR	NM	Storm2	02/26/08	8:30	none	
Dry Creek @ Wellsford Rd	535XDCAWR	NM	Storm2	03/04/08	8:20	none	Resampling event due to *Selenastrum* toxicity on 02/26/2008.
Dry Creek @ Wellsford Rd	535XDCAWR	Sediment	Storm2	03/04/08	8:20	none	
Dry Creek @ Wellsford Rd	535XDCAWR	Sediment	Storm2	03/28/08	14:40	none	Resampling event due to *Hyalella* toxicity on 03/04/08.
Duck Slough @ Gurr Rd	535XDSAGR	NM	Storm1	01/25/08	9:40	none	

Station Name	Station Code	Monitoring Event	Season	Sample Date	Sample Time	Failure Reason	Sample Comments
Duck Slough @ Gurr Rd	535XDSAGR	NM	Storm2	02/25/08	9:10	none	
Duck Slough @ Gurr Rd	535XDSAGR	Sediment	Storm2	03/04/08	13:50	none	
Duck Slough @ Hwy 99	535XDSAHN	NM	Storm1	01/25/08	13:10	none	
Duck Slough @ Hwy 99	535XDSAHN	NM	Storm2	02/25/08	12:40	none	
Duck Slough @ Hwy 99	535XDSAHN	Sediment	Storm2	03/04/08	15:30	none	
Hatch Drain @ Tuolumne Rd	535XHDATR	NM	Storm1	01/24/08	10:00	none	
Hatch Drain @ Tuolumne Rd	535XHDATR	NM	Storm1	01/30/08	12:10	none	Resampling event due to *Selenastrum* toxicity on 01/25/2008.
Hatch Drain @ Tuolumne Rd	535XHDATR	NM	Storm2	02/26/08	9:20	none	
Hatch Drain @ Tuolumne Rd	535XHDATR	NM	Storm2	03/04/08	10:30	none	Resampling event due to *Selenastrum* toxicity on 02/26/2008.
Hatch Drain @ Tuolumne Rd	535XHDATR	Sediment	Storm2	03/04/08	10:30	none	
Hatch Drain @ Tuolumne Rd	535XHDATR	Sediment	Storm2	03/28/08	13:40	none	Resampling event due to *Hyalella* toxicity on 03/04/08.
Highline Canal @ Hwy 99	535XHCHNN	NM	Storm1	01/24/08	14:40	none	
Highline Canal @ Hwy 99	535XHCHNN	NM	Storm2	02/26/08	13:00	none	
Highline Canal @ Hwy 99	535XHCHNN	NM	Storm2	03/04/08	12:40	none	Resampling event due to *Selenastrum* toxicity on 02/26/2008.
Highline Canal @ Hwy 99	535XHCHNN	Sediment	Storm2	03/04/08	12:40	none	
Highline Canal @ Hwy 99	535XHCHNN	Sediment	Storm2	03/28/08	10:30	none	Resampling event due to *Hyalella* toxicity on 03/04/08.
Highline Canal @ Lombardy Ave	535XHCALR	NM	Storm1	01/24/08	12:50	none	
Highline Canal @ Lombardy Ave	535XHCALR	NM	Storm1	01/30/08	12:20	none	Resampling event due to *Ceriodaphnia* toxicity on 01/24/2008.
Highline Canal @ Lombardy Ave	535XHCALR	NM	Storm2	02/26/08	12:00	none	
Highline Canal @ Lombardy Ave	535XHCALR	NM	Storm2	03/04/08	13:20	none	Resampling event due to *Pimephales* toxicity on 02/26/2008.
Highline Canal @ Lombardy Ave	535XHCALR	Sediment	Storm2	03/04/08	13:20	none	

Station Name	Station Code	Monitoring Event	Season	Sample Date	Sample Time	Failure Reason	Sample Comments
Highline Canal @ Lombardy Ave	535XHCALR	Sediment	Storm2	03/28/08	11:30	none	Resampling event due to *Hyalella* toxicity on 03/04/08.
Hilmar Drain @ Central Ave	535XHDACA	NM	Storm1	01/24/08	14:10	none	
Hilmar Drain @ Central Ave	535XHDACA	NM	Storm2	02/26/08	11:20	none	
Hilmar Drain @ Central Ave	535XHDACA	Sediment	Storm2	03/04/08	16:40	none	
Hilmar Drain @ Central Ave	535XHDACA	Sediment	Storm2	03/28/08	13:10	none	Resampling event due to *Hyalella* toxicity on 03/04/08.
Livingston Drain @ Robin Ave	535XLDARA	NM	Storm1	01/24/08	15:40	none	
Livingston Drain @ Robin Ave	535XLDARA	NM	Storm2	02/26/08	12:50	none	
Livingston Drain @ Robin Ave	535XLDARA	NM	Storm2	03/04/08	13:10	Dry	Resampling event due to *Selenastrum* toxicity on 02/26/2008.
Livingston Drain @ Robin Ave	535XLDARA	Sediment	Storm2	03/04/08	13:10	Dry	
Merced River @ Santa Fe	535XMRSFD	NM	Storm1	01/24/08	11:40	none	
Merced River @ Santa Fe	535XMRSFD	NM	Storm1	01/30/08	11:40	none	Resampling event due to *Ceriodaphnia* toxicity on 01/24/2008.
Merced River @ Santa Fe	535XMRSFD	NM	Storm2	02/26/08	11:00	none	
Miles Creek @ Reilly Rd	535XMCARR	NM	Storm1	01/25/08	13:40	none	
Miles Creek @ Reilly Rd	535XMCARR	NM	Storm1	01/30/08	10:40	none	Resampling event due to *Ceriodaphnia* toxicity on 01/25/2008.
Miles Creek @ Reilly Rd	535XMCARR	NM	Storm2	02/25/08	11:50	none	
Miles Creek @ Reilly Rd	535XMCARR	Sediment	Storm2	03/04/08	15:00	none	
Mustang Creek @ East Ave	535XMCAEA	NM	Storm1	01/24/08	10:40	none	
Mustang Creek @ East Ave	535XMCAEA	NM	Storm1	01/30/08	12:40	none	Resampling event due to *Ceriodaphnia* toxicity on 01/24/2008.
Mustang Creek @ East Ave	535XMCAEA	NM	Storm2	02/26/08	9:50	none	
Mustang Creek @ East Ave	535XMCAEA	NM	Storm2	03/04/08	14:00	none	Resampling event due to *Selenastrum* toxicity on 02/26/2008.
Mustang Creek @ East Ave	535XMCAEA	Sediment	Storm2	03/04/08	14:00	none	

Station Name	Station Code	Monitoring Event	Season	Sample Date	Sample Time	Failure Reason	Sample Comments
Mustang Creek @ East Ave	535XMCAEA	Sediment	Storm2	03/28/08	12:20	none	Resampling event due to *Hyalella* toxicity on 03/04/08.
Prairie Flower Drain @ Crows Landing Rd	535XPFDCL	NM	Storm1	01/24/08	12:20	none	
Prairie Flower Drain @ Crows Landing Rd	535XPFDCL	NM	Storm1	01/30/08	12:40	none	Resampling event due to *Selenastrum* toxicity on 01/25/2008.
Prairie Flower Drain @ Crows Landing Rd	535XPFDCL	NM	Storm2	02/26/08	10:10	none	
Prairie Flower Drain @ Crows Landing Rd	535XPFDCL	NM	Storm2	03/04/08	11:30	none	Resampling event due to *Selenastrum* toxicity on 02/26/2008.
Prairie Flower Drain @ Crows Landing Rd	535XPFDCL	Sediment	Storm2	03/04/08	11:30	none	
Silva Drain @ Meadow Dr	535XSDAMD	NM	Storm1	01/24/08	11:12	Dry	
Silva Drain @ Meadow Dr	535XSDAMD	NM	Storm2	02/26/08	10:30	Dry	
Silva Drain @ Meadow Dr	535XSDAMD	Sediment	Storm2	03/04/08	14:40	Dry	
South Slough @ Quinley Rd	535XSSAQR	NM	Storm1	01/25/08	8:50	Dry	
South Slough @ Quinley Rd	535XSSAQR	NM	Storm2	02/25/08	8:40	Dry	
South Slough @ Quinley Rd	535XSSAQR	Sediment	Storm2	03/04/08	13:33	Dry	
Westport Drain @ Vivian Rd	535XWDAVR	NM	Storm1	01/24/08	8:40	none	
Westport Drain @ Vivian Rd	535XWDAVR	NM	Storm2	02/26/08	8:30	none	
Westport Drain @ Vivian Rd	535XWDAVR	NM	Storm2	03/04/08	9:50	none	Resampling event due to *Selenastrum* toxicity on 02/26/2008.
Westport Drain @ Vivian Rd	535XWDAVR	Sediment	Storm2	03/04/08	9:50	none	

Sampling and Analytical Methods Used

Sample collection criteria and field instruments are provided in Table 11 and Table 12. Analytical methods and reporting limits are provided in Table 13. All field sampling methods were performed as outlined in the standard operating procedures (SOPs) provided in the Quality Assurance Project Plan (QAPP). All analytical methods were performed as described in the QAPP.

Table 11. Sampling procedures, containers, sample volumes, preservation and storage techniques, and holding times.

Parameter	Sample Container	Sample Volume[1]	Immediate Processing and Storage	Holding Time[2]
Physical Parameters[3]				
Color	Glass or polyethylene	500 mL	Store at 4°C	48 hours
Turbidity	Glass or polyethylene	150 mL	Store at 4°C	48 hours
Total Dissolved Solids	Polyethylene	500 mL	Store at 4°C	7 days
Drinking Water				
E. coli (pathogens)	Polyethylene (sterile)	100 mL	Store at 4°C	24 hours[4]
Total Organic Carbon	Amber Glass VOA, PTFE-lined cap	125 mL	Preserve w/HCL; Store at 4°C	28 days
Toxicity				
Aquatic bioassays	Amber glass	5 gallons	Store at 4°C	36 hours
Sediment bioassays	Glass	1 liter (x2)	Store at 4°C	14 days
Pesticides				
Carbamates	Amber Glass	1 liter	Store at 4°C; Extract within 7 days	40 days
Organochlorines	Amber Glass	1 liter		
Organophosphates	Amber Glass	1 liter		
Pyrethroids	Amber Glass	1 liter		
Herbicides (general)	Amber Glass	1 liter		
Herbicides (paraquat)	Polyethylene	1 liter		
Herbicides (glyphosate)	Amber Glass VOA	40 ml (x2)	Store at 4°C, freeze within 2 weeks	6 months
Nutrients				
TKN, Ammonia, and Total Phosphorus	Polyethylene	500 mL	Preserve to ≤ pH 2 with H_2SO_4; Store at 4°C	28 days
Nitrate as NO3, Nitrite as N, and Soluble Ortho-Phosphate	Polyethylene	1000 mL	Store at 4°C	48 hours
Metals/Trace Elements				
Trace elements[5]	Polyethylene	500 mL	Filter as necessary; Preserve to ≤ pH 2 with HNO_3	40 days

1. Additional volumes may be required for QC analyses; NA = Not Applicable
2. Holding time after initial preservation or extraction.
3. Volume of water necessary to analyze the physical parameters is typically combined in multiple 1L polyethylene bottles, which provides sufficient volume for re-analyses and lab spike duplicates. This is only possible when the same laboratory provides the analyses for all of the physical parameters.
4. Samples for bacteria analyses should be set up as soon as possible.
5. To include arsenic, boron, cadmium, copper, lead, nickel, selenium, and zinc.

Table 12. Field parameters and instruments used to collect measurements.

Parameter	Instrument
Dissolved oxygen	YSI Model 556
Temperature	YSI Model 556
pH	YSI Model 556
Specific Conductance	YSI Model 556
Discharge	Marsh-McBirney Flow Meter

Table 13. Analytical methods, target reporting limits (RL) and units.

Analyte	Method	RL	Units
Physical Parameters			
Color	EPA 100.2	5.0	color units
Turbidity	EPA 180.1	1.0	NTU
Dissolved Solids, Total	EPA 160.1	10	mg/L
Drinking Water Parameters			
Escherischia coli (*E. coli*)	SM 9223	2	MPN/100 mL
Total Organic Carbon	EPA 415.1	0.5	mg/L
Nutrients			
Total Kjeldahl Nitrogen	EPA 351.3	0.5	mg/L
Nitrate as N	EPA 300.0	0.05	mg/L
Nitrite as N	EPA 354.1	0.05	mg/L
Ammonia	EPA 350.2	0.10	mg/L
Hardness	EPA 130.2	10	mg/L
Total Phosphorus	EPA 365.2	0.01	mg/L
Soluble Orthophosphate	EPA 365.2	0.01	mg/L
Metals			
Arsenic	EPA 200.8	1	µg/L
Boron	EPA 200.8	10	µg/L
Cadmium	EPA 200.8	0.1	µg/L
Copper	EPA 200.8	0.5	µg/L
Lead	EPA 200.8	0.5	µg/L
Nickel	EPA 200.8	1	µg/L
Selenium	EPA 200.8	1	µg/L
Zinc	EPA 200.8	1	µg/L
Carbamate Pesticides			
Aldicarb	EPA 8321	0.5	µg/L
Carbaryl	EPA 8321	0.5	µg/L
Carbofuran	EPA 8321	0.5	µg/L
Methiocarb	EPA 8321	0.5	µg/L
Methomyl	EPA 8321	0.5	µg/L
Oxnamyl	EPA 8321	0.5	µg/L
Organochlorine Pesticides			
DDD	EPA 8081A	0.02	µg/L
DDE	EPA 8081A	0.01	µg/L
DDt	EPA 8081A	0.01	µg/L
Dicofol	EPA 8081A	0.1	µg/L
Dieldrin	EPA 8081A	0.01	µg/L
Endrin	EPA 8081A	0.01	µg/L
Methoxychlor	EPA 8081A	0.05	µg/L
Organophosphorus Pesticides			

Analyte	Method	RL	Units
Azinphos-methyl	EPA 8141A	0.1	µg/L
Chlorpyrifos	EPA 8141A	0.02	µg/L
Diazinon	EPA 8141A	0.02	µg/L
Dimethoate	EPA 8141A	0.1	µg/L
Disulfoton	EPA 8141A	0.1	µg/L
Malathion	EPA 8141A	0.1	µg/L
Methamidophos	EPA 8141A	0.2	µg/L
Methidathion	EPA 8141A	0.1	µg/L
Parathion-methyl	EPA 8141A	0.1	µg/L
Phorate	EPA 8141A	0.2	µg/L
Phosmet	EPA 8141A	0.2	µg/L
Pyrethroid Pesticides			
Biphenthrin	EPA 8081A	0.05	µg/L
Cyfluthrin	EPA 8081A	0.05	µg/L
Cypermethrin	EPA 8081A	0.05	µg/L
Esfenvalerate	EPA 8081A	0.05	µg/L
Lambda-Cyhalothrin	EPA 8081A	0.05	µg/L
Permethrin	EPA 8081A	0.05	µg/L
Herbicides			
Atrazine	EPA 619	0.5	µg/L
Cyanazine	EPA 619	0.5	µg/L
Diuron	EPA 8321	0.5	µg/L
Glyphosate	EPA 547	5	µg/L
Linuron	EPA 8321	0.5	µg/L
Molinate	EPA 8141A	0.5	µg/L
Paraquat dichloride	EPA 549.1	0.5	µg/L
Simazine	EPA 619	0.5	µg/L
Thiobencarb	EPA 8141A	0.5	µg/L

Copy of Chain of Custody Forms

Original Chain of Custody (COC) forms have been scanned, converted to pdf and are provided in Appendix II. COCs were faxed by the contract laboratories to Michael L. Johnson, LLC after the receipt of samples by the laboratory. As such, they are complete and accurate records of sample handling and processing and reflect the timing of sample collection and delivery to the laboratories. Sample collection and delivery was performed according to the QAPP. If there were any discrepancies between the COC and sample delivery, the issues were resolved and documented either directly on the COC or on an anomaly form filled out by the laboratory. Documentation of COC anomalies can be found in Table II-1 of Appendix II.

Lab and Field QC Results

Laboratory and field quality control (QC) results are included in Appendix III. Field duplicate and field blank results are included for organics, inorganics (including metals, physical parameters, nutrients and *E. coli*), and field duplicates for toxicity. Laboratory QC results include matrix spikes (MS) performed on both Coalition samples and samples from other projects, laboratory control spikes (LCS), laboratory blanks and laboratory duplicates. All control criteria are listed with the result and samples not meeting control criteria are flagged.

Precision and Accuracy

Normal surface water monitoring occurred twice during the storm season of 2008 for 23 sites, with the following exceptions due to lack of water:

- Ash Slough @ Ave 21 (01/25/08, 02/25/08)
- Berenda Slough along Ave 18 ½ (01/25/08, 02/25/08)
- Silva Drain @ Meadow Dr (01/24/08, 02/26/08)
- South Slough @ Quinley Rd (01/25/08, 02/25/08)

Resampling to test for water column toxicity persistence occurred at the following sites with the exception of Dry Creek @ Rd 18 (sample toxic on 01/25/08) which was not resampled due to a laboratory communication error. Dry Creek @ Wellsford Rd was resampled instead and did not exhibit toxicity in the original sample on 01/24/08 or resample on 01/30/08):

- Black Rascal Creek @ Yosemite Rd (03/04/08)
- Cottonwood Creek @ Rd 20 (01/30/08)
- Deadman Creek @ Gurr Rd (03/04/08)
- Deadman Creek @ Hwy 59 (01/30/08)
- Dry Creek @ Rd 18 (03/04/08)
- Dry Creek @ Wellsford Rd (01/30/08, 03/04/08)
- Hatch Drain @ Tuolumne Rd (01/30/08, 03/04/08)
- Highline Canal @ Hwy 99 (03/04/08)
- Highline Canal @ Lombardy Ave (01/30/08, 03/04/08)
- Livingston Drain @ Robin Ave (03/04/08)
- Merced River @ Santa Fe (01/30/08)
- Miles Creek @ Reilly Rd (01/30/08)
- Mustang Creek @ East Ave (01/30/08, 03/04/08)
- Prairie Flower Drain @ Crows Landing Rd (01/30/08, 03/04/08)
- Westport Drain @ Vivian Rd (03/04/08)

During water column toxicity resampling one site was dry and therefore not sampled:

- Livingston Drain @ Robin Ave (03/04/08)

Sediment sampling occurred once during the storm season during the month of March. The following sites were not sampled due to a lack of water:

- Ash Slough @ Ave 21 (03/04/08)
- Berenda Slough along Ave 18 ½ (03/04/08)
- Livingston Drain @ Robin Ave (03/04/08)
- Silva Drain @ Meadow Dr (03/04/08)
- South Slough @ Quinley Rd (03/04/08)

Resampling to test for sediment toxicity persistence occurred at the following sites:

- Dry Creek @ Wellsford Rd (03/28/08)
- Highline Canal @ Hwy 99 (03/28/08)
- Highline Canal @ Lombardy Ave (03/28/08)
- Hilmar Drain @ Central Ave (03/28/08)
- Mustang Creek @ East Ave (03/28/08)

During sediment the following site was dry and therefore not sampled:

- Cottonwood Creek @ Rd 20 (03/28/08)

Chemistry

Due to the addition of new sites during the irrigation season of 2006, not all sites are sampled for all constituents since they are part of Phase I monitoring. In addition some constituents at specific sites have been dropped due to no exceedances in two or more years (see Table 6). Therefore, for normal monitoring, not including laboratory or field QCs, 38 organic (pesticides including carbamates, organochlorines, organophoshates and herbicides), 26 organic (pyrethroid pesticides), 36 *E. coli*, 38 physical parameter, and 32 nutrient and metal samples were collected and analyzed. There was 100% completeness for environmental samples collected for chemistry analyses.

For each storm monitoring event, one field duplicate and field blank were collected for each constituent to meet the field QC requirement of 5%. Field blanks and duplicates comprised 8-12% of organic samples, 8% of *E. coli* samples, 8% of physical parameter samples, 9% of nutrient samples and 6-9% of metal samples. Field duplicate are examined for field precision based on the relative percent difference (RPD) between the duplicate and the environmental sample (RPD < 25). When water is sampled at high flows, there is a higher chance that the field duplicate does meet data quality objectives due to the heterogeneity of the water column. Field duplicates are collected by hand by holding both bottles under water at the same time. However, the samples may represent different locations along the cross section of the water body.

For some constituents the environmental sample may exceed the amount that the detector can detect and therefore requires a dilution. The result reported is the amount found in the diluted sample multiplied by the dilution factor to represent the amount of the analyte present in the original sample. The dilution factor is recorded and the reporting limit (RL) is generally increased by multiplying the RL for that analyte by the dilution factor. There are times that the RL is increased higher than this value based on method requirements. Therefore, for each dilution that occurs, there is a corresponding increase in the limit of quantification.

For pesticides such as paraquat, co-elution, also referred to as matrix interference, may cause the RL to be raised and the sample is flagged. In such cases the dilution factor (DF) is recorded in the laboratory comments for each sample.

All results are reported in the Monitoring Results section of this report (Appendix I). Each result is flagged if it does not meet data quality objectives (acceptability criteria) using SWAMP codes and can also be found in the SWAMP comparable database managed by the Coalition and posted on the UC Davis Center for Environmental Data Exchange Network (CEDEN) ftp site (ftp://aeal-FTP.ucdavis.edu). A review of the number of samples analyzed and the percentage per analyte that meets acceptability criteria are listed in the tables following this section. A brief overview is listed below to assess overall precision and accuracy per analyte (all pesticides are grouped and discussed together).

- Color: One hundred percent of field blanks were less than the RL. Sixty-seven percent of field duplicates had RPDs less than 25. Laboratory control spikes and lab blanks were run with each color batch and all met laboratory QC criteria. Lab duplicates were recorded by the laboratory to access precision and 100% had RPDs less than 25.

- Hardness: One hundred percent of all field blanks and field duplicates met acceptance criteria. All laboratory QCs met quality criteria. Lab control spikes, matrix spikes, matrix spike duplicates, and lab blanks were run with every batch and all met precision and accuracy requirements.

- Total Dissolved Solids (TDS): One hundred percent of field blanks and field duplicates met acceptance criteria. Lab blanks and laboratory duplicates were run with every batch and met acceptance criteria for 100% of samples. Matrix spikes cannot be performed for TDS.

- Turbidity: One hundred percent of field blanks and 67% of field duplicates met acceptance criteria. Lab blanks were run with every batch and 100% were less than the RL. Laboratory control spikes and laboratory duplicates were analyzed with each batch and 100% of the samples met acceptance criteria. Matrix spikes cannot be performed for turbidity.

- Nitrate as N: One hundred percent of field duplicates and field blanks met acceptance criteria. Lab blanks were run with every batch and were less than the RL for all samples. Lab control spikes were within acceptability criteria for all batches. Matrix spikes were performed in each batch with 75% meeting acceptability requirements and matrix spike duplicates met 100% of acceptability requirement for precision.

- Ammonia as N: One hundred percent of field blanks met acceptance criteria. Thirty-three percent of field duplicates had an RPD less than 25. The field duplicate collected on January 25, 2008 had an RPD of 29.7 and the other field duplicate collected on February 26, 2008 had an RPD of 68. The February field duplicate had a result of 0.2 µg/L whereas the environmental sample had a result of 0.099 µg/L which was below the RL and considered detected but not quantifiable (DNQ). The Coalition treats results that are below the RL as real values however it is important to note that these results are not above a limit that the laboratory can accurately detect and therefore should be considered estimates. Lab blanks and laboratory control spikes were run with every batch and 100% were less than the RL. Ninety percent of matrix spikes and 100% of matrix spike duplicates were within acceptability criteria.

- Nitrogen, Total Kjeldahl (TKN): One hundred percent of field blanks and 67% of field duplicates met acceptance criteria. Lab blanks were run with every batch and were less than the RL. Lab control spikes were within acceptability criteria for all batches. Matrix spikes were performed in each batch with 92% meeting acceptability requirements. Matrix spike duplicates met 100% of acceptability requirement for precision.

- Nitrite as N: One hundred percent of field duplicates and field blanks met acceptance criteria. Lab blanks were run with every batch and were less than the RL. Lab control spikes, matrix spikes and matrix spike duplicates were within acceptability criteria for all batches meeting requirements of accuracy and precision.

- Orthophosphate as P: One hundred percent of field duplicates and field blanks met acceptance criteria. Lab blanks were run with every batch and were less than the RL. Lab control spikes were within acceptability criteria for all batches. Matrix spikes were performed in each batch with 75% meeting acceptability criteria and 100% of matrix spike duplicates meeting the requirements of accuracy and precision.

- Phosphate as P: One hundred percent of field blanks and 67% of field duplicates met acceptance criteria. Lab blanks were run with every batch and were less than the RL. Lab control spikes, matrix spikes and matrix spike duplicates were within acceptability criteria for all batches meeting requirements of accuracy and precision.

- Total Organic Carbon (TOC): Sixty-seven percent of field blanks and field duplicates collected met acceptance criteria. The detection in the field blank sample that exceeded the acceptance criteria (<RL or <1/5 the environmental sample) was 1.4 µg/L (environmental sample = 6.5 µg/L). Contamination in the field may be due to contamination of the field blank water, the field blank storage container, the field blank bottle, or contamination from the sampler. The water analyzed in the field blank was de-ionized (DI) water collected from UC Davis and stored in a high-density polyethylene (HDPE) carboy which is used only to store DI water. The field blank bottle came directly from the laboratory and is certified pre-clean. The bottle was not opened until right before filling it with DI water. Clean gloves were used when filling the bottle with DI water from the carboy and neither the lid nor the opening of the bottle was touched. The cap was immediately returned to the bottle and screwed on tightly after filling with DI water. All sampling SOPs (which include the above steps to prevent contamination) were followed. Other sources of contamination may have occurred during transport from the field to the laboratory (all bottles were closed tightly and only touched when being put in the cooler by the sampler and taken from the cooler by the laboratory with gloved hands) and/or during the laboratory extraction process. The associated lab blank had no total organic carbon detections. It is difficult to know for sure the source of contamination and both the samplers and the laboratory have been informed of the issue. Lab control spikes laboratory duplicates were within acceptability criteria for all batches. Matrix spikes were performed in each batch with 67% meeting acceptability requirements and matrix spike duplicates met 100% of acceptability requirement for precision.

- Total Metals: One hundred percent of field blanks met field precision criteria. All field duplicates, except for cadmium and selenium, met acceptance criteria. Sixty-seven percent of cadmium and selenium field duplicates had RPDs less than 25. Field duplicate RPDs outside of criteria were 33.3 and 38 for cadmium and selenium, respectively. Due to past detections in field blanks, travel blanks were sent from the lab and traveled with the sampling crew from beginning to end. All travel blanks met acceptability criteria of being less than the RL. Laboratory blanks were run for each metals batch and 100% of samples met acceptability criteria. Laboratory control spikes were within acceptable recovery limits for 100% of samples run. All matrix spike and matrix spike duplicate samples met the requirements of accuracy and precision (RPD < 25).

- *E. coli:* Sterility checks, or laboratory blanks, negative control and positive control samples were run for each batch. One hundred percent of lab blanks performed by the laboratory were less than the RL. One hundred percent of field blanks collected had *E. coli* numbers less than the RL of 1. R_{log}s were performed on *E. coli* laboratory duplicates by Caltest Laboratories. The mean R_{log} for the laboratory was calculated to be 0.40. This value multiplied by 3.27 resulted in a precision criterion of 1.30. All laboratory duplicates had R_{log}s below the criteria acceptance level. RPDs were also calculated for E. coli laboratory duplicates and 100% were less than 25. Due to the nature of the analysis method and *E. coli* distribution within the water column, it is not possible to use RPDs to assess precision, however field duplicate RPDs have been recorded to monitor the variation in duplicates over time analyzed by the lab.

- Pesticides: One hundred percent of field blanks collected met acceptability criteria. One hundred percent of field duplicates collected met acceptability criteria of RPDs <25 except for simazine (a single sample was above criteria with an RPD of 27). The field crews were notified of the high RPD; all field SOPs were followed including collecting the environmental and field duplicate samples at the same time. Storm events tend to cause turbid waters due to increased sediment mobilization. A water body that is not well mixed across the width of the channel can result in unequal concentrations of a pesticide.

For the storm season, pesticides were analyzed in eight different groups: pyrethroids (EPA 8081A), organochlorines (EPA 8081A), organophosphates (EPA 8141A), carbamates (EPA 8321A), methamidophos (EPA 8141A), paraquat (EPA 549.2), glyphosate (EPA 547), and triazines (EPA 619). Lab blanks were performed for each batch and met acceptability criteria for all analysis. Matrix spikes and lab control spikes were performed for each batch to assess precision and accuracy as well as possible matrix interference. Either a matrix spike duplicate and/or a lab control spike duplicate were performed per batch to assess precision. Surrogates were run for each analysis except for paraquat and glyphosate. Surrogate recoveries were within specific acceptance criteria for 94% of all samples analyzed. Laboratory control spikes and laboratory control spike duplicates were within acceptability criteria for 100% of all analytes except for paraquat (86% of laboratory control spikes met acceptability requirements). One hundred percent of matrix spikes were within acceptability criteria except for cyanazine (75% were within recovery criteria) and paraquat (none of the matrix spikes were within critiera). Paraquat analysis is difficult to perform due to matrix interferences; paraquat tends to bind to suspended solids in the sample and therefore recoveries of matrix spike samples are consistently low. The Coalition switched laboratories prior to the storm season in hopes that the new laboratory would have improved matrix spike recoveries. The Coalition will discuss with the laboratory measures to improve matrix spike recoveries. Laboratory precision, as assessed by the RPD of laboratory duplicates, met acceptability criteria in 100% of matrix spike duplicates for all samples. All batches with laboratory QCs outside of acceptability criteria have been flagged in addition to the specific sample acceptability criteria. If a surrogate was outside of acceptability criteria, the surrogate was flagged as well as the associated sample within that batch. Batches are approved by evaluating all measures of precision and accuracy such that although a single QC sample may be outside of acceptability criteria, the entire batch may be accepted due to other QCs within that batch meeting acceptability criteria.

Hold times for all chemistry analysis were met except for one color sample and eight nitrate samples. The color sample was performed a few hours past the 48 hour hold time due to a laboratory error. The nitrate samples were run overnight and due to an instrument malfunction the remaining eight samples were run past the 48 hour hold time.

Toxicity

For aquatic toxicity tests, the acceptability of test results is determined primarily by performance-based criteria for test organisms, culture and test conditions, and the results of control bioassays. Control bioassays include monthly reference toxicant testing and negative and solvent controls (for TIEs). Test acceptability requirements are documented in the method documents for each bioassay method and are included in the QAPP. In addition to the QA requirements for the toxicity testing methods, a minimum of 5% of the samples collected are required to be collected as field duplicates. Field duplicates were collected every sampling event such that the overall rate of field duplicates would be at least 5% of all samples including management plan samples and resamples due to toxicity during normal monitoring. The overall percentage of field duplicates are as follows: *Ceriodaphnia* 7% *Pimephales* 7%, *Selenastrum* 6% and *Hyalella* 4%.

- Water Column Toxicity: Field duplicates were collected during each storm event and were tested for *Ceriodaphnia, Selenastrum, and Pimephales*. For these three species RPDs for all field duplicates were within acceptability criteria (RPD < 25) except for *Selenastrum*, which had 67% of field duplicate samples meeting the acceptability criteria. All tests met holding time requirements (<36 hrs), water quality requirements and control requirements (as listed in the EPA method guidelines).

- Sediment Toxicity: Sediment was collected on March 4, 2008 and resampled on March 28, 2008. Three of the four ice chests containing samples from the March 4 sampling event arrived at Nautilus on March 7. Due to courier error, the remaining ice chest arrived on March 10. All samples were received in good condition and within temperature range requirements. Once received the samples were moved into a 4°C refrigerator.

  One field duplicate was collected and was within acceptability criteria. One hundred percent of the sediment samples had laboratory controls within acceptability criteria. All sediment samples met holding time criteria.

Table 14. ESJWQC summary of field blank quality control sample evaluations.

Samples were collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	<RL or < (env sample/5)	3	3	100.00
EPA 8321A CARB	Carbaryl	<RL or < (env sample/5)	3	3	100.00
EPA 8321A CARB	Carbofuran	<RL or < (env sample/5)	3	3	100.00
EPA 8321A CARB	Methiocarb	<RL or < (env sample/5)	3	3	100.00
EPA 8321A CARB	Methomyl	<RL or < (env sample/5)	3	3	100.00
EPA 8321A CARB	Oxamyl	<RL or < (env sample/5)	3	3	100.00
EPA 8321A CARB	Diuron	<RL or < (env sample/5)	3	3	100.00
EPA 8321A CARB	Linuron	<RL or < (env sample/5)	3	3	100.00
EPA 619	Atrazine	<RL or < (env sample/5)	3	3	100.00
EPA 619	Cyanazine	<RL or < (env sample/5)	3	3	100.00
EPA 619	Simazine	<RL or < (env sample/5)	3	3	100.00
EPA 547M	Glyphosate	<RL or < (env sample/5)	3	3	100.00
EPA 549.2M	Paraquat dichloride	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	DDD(p,p')	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	DDE(p,p')	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	DDT(p,p')	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Dicofol	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Dieldrin	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Endrin	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Methoxychlor	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Bifenthrin	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Cyfluthrin, total	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Cypermethrin, total	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Cyhalothrin, lambda, total	<RL or < (env sample/5)	3	3	100.00
EPA 8081A	Permethrin, total	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Azinphos methyl	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Chlorpyrifos	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Diazinon	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Dimethoate	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Disulfoton	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Malathion	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Methidathion	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Parathion, Methyl	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Phorate	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Phosmet	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Molinate	<RL or < (env sample/5)	3	3	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Thiobencarb	<RL or < (env sample/5)	3	3	100.00
EPA 8141A OP	Methamidophos	<RL or < (env sample/5)	3	3	100.00
EPA 110.2	Color	<RL or < (env sample/5)	3	3	100.00
EPA 130.2	Hardness as CaCO3	<RL or < (env sample/5)	2	2	100.00
EPA 160.1	Total Dissolved Solids	<RL or < (env sample/5)	3	3	100.00
EPA 180.1	Turbidity	<RL or < (env sample/5)	3	3	100.00
EPA 300.0	Nitrate as N	<RL or < (env sample/5)	3	3	100.00
EPA 350.2	Ammonia as N	<RL or < (env sample/5)	3	3	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	<RL or < (env sample/5)	3	3	100.00
EPA 354.1	Nitrite as N	<RL or < (env sample/5)	3	3	100.00
EPA 365.2	OrthoPhosphate as P	<RL or < (env sample/5)	3	3	100.00
EPA 365.2	Phosphate as P	<RL or < (env sample/5)	3	3	100.00
EPA 415.1	Total Organic Carbon	<RL or < (env sample/5)	3	2	66.67
SM 9223	E. coli	<RL or < (env sample/5)	3	3	100.00
EPA 200.8	Arsenic	<RL or < (env sample/5)	2	2	100.00
EPA 200.8	Boron	<RL or < (env sample/5)	2	2	100.00
EPA 200.8	Cadmium	<RL or < (env sample/5)	2	2	100.00
EPA 200.8	Copper	<RL or < (env sample/5)	2	2	100.00
EPA 200.8	Lead	<RL or < (env sample/5)	2	2	100.00
EPA 200.8	Nickel	<RL or < (env sample/5)	2	2	100.00
EPA 200.8	Selenium	<RL or < (env sample/5)	2	2	100.00
EPA 200.8	Zinc	<RL or < (env sample/5)	2	2	100.00
		TOTAL	168	167	99.40

Table 15. ESJWQC summary of field duplicate quality control sample evaluations.

Samples were collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	RPD ≤ 25	3	3	100.00
EPA 8321A CARB	Carbaryl	RPD ≤ 25	3	3	100.00
EPA 8321A CARB	Carbofuran	RPD ≤ 25	3	3	100.00
EPA 8321A CARB	Methiocarb	RPD ≤ 25	3	3	100.00
EPA 8321A CARB	Methomyl	RPD ≤ 25	3	3	100.00
EPA 8321A CARB	Oxamyl	RPD ≤ 25	3	3	100.00
EPA 8321A CARB	Diuron	RPD ≤ 25	3	3	100.00
EPA 8321A CARB	Linuron	RPD ≤ 25	3	3	100.00
EPA 619	Atrazine	RPD ≤ 25	3	3	100.00
EPA 619	Cyanazine	RPD ≤ 25	3	3	100.00
EPA 619	Simazine	RPD ≤ 25	3	2	66.67
EPA 547M	Glyphosate	RPD ≤ 25	3	3	100.00
EPA 549.2M	Paraquat dichloride	RPD ≤ 25	3	3	100.00
EPA 8081A	DDD(p,p')	RPD ≤ 25	3	3	100.00
EPA 8081A	DDE(p,p')	RPD ≤ 25	3	3	100.00
EPA 8081A	DDT(p,p')	RPD ≤ 25	3	3	100.00
EPA 8081A	Dicofol	RPD ≤ 25	3	3	100.00
EPA 8081A	Dieldrin	RPD ≤ 25	3	3	100.00
EPA 8081A	Endrin	RPD ≤ 25	3	3	100.00
EPA 8081A	Methoxychlor	RPD ≤ 25	3	3	100.00
EPA 8081A	Bifenthrin	RPD ≤ 25	3	3	100.00
EPA 8081A	Cyfluthrin, total	RPD ≤ 25	3	3	100.00
EPA 8081A	Cypermethrin, total	RPD ≤ 25	3	3	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	RPD ≤ 25	3	3	100.00
EPA 8081A	Cyhalothrin, lambda, total	RPD ≤ 25	3	3	100.00
EPA 8081A	Permethrin, total	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Azinphos methyl	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Chlorpyrifos	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Diazinon	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Dimethoate	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Disulfoton	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Malathion	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Methidathion	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Parathion, Methyl	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Phorate	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Phosmet	RPD ≤ 25	3	3	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Molinate	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Thiobencarb	RPD ≤ 25	3	3	100.00
EPA 8141A OP	Methamidophos	RPD ≤ 25	3	3	100.00
EPA 110.2	Color	RPD ≤ 25	3	2	66.67
EPA 130.2	Hardness as CaCO3	RPD ≤ 25	3	3	100.00
EPA 160.1	Total Dissolved Solids	RPD ≤ 25	3	3	100.00
EPA 180.1	Turbidity	RPD ≤ 25	3	2	66.67
EPA 300.0	Nitrate as N	RPD ≤ 25	3	3	100.00
EPA 350.2	Ammonia as N	RPD ≤ 25	3	1	33.33
EPA 351.3	Nitrogen, Total Kjeldahl	RPD ≤ 25	3	2	66.67
EPA 354.1	Nitrite as N	RPD ≤ 25	3	3	100.00
EPA 365.2	OrthoPhosphate as P	RPD ≤ 25	3	3	100.00
EPA 365.2	Phosphate as P	RPD ≤ 25	3	2	66.67
EPA 415.1	Total Organic Carbon	RPD ≤ 25	3	2	66.67
SM 9223	E. coli	RPD ≤ 25	3	3	100.00
EPA 200.8	Arsenic	RPD ≤ 25	3	3	100.00
EPA 200.8	Boron	RPD ≤ 25	3	3	100.00
EPA 200.8	Cadmium	RPD ≤ 25	3	2	66.67
EPA 200.8	Copper	RPD ≤ 25	3	3	100.00
EPA 200.8	Lead	RPD ≤ 25	3	3	100.00
EPA 200.8	Nickel	RPD ≤ 25	3	3	100.00
EPA 200.8	Selenium	RPD ≤ 25	3	2	66.67
EPA 200.8	Zinc	RPD ≤ 25	3	3	100.00
		TOTAL	177	167	94.35

Table 16. ESJWQC summary of method blank quality control sample evaluations.

Samples were analyzed in batches with samples collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	<RL	4	4	100.00
EPA 8321A CARB	Carbaryl	<RL	4	4	100.00
EPA 8321A CARB	Carbofuran	<RL	4	4	100.00
EPA 8321A CARB	Methiocarb	<RL	4	4	100.00
EPA 8321A CARB	Methomyl	<RL	4	4	100.00
EPA 8321A CARB	Oxamyl	<RL	4	4	100.00
EPA 8321A CARB	Diuron	<RL	4	4	100.00
EPA 8321A CARB	Linuron	<RL	4	4	100.00
EPA 619	Atrazine	<RL	4	4	100.00
EPA 619	Cyanazine	<RL	4	4	100.00
EPA 619	Simazine	<RL	4	4	100.00
EPA 547M	Glyphosate	<RL	4	4	100.00
EPA 549.2M	Paraquat dichloride	<RL	5	5	100.00
EPA 8081A	DDD(p,p')	<RL	4	4	100.00
EPA 8081A	DDE(p,p')	<RL	4	4	100.00
EPA 8081A	DDT(p,p')	<RL	4	4	100.00
EPA 8081A	Dicofol	<RL	4	4	100.00
EPA 8081A	Dieldrin	<RL	4	4	100.00
EPA 8081A	Endrin	<RL	4	4	100.00
EPA 8081A	Methoxychlor	<RL	4	4	100.00
EPA 8081A	Bifenthrin	<RL	4	4	100.00
EPA 8081A	Cyfluthrin, total	<RL	4	4	100.00
EPA 8081A	Cypermethrin, total	<RL	4	4	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	<RL	4	4	100.00
EPA 8081A	Cyhalothrin, lambda, total	<RL	4	4	100.00
EPA 8081A	Permethrin, total	<RL	4	4	100.00
EPA 8141A OP	Azinphos methyl	<RL	4	4	100.00
EPA 8141A OP	Chlorpyrifos	<RL	4	4	100.00
EPA 8141A OP	Diazinon	<RL	4	4	100.00
EPA 8141A OP	Dimethoate	<RL	4	4	100.00
EPA 8141A OP	Disulfoton	<RL	4	4	100.00
EPA 8141A OP	Malathion	<RL	4	4	100.00
EPA 8141A OP	Methidathion	<RL	4	4	100.00
EPA 8141A OP	Parathion, Methyl	<RL	4	4	100.00
EPA 8141A OP	Phorate	<RL	4	4	100.00
EPA 8141A OP	Phosmet	<RL	4	4	100.00
EPA 8141A OP	Molinate	<RL	4	4	100.00
EPA 8141A OP	Thiobencarb	<RL	4	4	100.00
EPA 8141A OP	Methamidophos	<RL	4	4	100.00
EPA 110.2	Color	<RL	4	4	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 130.2	Hardness as CaCO3	<RL	6	6	100.00
EPA 160.1	Total Dissolved Solids	<RL	5	5	100.00
EPA 180.1	Turbidity	<RL	4	4	100.00
EPA 300.0	Nitrate as N	<RL	4	4	100.00
EPA 350.2	Ammonia as N	<RL	5	5	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	<RL	6	6	100.00
EPA 354.1	Nitrite as N	<RL	5	5	100.00
EPA 365.2	OrthoPhosphate as P	<RL	4	4	100.00
EPA 365.2	Phosphate as P	<RL	4	4	100.00
EPA 415.1	Total Organic Carbon	<RL	5	5	100.00
SM 9223	E. coli	<RL	4	4	100.00
EPA 200.8	Arsenic	<RL	6	6	100.00
EPA 200.8	Boron	<RL	6	6	100.00
EPA 200.8	Cadmium	<RL	6	6	100.00
EPA 200.8	Copper	<RL	6	6	100.00
EPA 200.8	Lead	<RL	6	6	100.00
EPA 200.8	Nickel	<RL	6	6	100.00
EPA 200.8	Selenium	<RL	7	7	100.00
EPA 200.8	Zinc	<RL	6	6	100.00
		TOTAL	262	262	100.00

Table 17. ESJWQC summary of lab control spike quality control sample evaluations.

Laboratory control spikes and laboratory control spike duplicates were analyzed in batches with samples collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	PR 31-133	4	4	100.00
EPA 8321A CARB	Carbaryl	PR 44-133	4	4	100.00
EPA 8321A CARB	Carbofuran	PR 36-165	4	4	100.00
EPA 8321A CARB	Methiocarb	PR 35-142	4	4	100.00
EPA 8321A CARB	Methomyl	PR23-152	4	4	100.00
EPA 8321A CARB	Oxamyl	PR 10-117	4	4	100.00
EPA 8321A CARB	Diuron	PR 52-136	4	4	100.00
EPA 8321A CARB	Linuron	PR 49-144	4	4	100.00
EPA 619	Atrazine	PR 39-156	4	4	100.00
EPA 619	Cyanazine	PR 22-172	4	4	100.00
EPA 619	Simazine	PR 21-179	4	4	100.00
EPA 547M	Glyphosate	PR 72-131	8	8	100.00
EPA 549.2M	Paraquat dichloride	PR 50-126	7	6	85.71
EPA 8081A	DDD(p,p')	PR 38-135	4	4	100.00
EPA 8081A	DDE(p,p')	PR 21-134	4	4	100.00
EPA 8081A	DDT(p,p')	PR 18-145	4	4	100.00
EPA 8081A	Dicofol	PR 40-135	4	4	100.00
EPA 8081A	Dieldrin	PR 48-121	4	4	100.00
EPA 8081A	Endrin	PR 24-143	4	4	100.00
EPA 8081A	Methoxychlor	PR 30-163	4	4	100.00
EPA 8081A	Bifenthrin	PR 52-117	4	4	100.00
EPA 8081A	Cyfluthrin	PR 53-125	4	4	100.00
EPA 8081A	Cypermethrin	PR 55-107	4	4	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	PR 52-117	4	4	100.00
EPA 8081A	Cyhalothrin, lambda, total	PR 62-104	4	4	100.00
EPA 8081A	Permethrin, total	PR 24-166	4	4	100.00
EPA 8141A OP	Azinphos methyl	PR 36-189	4	4	100.00
EPA 8141A OP	Chlorpyrifos	PR 61-125	4	4	100.00
EPA 8141A OP	Diazinon	PR 57-130	4	4	100.00
EPA 8141A OP	Dimethoate	PR 68-202	4	4	100.00
EPA 8141A OP	Disulfoton	PR 47-117	4	4	100.00
EPA 8141A OP	Malathion	PR 47-125	4	4	100.00
EPA 8141A OP	Methidathion	PR 50-150	4	4	100.00
EPA 8141A OP	Parathion, Methyl	PR 55-164	4	4	100.00
EPA 8141A OP	Phorate	PR 44-117	4	4	100.00
EPA 8141A OP	Phosmet	PR 50-150	4	4	100.00
EPA 8141A OP	Molinate	PR 50-150	4	4	100.00
EPA 8141A OP	Thiobencarb	PR 50-150	4	4	100.00
EPA 8141A OP	Methamidophos	PR 40-135	4	4	100.00
EPA 110.2	Color	PR 80-120	4	4	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 130.2	Hardness as CaCO3	PR 80-120	6	6	100.00
EPA 160.1	Total Dissolved Solids	PR 80-120	5	5	100.00
EPA 180.1	Turbidity	PR 90-110	4	4	100.00
EPA 300.0	Nitrate as N	PR 90-110	4	4	100.00
EPA 350.2	Ammonia as N	PR 90-110	5	5	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	PR 90-110	6	6	100.00
EPA 354.1	Nitrite as N	PR 80-120	5	5	100.00
EPA 365.2	OrthoPhosphate as P	PR 90-110	4	4	100.00
EPA 365.2	Phosphate as P	PR 90-110	4	4	100.00
EPA 415.1	Total Organic Carbon	PR 80-120	5	5	100.00
SM 9223	E. coli	PR 80-120			NA
EPA 200.8	Arsenic	PR 85-115	6	6	100.00
EPA 200.8	Boron	PR 85-115	6	6	100.00
EPA 200.8	Cadmium	PR 85-115	6	6	100.00
EPA 200.8	Copper	PR 85-115	6	6	100.00
EPA 200.8	Lead	PR 85-115	6	6	100.00
EPA 200.8	Nickel	PR 85-115	6	6	100.00
EPA 200.8	Selenium	PR 85-115	7	7	100.00
EPA 200.8	Zinc	PR 85-115	6	6	100.00
		TOTAL	264	263	99.62

Table 18. ESJWQC summary of lab control spike duplicate quality control sample evaluations.

Laboratory control spikes and laboratory control spike duplicates were analyzed in batches with samples collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Pairs	Pairs Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	RPD ≤ 25			NA
EPA 8321A CARB	Carbaryl	RPD ≤ 25			NA
EPA 8321A CARB	Carbofuran	RPD ≤ 25			NA
EPA 8321A CARB	Methiocarb	RPD ≤ 25			NA
EPA 8321A CARB	Methomyl	RPD ≤ 25			NA
EPA 8321A CARB	Oxamyl	RPD ≤ 25			NA
EPA 8321A CARB	Diuron	RPD ≤ 25			NA
EPA 8321A CARB	Linuron	RPD ≤ 25			NA
					NA
EPA 619	Atrazine	RPD ≤ 25			NA
EPA 619	Cyanazine	RPD ≤ 25			NA
EPA 619	Simazine	RPD ≤ 25			NA
EPA 547M	Glyphosate	RPD ≤ 25	4	4	100.00
EPA 549.2M	Paraquat dichloride	RPD ≤ 25	2	2	100.00
EPA 8081A	DDD(p,p')	RPD ≤ 25			NA
EPA 8081A	DDE(p,p')	RPD ≤ 25			NA
EPA 8081A	DDT(p,p')	RPD ≤ 25			NA
EPA 8081A	Dicofol	RPD ≤ 25			NA
EPA 8081A	Dieldrin	RPD ≤ 25			NA
EPA 8081A	Endrin	RPD ≤ 25			NA
EPA 8081A	Methoxychlor	RPD ≤ 25			NA
EPA 8081A	Bifenthrin	RPD ≤ 25			NA
EPA 8081A	Cyfluthrin	RPD ≤ 25			NA
EPA 8081A	Cypermethrin	RPD ≤ 25			NA
EPA 8081A	Esfenvalerate/Fenvalerate, total	RPD ≤ 25			NA
EPA 8081A	Cyhalothrin, lambda, total	RPD ≤ 25			NA
EPA 8081A	Permethrin, total	RPD ≤ 25			NA
EPA 8141A OP	Azinphos methyl	RPD ≤ 25			NA
EPA 8141A OP	Chlorpyrifos	RPD ≤ 25			NA
EPA 8141A OP	Diazinon	RPD ≤ 25			NA
EPA 8141A OP	Dimethoate	RPD ≤ 25			NA
EPA 8141A OP	Disulfoton	RPD ≤ 25			NA
EPA 8141A OP	Malathion	RPD ≤ 25			NA
EPA 8141A OP	Methidathion	RPD ≤ 25			NA
EPA 8141A OP	Parathion, Methyl	RPD ≤ 25			NA
EPA 8141A OP	Phorate	RPD ≤ 25			NA

Method	Analyte	Data Quality Objective	Number of Pairs	Pairs Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Phosmet	RPD ≤ 25			NA
EPA 8141A OP	Molinate	RPD ≤ 25			NA
EPA 8141A OP	Thiobencarb	RPD ≤ 25			NA
EPA 8141A OP	Methamidophos	RPD ≤ 25			NA
EPA 110.2	Color	RPD ≤ 25			NA
EPA 130.2	Hardness as CaCO3	RPD ≤ 25			NA
EPA 160.1	Total Dissolved Solids	RPD ≤ 25			NA
EPA 180.1	Turbidity	RPD ≤ 25			NA
EPA 300.0	Nitrate as N	RPD ≤ 25			NA
EPA 350.2	Ammonia as N	RPD ≤ 25			NA
EPA 351.3	Nitrogen, Total Kjeldahl	RPD ≤ 25			NA
EPA 354.1	Nitrite as N	RPD ≤ 25			NA
EPA 365.2	OrthoPhosphate as P	RPD ≤ 25			NA
EPA 365.2	Phosphate as P	RPD ≤ 25			NA
EPA 415.1	Total Organic Carbon	RPD ≤ 25			NA
SM 9223	E. coli	RPD ≤ 25			NA
EPA 200.8	Arsenic	RPD ≤ 25			NA
EPA 200.8	Boron	RPD ≤ 25			NA
EPA 200.8	Cadmium	RPD ≤ 25			NA
EPA 200.8	Copper	RPD ≤ 25			NA
EPA 200.8	Lead	RPD ≤ 25			NA
EPA 200.8	Nickel	RPD ≤ 25			NA
EPA 200.8	Selenium	RPD ≤ 25			NA
EPA 200.8	Zinc	RPD ≤ 25			NA
		TOTAL	6	6	100.00

Table 19. ESJWQC summary of matrix spike quality control sample evaluations.

Matrix spikes and matrix spike duplicates were collected during the storm season of 2008. Included in the following table are NONAG matrix spikes included for batch quality assurance purposes. Evaluations are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	PR 31-133	8	8	100.00
EPA 8321A CARB	Carbaryl	PR 44-133	8	7	87.50
EPA 8321A CARB	Carbofuran	PR 36-165	8	8	100.00
EPA 8321A CARB	Methiocarb	PR 35-142	8	8	100.00
EPA 8321A CARB	Methomyl	PR 23-152	8	8	100.00
EPA 8321A CARB	Oxamyl	PR 10-117	8	8	100.00
EPA 8321A CARB	Diuron	PR52-136	8	8	100.00
EPA 8321A CARB	Linuron	PR 49-144	8	8	100.00
EPA 619	Atrazine	PR 39-156	8	8	100.00
EPA 619	Cyanazine	PR 22-172	8	6	75.00
EPA 619	Simazine	PR 21-179	8	8	100.00
EPA 547M	Glyphosate	PR 72-131	8	8	100.00
EPA 549.2M	Paraquat dichloride	PR 50-126	8	0	0.00
EPA 8081A	DDD(p,p')	PR 38-135	8	8	100.00
EPA 8081A	DDE(p,p')	PR 21-134	8	8	100.00
EPA 8081A	DDT(p,p')	PR 18-145	8	8	100.00
EPA 8081A	Dicofol	PR 40-135	8	8	100.00
EPA 8081A	Dieldrin	PR 48-121	8	8	100.00
EPA 8081A	Endrin	PR 24-143	8	8	100.00
EPA 8081A	Methoxychlor	PR 30-163	8	8	100.00
EPA 8081A	Bifenthrin	PR 52-117	8	8	100.00
EPA 8081A	Cyfluthrin	PR 53-125	8	8	100.00
EPA 8081A	Cypermethrin	PR 55-107	8	8	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	PR 52-117	8	8	100.00
EPA 8081A	Cyhalothrin, lambda, total	PR 62-104	8	4	50.00
EPA 8081A	Permethrin, total	PR 24-166	8	8	100.00
EPA 8141A OP	Azinphos methyl	PR 36-189	8	6	75.00
EPA 8141A OP	Chlorpyrifos	PR 61-125	8	8	100.00
EPA 8141A OP	Diazinon	PR 57-130	8	8	100.00
EPA 8141A OP	Dimethoate	PR 68-202	8	8	100.00
EPA 8141A OP	Disulfoton	PR 47-117	8	8	100.00
EPA 8141A OP	Malathion	PR 47-125	8	8	100.00
EPA 8141A OP	Methidathion	PR 50-150	8	8	100.00
EPA 8141A OP	Parathion, Methyl	PR 55-164	8	8	100.00
EPA 8141A OP	Phorate	PR 44-117	8	8	100.00
EPA 8141A OP	Phosmet	PR 50-150	8	6	75.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Molinate	PR 50-150	8	8	100.00
EPA 8141A OP	Thiobencarb	PR 50-150	8	8	100.00
EPA 8141A OP	Methamidophos	PR 40-135	8	8	100.00
EPA 110.2	Color	PR 80-120			NA
EPA 130.2	Hardness as CaCO3	PR 80-120	12	12	100.00
EPA 160.1	Total Dissolved Solids	PR 80-120			NA
EPA 180.1	Turbidity	PR 90-110			NA
EPA 300.0	Nitrate as N	PR 90-110	8	6	75.00
EPA 350.2	Ammonia as N	PR 90-110	10	9	90.00
EPA 351.3	Nitrogen, Total Kjeldahl	PR 90-110	12	11	91.67
EPA 354.1	Nitrite as N	PR 80-120	10	10	100.00
EPA 365.2	OrthoPhosphate as P	PR 90-110	8	6	75.00
EPA 365.2	Phosphate as P	PR 90-110	8	8	100.00
EPA 415.1	Total Organic Carbon	PR 80-120	12	8	66.67
SM 9223	E. coli	PR 80-120			NA
EPA 200.8	Arsenic	PR 85-115	12	12	100.00
EPA 200.8	Boron	PR 85-115	12	8	66.67
EPA 200.8	Cadmium	PR 85-115	12	12	100.00
EPA 200.8	Copper	PR 85-115	12	12	100.00
EPA 200.8	Lead	PR 85-115	12	12	100.00
EPA 200.8	Nickel	PR 85-115	12	11	91.67
EPA 200.8	Selenium	PR 85-115	14	14	100.00
EPA 200.8	Zinc	PR 85-115	12	11	91.67
		TOTAL	490	455	92.86

Table 20. ESJWQC summary of matrix spike duplicate quality control sample evaluations.

Matrix spikes and matrix spike duplicates were collected during the storm season of 2008. Included in the following table are NONAG matrix spikes included for batch quality assurance purposes. Evaluations are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Pairs	Pairs Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	RPD ≤ 25	4	4	100.00
EPA 8321A CARB	Carbaryl	RPD ≤ 25	4	4	100.00
EPA 8321A CARB	Carbofuran	RPD ≤ 25	4	4	100.00
EPA 8321A CARB	Methiocarb	RPD ≤ 25	4	4	100.00
EPA 8321A CARB	Methomyl	RPD ≤ 25	4	4	100.00
EPA 8321A CARB	Oxamyl	RPD ≤ 25	4	4	100.00
EPA 8321A CARB	Diuron	RPD ≤ 25	4	4	100.00
EPA 8321A CARB	Linuron	RPD ≤ 25	4	4	100.00
EPA 619	Atrazine	RPD ≤ 25	4	4	100.00
EPA 619	Cyanazine	RPD ≤ 25	4	4	100.00
EPA 619	Simazine	RPD ≤ 25	4	4	100.00
EPA 547M	Glyphosate	RPD ≤ 25	4	4	100.00
EPA 549.2M	Paraquat dichloride	RPD ≤ 25	4	4	100.00
EPA 8081A	DDD(p,p')	RPD ≤ 25	4	4	100.00
EPA 8081A	DDE(p,p')	RPD ≤ 25	4	4	100.00
EPA 8081A	DDT(p,p')	RPD ≤ 25	4	4	100.00
EPA 8081A	Dicofol	RPD ≤ 25	4	4	100.00
EPA 8081A	Dieldrin	RPD ≤ 25	4	4	100.00
EPA 8081A	Endrin	RPD ≤ 25	4	4	100.00
EPA 8081A	Methoxychlor	RPD ≤ 25	4	4	100.00
EPA 8081A	Bifenthrin	RPD ≤ 25	4	4	100.00
EPA 8081A	Cyfluthrin	RPD ≤ 25	4	4	100.00
EPA 8081A	Cypermethrin	RPD ≤ 25	4	4	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	RPD ≤ 25	4	4	100.00
EPA 8081A	Cyhalothrin, lambda, total	RPD ≤ 25	4	4	100.00
EPA 8081A	Permethrin, total	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Azinphos methyl	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Chlorpyrifos	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Diazinon	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Dimethoate	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Disulfoton	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Malathion	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Methidathion	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Parathion, Methyl	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Phorate	RPD ≤ 25	4	4	100.00

Method	Analyte	Data Quality Objective	Number of Pairs	Pairs Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Phosmet	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Molinate	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Thiobencarb	RPD ≤ 25	4	4	100.00
EPA 8141A OP	Methamidophos	RPD ≤ 25	4	4	100.00
EPA 110.2	Color	RPD ≤ 25			NA
EPA 130.2	Hardness as CaCO3	RPD ≤ 25	6	6	100.00
EPA 160.1	Total Dissolved Solids	RPD ≤ 25			NA
EPA 180.1	Turbidity	RPD ≤ 25			NA
EPA 300.0	Nitrate as N	RPD ≤ 25	4	4	100.00
EPA 350.2	Ammonia as N	RPD ≤ 25	5	5	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	RPD ≤ 25	6	6	100.00
EPA 354.1	Nitrite as N	RPD ≤ 25	5	5	100.00
EPA 365.2	OrthoPhosphate as P	RPD ≤ 25	4	4	100.00
EPA 365.2	Phosphate as P	RPD ≤ 25	4	4	100.00
EPA 415.1	Total Organic Carbon	RPD ≤ 25	6	6	100.00
SM 9223	E. coli	RPD ≤ 25			NA
EPA 200.8	Arsenic	RPD ≤ 25	6	6	100.00
EPA 200.8	Boron	RPD ≤ 25	6	6	100.00
EPA 200.8	Cadmium	RPD ≤ 25	6	6	100.00
EPA 200.8	Copper	RPD ≤ 25	6	6	100.00
EPA 200.8	Lead	RPD ≤ 25	6	6	100.00
EPA 200.8	Nickel	RPD ≤ 25	6	6	100.00
EPA 200.8	Selenium	RPD ≤ 25	7	7	100.00
EPA 200.8	Zinc	RPD ≤ 25	6	6	100.00
		TOTAL	245	245	100.00

Table 21. ESJWQC summary of lab duplicate quality control sample evaluations.

Samples were analyzed in batches with samples collected during the storm season of 2008, and also include NONAG matrix spikes included for batch quality assurance purposes, and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8260B	Acrolein	RPD ≤ 25			NA
EPA 8321A CARB	Aldicarb	RPD ≤ 25			NA
EPA 8321A CARB	Carbaryl	RPD ≤ 25			NA
EPA 8321A CARB	Carbofuran	RPD ≤ 25			NA
EPA 8321A CARB	Methiocarb	RPD ≤ 25			NA
EPA 8321A CARB	Methomyl	RPD ≤ 25			NA
EPA 8321A CARB	Oxamyl	RPD ≤ 25			NA
EPA 8321A CARB	Diuron	RPD ≤ 25			NA
EPA 8321A CARB	Linuron	RPD ≤ 25			NA
EPA 619	Atrazine	RPD ≤ 25			NA
EPA 619	Cyanazine	RPD ≤ 25			NA
EPA 619	Simazine	RPD ≤ 25			NA
EPA 547M	Glyphosate	RPD ≤ 25			NA
EPA 549.2M	Paraquat dichloride	RPD ≤ 25			NA
EPA 8081A	DDD(p,p')	RPD ≤ 25			NA
EPA 8081A	DDE(p,p')	RPD ≤ 25			NA
EPA 8081A	DDT(p,p')	RPD ≤ 25			NA
EPA 8081A	Dicofol	RPD ≤ 25			NA
EPA 8081A	Dieldrin	RPD ≤ 25			NA
EPA 8081A	Endrin	RPD ≤ 25			NA
EPA 8081A	Methoxychlor	RPD ≤ 25			NA
EPA 8081A	Bifenthrin	RPD ≤ 25			NA
EPA 8081A	Cyfluthrin, total	RPD ≤ 25			NA
EPA 8081A	Cypermethrin, total	RPD ≤ 25			NA
EPA 8081A	Esfenvalerate/Fenvalerate, total	RPD ≤ 25			NA
EPA 8081A	Cyhalothrin, lambda, total	RPD ≤ 25			NA
EPA 8081A	Permethrin, total	RPD ≤ 25			NA
EPA 8141A OP	Azinphos methyl	RPD ≤ 25			NA
EPA 8141A OP	Chlorpyrifos	RPD ≤ 25			NA
EPA 8141A OP	Diazinon	RPD ≤ 25			NA
EPA 8141A OP	Dimethoate	RPD ≤ 25			NA
EPA 8141A OP	Disulfoton	RPD ≤ 25			NA
EPA 8141A OP	Malathion	RPD ≤ 25			NA
EPA 8141A OP	Methidathion	RPD ≤ 25			NA
EPA 8141A OP	Parathion, Methyl	RPD ≤ 25			NA

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Phorate	RPD ≤ 25			NA
EPA 8141A OP	Phosmet	RPD ≤ 25			NA
EPA 8141A OP	Molinate	RPD ≤ 25			NA
EPA 8141A OP	Thiobencarb	RPD ≤ 25			NA
EPA 8141A OP	Methamidophos	RPD ≤ 25			NA
EPA 110.2	Color	RPD ≤ 25	4	4	100.00
EPA 130.2	Hardness as CaCO3	RPD ≤ 25			NA
EPA 160.1	Total Dissolved Solids	RPD ≤ 25	5	5	100.00
EPA 180.1	Turbidity	RPD ≤ 25	4	4	100.00
EPA 300.0	Nitrate as N	RPD ≤ 25			NA
EPA 350.2	Ammonia as N	RPD ≤ 25			NA
EPA 351.3	Nitrogen, Total Kjeldahl	RPD ≤ 25			NA
EPA 354.1	Nitrite as N	RPD ≤ 25			NA
EPA 365.2	OrthoPhosphate as P	RPD ≤ 25			NA
EPA 365.2	Phosphate as P	RPD ≤ 25			NA
EPA 415.1	Total Organic Carbon	RPD ≤ 25			NA
SM 9223	E. coli	RPD ≤ 25	3	3	100.00
EPA 200.8	Arsenic	RPD ≤ 25			NA
EPA 200.8	Boron	RPD ≤ 25			NA
EPA 200.8	Cadmium	RPD ≤ 25			NA
EPA 200.8	Copper	RPD ≤ 25			NA
EPA 200.8	Lead	RPD ≤ 25			NA
EPA 200.8	Nickel	RPD ≤ 25			NA
EPA 200.8	Selenium	RPD ≤ 25			NA
EPA 200.8	Zinc	RPD ≤ 25			NA
		TOTAL	16	16	100.00

Table 22. ESJWQC summary of surrogate recovery quality control sample evaluations.

Surrogates were run with water samples collected and LABQAs analyzed during the storm season of 2008 for all organics except paraquat and glyphosate. Included are NONAG samples. Evaluations are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Isoxaben(Surrogate)	RPD ≤ 25; PR 36-140	60	60	100.00
EPA 8321A CARB	Tributylphosphate(Surrogate)	RPD ≤ 25; PR 36-140	60	54	90.00
EPA 8321A CARB	Triphenyl phosphate(Surrogate)	RPD ≤ 25; PR 56-129			NA
EPA 619	Tributylphosphate(Surrogate)	RPD ≤ 25; PR 62-145	60	57	95.00
EPA 619	Triphenyl phosphate(Surrogate)	RPD ≤ 25; PR 54-144	60	54	90.00
EPA 8081A	Decachlorobiphenyl(Surrogate)	RPD ≤ 25; PR 16-146	60	60	100.00
EPA 8081A	Tetrachloro-m-xylene(Surrogate)	RPD ≤ 25; PR 15-98	60	60	100.00
EPA 8141A OP	Tributylphosphate(Surrogate)	RPD ≤ 25; PR 60-150	120	113	94.17
EPA 8141A OP	Triphenyl phosphate(Surrogate)	RPD ≤ 25; PR 56-129	120	108	90.00
		TOTAL	600	566	94.33

Table 23. ESJWQC summary of holding time evaluations for environmental, field blank, field duplicate and matrix spike samples collected during the storm season of 2008; sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	7 days	48	48	100.00
EPA 8321A CARB	Carbaryl	7 days	48	48	100.00
EPA 8321A CARB	Carbofuran	7 days	48	48	100.00
EPA 8321A CARB	Methiocarb	7 days	48	48	100.00
EPA 8321A CARB	Methomyl	7 days	48	48	100.00
EPA 8321A CARB	Oxamyl	7 days	48	48	100.00
EPA 8321A CARB	Diuron	7 days	48	48	100.00
EPA 8321A CARB	Linuron	7 days	48	48	100.00
EPA 619	Atrazine	7 days	48	48	100.00
EPA 619	Cyanazine	7 days	48	48	100.00
EPA 619	Simazine	7 days	48	48	100.00
EPA 547M	Glyphosate	14 days	48	48	100.00
EPA 549.2M	Paraquat dichloride	7 days	48	48	100.00
EPA 8081A	DDD(p,p')	7 days	48	48	100.00
EPA 8081A	DDE(p,p')	7 days	48	48	100.00
EPA 8081A	DDT(p,p')	7 days	48	48	100.00
EPA 8081A	Dicofol	7 days	48	48	100.00
EPA 8081A	Dieldrin	7 days	48	48	100.00
EPA 8081A	Endrin	7 days	48	48	100.00
EPA 8081A	Methoxychlor	7 days	48	48	100.00
EPA 8081A	Bifenthrin	7 days	36	36	100.00
EPA 8081A	Cyfluthrin	7 days	36	36	100.00
EPA 8081A	Cypermethrin	7 days	36	36	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	7 days	36	36	100.00
EPA 8081A	Cyhalothrin, lambda, total	7 days	36	36	100.00
EPA 8081A	Permethrin, total	7 days	36	36	100.00
EPA 8141A OP	Azinphos methyl	7 days	48	48	100.00
EPA 8141A OP	Chlorpyrifos	7 days	48	48	100.00
EPA 8141A OP	Diazinon	7 days	48	48	100.00
EPA 8141A OP	Dimethoate	7 days	48	48	100.00
EPA 8141A OP	Disulfoton	7 days	48	48	100.00
EPA 8141A OP	Malathion	7 days	48	48	100.00
EPA 8141A OP	Methidathion	7 days	48	48	100.00
EPA 8141A OP	Parathion, Methyl	7 days	48	48	100.00
EPA 8141A OP	Phorate	7 days	48	48	100.00
EPA 8141A OP	Phosmet	7 days	48	48	100.00
EPA 8141A OP	Molinate	7 days	48	48	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Thiobencarb	7 days	48	48	100.00
EPA 8141A OP	Methamidophos	7 days	48	48	100.00
EPA 110.2	Color	48 hours	44	43	97.73
EPA 130.2	Hardness as CaCO3	6 months	41	41	100.00
EPA 160.1	Total Dissolved Solids	48 hours	44	44	100.00
EPA 180.1	Turbidity	48 hours	44	44	100.00
EPA 300.0	Nitrate as N	48 hours	42	34	80.95
EPA 350.2	Ammonia as N	Field acidify, 28 days	42	42	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	Field acidify, 28 days	42	42	100.00
EPA 354.1	Nitrite as N	48 hours	42	42	100.00
EPA 365.2	OrthoPhosphate as P	48 hours	42	42	100.00
EPA 365.2	Phosphate as P	Field acidify, 28 days	42	42	100.00
EPA 415.1	Total Organic Carbon	28 days	48	48	100.00
SM 9223	E. coli	24 hours	42	42	100.00
EPA 200.8	Arsenic	Field acidify, 40 days	41	41	100.00
EPA 200.8	Boron	Field acidify, 40 days	41	41	100.00
EPA 200.8	Cadmium	Field acidify, 40 days	41	41	100.00
EPA 200.8	Copper	Field acidify, 40 days	41	41	100.00
EPA 200.8	Lead	Field acidify, 40 days	41	41	100.00
EPA 200.8	Nickel	Field acidify, 40 days	41	41	100.00
EPA 200.8	Selenium	Field acidify, 40 days	41	41	100.00
EPA 200.8	Zinc	Field acidify, 40 days	41	41	100.00
		TOTAL	2643	2634	99.66

Table 24. ESJWQC summary of toxicity retest evaluations due to failed toxicity criteria for samples collected during the storm season of 2008; sorted by method and species.

Method	Toxicity Species	Total Samples	Total Samples Retested	Percent Samples Within Acceptable Criteria
EPA 821/R-02-012	*Ceriodaphnia dubia*	45	0	100.00
EPA 821/R-02-012	*Pimephales promelas*	43	0	100.00
EPA 821/R-02-013	*Selenastrum capricornutum*	50	0	100.00
EPA 600/R-99-064	*Hyalella azteca*	24	0	100.00

Table 25. ESJWQC summary of toxicity field duplicate sample evaluations collected during the storm season of 2008; sorted by method and species.

Method	Toxicity Species	Total Field Duplicate Samples	Data Quality Objective (DQO)	Total Field Duplicate Samples Within DQO	Percent Samples Within Acceptable Criteria
EPA 821/R-02-012	*Ceriodaphnia dubia*	3	RPD ≤ 25	3	100.00
EPA 821/R-02-012	*Pimephales promelas*	3	RPD ≤ 25	3	100.00
EPA 821/R-02-013	*Selenastrum capricornutum*	3	RPD ≤ 25	2	66.67
EPA 600/R-99-064	*Hyalella azteca*	1	RPD ≤ 25	1	100.00

Pesticide Use Information

All exceedances for the 2008 storm sampling are provided in the next section of this report, Data Interpretation. Pesticide use reports (PUR) for October 2007 – March 2008 were requested from all the counties within the Coalition region and applications relevant to exceedances are included in Appendix IV. It should be noted that PUR data are considered preliminary and may include errors and/or omissions.

For each sampling period in which chemicals, metals or toxicity were detected, all reported pesticide use for one to six months prior to sampling (depending on the exceedance (Table 26) was collected for the specific site subwatershed based on Township-Range-Section (TRS). All pesticide products that contained the detected chemicals and metals are listed by their active ingredients and application method and are provided in maps in Appendix IV. Pesticide use is reported as amount of product used. Some products may have more than one active ingredient and in this case the product appears more than once with the name of the chemical ingredient. Data are not available for individual fields or parcels except where they coincide with complete sections. Where consecutive exceedances require pesticide use reports, only additional pesticide use from the date of the previous exceedance are provided for the later exceedance.

Dieldrin, endrin, DDT and DDE exceedances are not queried since there are no registered products that contain these chemicals. Nitrate/nitrite exceedances are not listed since the use of these products are not reported.

Table 26. Pesticide use data collected for reported exceedences.

Exceedance Type	Pesticides Use Data Collected
Pesticides in water column	1 month, except pyrethroids 6 months
Metals in water column	3 months
Sediment Toxicity – *Hyalella azteca*	3 months with 6 months for pyrethroids
Water column toxicity – *Selenastrum capricornutum, Pimephales promelas* and *Ceriodaphnia dubia*	1 month with 6 months for pyrethroids

Data Interpretation

A summary of exceedances that occurred during monitoring over the 2008 storm season is presented in Table 29 - Table 32. Water quality trigger limits (WQTLs) used to determine exceedances are provided in Table 28.

Discrepancies exist between exceedances reported in this document and those submitted as exceedance reports to the CVRWQCB during the 2008 storm monitoring season. These discrepancies include detections that were either not reported in official exceedance reports or that were reported incorrectly and are described below as well as listed in Table 27.

Exceedances of cadmium included in this report were not reported during the 2008 storm season due to a change in the WQTL for cadmium, applied on March 13, 2008. As a result, seven exceedances of cadmium (including one field duplicate) were detected after monitoring results for the storm monitoring event had been reported. These exceedances occurred across six of the Coalition monitoring sites, as shown in Table 27, below.

In addition, discrepancies occurred between the initial percentages reported for *Selenastrum capricornutum* toxicity and those included in this report. *Selenastrum* toxicity test results are reported from the laboratory in both absorbance units and cells/mL (calculated based on absorbance). Initially a percent relative to the control was calculated based on the reported absorbance; however the percent relative to the control values entered into the Coalition database were calculated based on cell counts. As a result, the percentages reported in the initial exceedance reports may vary slightly from the final exceedances shown below.

One discrepancy occurred in the reported percent survival of *Ceriodaphnia dubia* compared to the control for the samples collected from Miles Creek @ Reilly Rd on January 30, 2008. This result was misreported to the Coalition in the preliminary summary of exceedances from the laboratory. The correct result has been updated from 15% to 19% survival.

As required by the MRP, all samples that were toxic were resampled, except for one, within 48 hours of receiving laboratory results. Due to an email with the incorrect site name, Dry Creek @ Rd 18 was not resampled due for *Selenastrum* toxicity experienced in the sample collected on January 25, 2008. The error was not caught until it was too late to resample. All samples that experienced toxicity greater than 50% of the control underwent toxicity identification evaluations (TIEs) and the results of these are included Appendix VI and summarized in Table 32. There were two toxic samples for which a TIE was not conducted; one was due to elevated levels of ammonia and the other due to a laboratory oversight.

Table 27. Exceedance discrepancies that occurred during the 2008 storm season.

Results are sorted by analyte and station name.

Station Name	Sample Date	Analyte	Reported unit	Exceedance Report	Current Report
Bear Creek @ Kibby Rd	01/24/08	Cadmium	µg/L	Not Reported	0.08
Highline Canal @ Hwy 99	01/24/08	Cadmium	µg/L	Not Reported	0.2
Highline Canal @ Lombardy Ave	01/24/08	Cadmium	µg/L	Not Reported	0.06
Merced River @ Santa Fe	01/24/08	Cadmium	µg/L	Not Reported	0.1
Deadman Creek (Dutchman) @ Gurr Rd	01/25/08	Cadmium	µg/L	Not Reported	0.05
Duck Slough @ Gurr Rd FD	01/25/08	Cadmium	µg/L	Not Reported	0.05
Duck Slough @ Gurr Rd	01/25/08	Cadmium	µg/L	Not Reported	0.07
Miles Creek @ Reilly Rd	1/30/08	*C. dubia*	% survival relative to control	15	19
Hatch Drain @ Tuolumne Rd	1/24/08	*S. capricornutum*	% growth relative to control (cell count)	75	74
Prairie Flower Drain @ Crows Landing Rd	1/24/08	*S. capricornutum*	% growth relative to control (cell count)	72	71
Deadman Creek @ Hwy 59	1/25/08	*S. capricornutum*	% growth relative to control (cell count)	45	44
Deadman Creek @ Hwy 59 FD	1/25/08	*S. capricornutum*	% growth relative to control (cell count)	59	58
Dry Creek @ Rd 18	1/25/08	*S. capricornutum*	% growth relative to control (cell count)	33	36
Black Rascal Creek @ Yosemite Rd	2/25/08	*S. capricornutum*	% growth relative to control (cell count)	41	38
Deadman Creek @ Gurr Rd	2/25/08	*S. capricornutum*	% growth relative to control (cell count)	50	47
Dry Creek @ Rd 18	2/25/08	*S. capricornutum*	% growth relative to control (cell count)	78	77
Dry Creek @ Wellsford Rd	2/26/08	*S. capricornutum*	% growth relative to control (cell count)	34	33
Hatch Drain @ Tuolumne Rd	2/26/08	*S. capricornutum*	% growth relative to control (cell count)	8	6
Highline Canal @ Hwy 99	2/26/08	*S. capricornutum*	% growth relative to control (cell count)	73	72

Station Name	Sample Date	Analyte	Reported unit	Exceedance Report	Current Report
Livingston Drain @ Robin Ave	2/26/08	*S. capricornutum*	% growth relative to control (cell count)	62	61
Livingston Drain @ Robin Ave (FD)	2/26/08	*S. capricornutum*	% growth relative to control (cell count)	66	65
Mustang Creek @ East Ave	2/26/08	*S. capricornutum*	% growth relative to control (cell count)	26	25
Prairie Flower Drain @ Crows Landing Rd	2/26/08	*S. capricornutum*	% growth relative to control (cell count)	41	39
Westport Drain @ Vivian Rd	2/26/08	*S. capricornutum*	% growth relative to control (cell count)	14	12
Dry Creek @ Rd 18	3/4/08	*S. capricornutum*	% growth relative to control (cell count)	34	35

Table 28. Water Quality Triggers Limits (WQTLs) for constituents and parameters measured during Coalition monitoring.

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Physical Parameters				
pH	6.5 - 8.5 units	Numeric		Sacramento/San Joaquin Rivers Basin Plan (page III.6.00)
Electrical Conductivity (maximum)	700 umhos/cm	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcot)
Dissolved Oxygen (minimum)	7 mg/L	Numeric	Cold Freshwater Habitat, Spawning	Sacramento/San Joaquin Rivers Basin Plan. Water Quality Control Plan for the Tulare Lake Basin.
	5 mg/L		Warm water habitat	Basin Plan Objective, page III-5.00: for waters designated WARM (aquatic life). Tulare Lake Basin Plan
Total Dissolved Solids	450 mg/L	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcot)
Turbidity	variable	Numeric	Municipal and Domestic Supply	Basin Plan Objective - increase varies based on natural turbidity
E. coli	235 MPN/100 ml			EPA ambient water quality criteria, single-sample maximum
TOC	NA			
Pesticides - Carbamates				
Aldicarb	3 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Carbaryl	2.53 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective: Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life). Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game)
Carbofuran	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Prohibition, page IV-25.00 (MUN, human health)
Methiocarb	0.5 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates/Resour.Publ.137, Fish Wildl.Serv., U.S.D.I., Washington, D.C :98 p. (OECDG Data File) -(Detect at .5 ug/L - no limit set)
Methomyl	0.52 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Oxamyl	50 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan, page III-3.00, under "Chemical constituents." Drinking Water Standards - Maximum Contaminant Levels (MCLs). California Dept of Health Services. Primary MCL
Pesticides - Organochlorines				
DDD(p,p')	0.00083 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan (page III-6.00, pesticides, third bullet). CTR, Human Health Protection, 30-Day Average - Sources of Drinking Water (water & fish consumption)
DDE(p,p')	0.00059 ug/L			
DDT(p,p')	0.00059 ug/L			
Dicofol	NA			

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Dieldrin	0.00014 ug/L	Numeric	Municipal and Domestic Supply	CTR, Human Health Protection, 30-Day Average - Sources of Drinking Water (water & fish consumption)
Endrin	0.036 ug/L	Numeric	Cold Freshwater Habitat, Spawning	CTR, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average
Methoxychlor	0.03 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous maximum (aquatic life)
Pesticides - Organophosphates				
Azinphos methyl	0.01 ug/L	Narrative	Cold Freshwater Habitat, Spawning	National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection (Instantaneous)
Chlorpyrifos	0.015 ug/L	Numeric	Cold Freshwater Habitat, Spawning	Sacramento/San Joaquin Rivers Basin Plan, page III-6.01; San Joaquin River & Delta, pending Sacramento & Feather Rivers (aquatic life); more stringent 4-day average selected over less stringent 1-hour average (Central Valley Regional Water Quality Control Board; recent ammendment for Diazinon and Chlorpyrifos in the Lower San Joaquin River).
Diazinon	0.1 ug/L	Numeric	Cold Freshwater Habitat, Spawning	Sacramento San Joaquin Basin Plan, San Joaquin River & Delta numeric standard pending Sacramento & Feather Rivers numeric standard
Dimethoate	1.0 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Notification Level – DHS (MUN, human health). California Notification Levels. (Department of Health Services)
Disulfoton	0.05 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous
Malathion	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Discharge Prohibition, page IV-25.00
Methamidophos	0.35 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, Drinking Water Health Advisories or Suggested No-Adverse-Response Levels for non-cancer health effects. USEPA IRIS Reference Dose (RfD) as a drinking water level.
Methidathion	0.7	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Parathion, Methyl	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Prohibition, page IV-25.00
Phorate	0.7 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, Drinking Water Health Advisories or Suggested No-Adverse-Response Levels for non-cancer health effects. USEPA IRIS Reference Dose (RfD) as a drinking water level.
Phosmet	140 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, Drinking Water Health Advisories or Suggested No-Adverse-Response Levels for non-cancer health effects. USEPA IRIS Reference Dose (RfD) as a drinking water level.
Pesticides - Pyrethroids				

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Biphenthrin	110 ug/L	Narrative		Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (human health)
Cypermethrin, total	0.002 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game)(aquatic life)
Cyhalothrin, lambda, total	35 ug/L	Narrative		Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Permethrin, total	0.03 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life). USEPA National Ambient Water Quality Criteria, CA DFG, 2000
Cyfluthrin, total	NA			
Esfenvalerate/ Fenvalerate, total	NA			
Pesticides - Herbicides				
Atrazine	1.0 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan, page III-3.00, under "Chemical constituents." California Primary MCL
Cyanazine	1.0 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, USEPA Health Advisory (human health)
Diuron	2 ug/L	Narrative	Municipal and Domestic Supply	One-in-a-Million Incremental Cancer Risk Estimates for Drinking Water. USEPA Health Advisory. Likely to be carcinogenic to humans (U.S. Environmental Protection Agency, 2005 Guidelines for Carcinogen Risk Assessment). Value modified using more recent information in USEPA Office of Pesticide Programs Registration Eligibility Decisions Documents. From Reference 36. (August 2007 Update Edition of the WQG)
Glyphosate	700 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Linuron	1.4 ug/L	Narrative	Municipal and Domestic Supply	USEPA IRIS Reference Dose as a drinking water level*
Molinate	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Discharge Prohibition, page IV-25.00
Paraquat dichloride	3.2 ug/L	Narrative	Municipal and Domestic Supply	USEPA IRIS Reference Dose as a drinking water level*
Simazine	4.0 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, California Primary MCL (MUN, human health)
Thiobencarb	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Discharge Prohibition, page IV-25.00
Metals (c)				

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Arsenic	10 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Boron	700 ug/L	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcot)
Cadmium	For aquatic life; variable (see cadmium worksheet). For MUN, trigger limit is 0.04 regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning/ Municipal and Domestic Supply	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - Varies with water hardness/ California Public Health Goal for Drinking Water
Copper	For aquatic life; variable (see copper worksheet). For MUN, trigger limit is 170 regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning/ Municipal and Domestic Supply	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - Varies with water hardness/ California Public Health Goal for Drinking Water
Lead	For aquatic life; variable (see Lead worksheet). For MUN, trigger limit is 2.0 regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning/ Municipal and Domestic Supply	CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness/ CA Public Health Goal for Drinking Water
Nickel	For aquatic life variable (see Nickel worksheet). For MUN nickel trigger limit is 12 ug/L regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning / Municipal and Domestic Supply	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness/ CA Public Health Goal for Drinking Water
Selenium	50 ug/L	Numeric	Municipal and Domestic Supply	California Primary MCL
Selenium	5 ug/L (4-day average)	Numeric	Cold Freshwater Habitat, Spawning	Table III-1: Trace Element Water Quality Objective. Applicable Water Bodies - San Joaquin River, mouth of the Merced River to Vernalis. Also CTR
Zinc	For aquatic life variable (see Zinc worksheet). For MUN nickel trigger limit is 5000 ug/L regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning, Municipal and Domestic Supply	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness/ CA Public Health Goal for Drinking Water
Nutrients				
Nitrate as NO3 Nitrate as N	45,000 ug/L as NO3 10,000 ug/L as N	Numeric	Municipal and Domestic Supply	California Primary MCL

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Nitrite as Nitrogen	1,000 ug/L as N	Numeric	Municipal and Domestic Supply	California Primary MCL
Ammonia	For aquatic life variable (see ammonia worksheet). For MUN ammonia trigger limit is 1.5 mg/L regardless of pH and Temperature values	Numeric	Cold Freshwater Habitat, Spawning/ Municipal and Domestic Supply	USEPA Freshwater Aquatic Life Criteria, Continuous Concentration/ Taste and Odor Threshold
Hardness	NA			
Phosphorus, total	NA			
Orthophosphate, soluble	NA			
TKN	NA			

NA = Not Available. Until completion of evaluation studies and MRP Plan submittals with site specific information on beneficial uses.
ND = Non Detect.

Table 29. Exceedances of field parameters; sorted by station name and sample date.

Station Name	Sample Date	Sample Time	Oxygen, Dissolved, mg/L	pH, none	Specific Conductivity, µS/cm
Bear Creek @ Kibby Rd	03/04/08	15:30		8.72	
Deadman Creek (Dutchman) @ Gurr Rd	02/25/08	9:50		8.51	
Duck Slough @ Hwy 99	03/04/08	15:30		8.65	
Hatch Drain @ Tuolumne Rd	01/24/08	10:00	4.67		1199
Hatch Drain @ Tuolumne Rd	01/30/08	12:10	5.28		1343
Hatch Drain @ Tuolumne Rd	02/26/08	9:20	1.9		1298
Hatch Drain @ Tuolumne Rd	03/04/08	10:30	2.12		1271
Hatch Drain @ Tuolumne Rd	03/28/08	13:40	5.18		1373
Highline Canal @ Hwy 99	02/26/08	13:00			747
Highline Canal @ Hwy 99	03/04/08	12:40		9.32	
Highline Canal @ Lombardy Ave	03/04/08	13:20	0.34		1402
Hilmar Drain @ Central Ave	01/24/08	14:10			1528
Hilmar Drain @ Central Ave	02/26/08	11:20			1476
Hilmar Drain @ Central Ave	03/04/08	16:40			1429
Hilmar Drain @ Central Ave	03/28/08	13:10	6.3		1111
Livingston Drain @ Robin Ave	02/26/08	12:50	5.68		
Mustang Creek @ East Ave	02/26/08	9:50	4.06		
Mustang Creek @ East Ave	03/04/08	14:00	2.44		
Mustang Creek @ East Ave	03/28/08	12:20	4.1		1467
Prairie Flower Drain @ Crows Landing Rd	01/24/08	12:20			2371
Prairie Flower Drain @ Crows Landing Rd	01/30/08	12:40			2944
Prairie Flower Drain @ Crows Landing Rd	02/26/08	10:10			2722
Prairie Flower Drain @ Crows Landing Rd	03/04/08	11:30			2639
Westport Drain @ Vivian Rd	01/24/08	8:40			1086
Westport Drain @ Vivian Rd	02/26/08	8:30	5.7		1104
Westport Drain @ Vivian Rd	03/04/08	9:50			1096

Table 30. Water column pesticides exceedances; sorted by station name and sample date.

Station Name	Sample Type Code	Sample Date	Sample Time	Chlorpyrifos, µg/L	DDT (p,p'), µg/L	Diazinon, µg/L	Diuron, µg/L	Methidathion, µg/L	Simazine, µg/L
Cottonwood Creek @ Rd 20	E	01/25/08	9:50	0.019			68		
Cottonwood Creek @ Rd 20	E	02/25/08	9:40	0.036		0.24	65		5.1
Deadman Creek (Dutchman) @ Gurr Rd	E	01/25/08	10:50		0.0073				
Deadman Creek @ Hwy 59	FD	01/25/08	12:00				6.3		19
Deadman Creek @ Hwy 59	E	01/25/08	12:00				6.2		25
Dry Creek @ Rd 18	E	01/25/08	11:10				21		
Dry Creek @ Rd 18	E	02/25/08	11:10	0.034		0.24	2.1		
Highline Canal @ Hwy 99	E	01/24/08	14:40	0.019			3.2		
Highline Canal @ Lombardy Ave	E	01/24/08	12:50	0.028					
Highline Canal @ Lombardy Ave	E	02/26/08	12:00						12
Livingston Drain @ Robin Ave	E	01/24/08	15:40	0.02					
Merced River @ Santa Fe	E	01/24/08	11:40	0.59					
Miles Creek @ Reilly Rd	E	01/25/08	13:40					2.3	
Mustang Creek @ East Ave	E	01/24/08	10:40	0.067					4.2
Mustang Creek @ East Ave	E	02/26/08	9:50	0.028					17

E = Environmental sample; FD = Field Duplicate

Table 31. Water column inorganics, physical parameters, metals, nutrients and bacteria exceedances in water column; sorted by station name and sample date.

The hardness value is included in parenthesis for those metals exceedances that are based on hardness.

Station Name	Sample Type Code	Sample Date	Sample Time	Ammonia as N	Arsenic, µg/L	Cadmium, µg/L	Color, color units	Copper, µg/L	Dissolved Solids, mg/L	*E. coli*, MPN/100 mL	Lead, µg/L	Nickel, µg/L	Nitrate as N, mg/L
Bear Creek @ Kibby Rd	E	01/24/08	16:00			0.08	150	8.6 (80)		>2400			
Bear Creek @ Kibby Rd	E	02/25/08	13:50				150	7.2 (64)		>2400			
Black Rascal Creek @ Yosemite Rd	E	01/24/08	17:00				85			>2400			
Black Rascal Creek @ Yosemite Rd	E	02/25/08	14:10				170			>2400			
Cottonwood Creek @ Rd 20	E	01/25/08	9:50				100	24 (26)		1200	5.4		
Cottonwood Creek @ Rd 20	E	02/25/08	9:40				120	21 (66)			1.9 (66)		
Deadman Creek (Dutchman) @ Gurr Rd	E	01/25/08	10:50		15	0.05	150	19 (130)		870	3.2	18	
Deadman Creek (Dutchman) @ Gurr Rd	E	02/25/08	9:50		13		58			550			
Deadman Creek @ Hwy 59	E	01/25/08	12:00				350			>2400			
Deadman Creek @ Hwy 59	E	02/25/08	10:50				540			1200			
Dry Creek @ Rd 18	E	01/25/08	11:10				76	20 (58)		>2400			
Dry Creek @ Rd 18	E	02/25/08	11:10				85	33 (54)					
Dry Creek @ Wellsford Rd	E	01/24/08	9:10				200			>2400	2.4		
Dry Creek @ Wellsford Rd	E	02/26/08	8:30			0.05	250	11 (60)		>2400	1.8 (60)		
Duck Slough @ Gurr Rd	FD	01/25/08	9:40			0.05	180	13 (80)		>2400	2.7		
Duck Slough @ Gurr Rd	E	01/25/08	9:40			0.07	200	13 (96)		>2400	2.9	13	
Duck Slough @ Gurr Rd	E	02/25/08	9:10			0.1	250	17 (100)		>2400	3.7	17	
Duck Slough @ Hwy 99	E	01/25/08	13:10				120			>2400			
Duck Slough @ Hwy 99	E	02/25/08	12:40			0.05	140	9.9 (84)		>2400	2.1		
Hatch Drain @ Tuolumne Rd	FD	01/24/08	10:00		16		40		820	340			22
Hatch Drain @ Tuolumne Rd	E	01/24/08	10:00		15		40		820	410			24
Hatch Drain @ Tuolumne Rd	E	02/26/08	9:20		16		37		900	920			24
Highline Canal @ Hwy 99	E	01/24/08	14:40	3.3		0.2	250	37 (170)	500	>2400	3.4		
Highline Canal @ Hwy 99	E	02/26/08	13:00	8.3		0.096	300	81 (190)	520	>2400			

Station Name	Sample Type Code	Sample Date	Sample Time	Ammonia as N	Arsenic, µg/L	Cadmium, µg/L	Color, color units	Copper, µg/L	Dissolved Solids, mg/L	*E. coli*, MPN/100 mL	Lead, µg/L	Nickel, µg/L	Nitrate as N, mg/L
Highline Canal @ Lombardy Ave	E	01/24/08	12:50			0.06	220	28 (150)		2000	3.2		
Highline Canal @ Lombardy Ave	E	02/26/08	12:00	1.7		0.09	330	32 (110)			2.7		
Hilmar Drain @ Central Ave	E	01/24/08	14:10				44		970				
Hilmar Drain @ Central Ave	E	02/26/08	11:20				35		910				
Livingston Drain @ Robin Ave	E	01/24/08	15:40				35	6.7 (28)		1700	2.4		
Livingston Drain @ Robin Ave	FD	02/26/08	12:50				75	18 (38)			0.93 (38)		
Livingston Drain @ Robin Ave	E	02/26/08	12:50				40	15 (38)			1.1 (38)		
Merced River @ Santa Fe	E	01/24/08	11:40			0.1	300	22 (42)			5.6		
Merced River @ Santa Fe	E	02/26/08	11:00				130						
Miles Creek @ Reilly Rd	E	01/25/08	13:40				150	15 (62)		>2400	3.2		
Miles Creek @ Reilly Rd	E	02/25/08	11:50			0.2	620	34 (84)		2000	7.7	26	
Mustang Creek @ East Ave	E	01/24/08	10:40				200			460			
Mustang Creek @ East Ave	E	02/26/08	9:50				250						
Prairie Flower Drain @ Crows Landing Rd	E	01/24/08	12:20				85		1500	1100			23
Prairie Flower Drain @ Crows Landing Rd	E	02/26/08	10:10				56		1600				28
Westport Drain @ Vivian Rd	E	01/24/08	8:40				22		740	290			28
Westport Drain @ Vivian Rd	E	02/26/08	8:30						730				26

E = Environmental sample; FD = Field Duplicate

Table 32. Water column and sediment toxicity exceedances and results of TIE studies.

Station Name	Sample Type Code	Sample Date	Sample Time	Species	Toxicity End Point	Mean	Percent Control	Toxicity Significance	Summary Comments
Black Rascal Creek @ Yosemite Rd	E	02/25/08	14:10	*Selenastrum capricornutum*	Total Cell Count	201668	38	SL	TIE was initiated on 3/11/08 and sample lost all toxicity. Resampled on 03/4/08; toxicity was not persistent.
Cottonwood Creek @ Rd 20	E	01/25/08	9:50	*Pimephales promelas*	Survival (%)	45	45	SL	TIE was initiated on 1/30/08 and concluded that non-polar organics was the probable cause of toxicity. Resampled on 01/30/08; toxicity was not persistent.
Cottonwood Creek @ Rd 20	E	03/04/08	9:20	*Hyalella azteca*	Survival (%)	93	96	SG	Resample not taken on 3/28/08 - site dry.
Deadman Creek (Dutchman) @ Gurr Rd	E	02/25/08	9:50	*Selenastrum capricornutum*	Total Cell Count	279824	47	SL	TIE was initiated on 3/11/08 and sample lost all toxicity. Resampled on 03/4/08; toxicity was not persistent.
Deadman Creek @ Hwy 59	FD	01/25/08	12:00	*Selenastrum capricornutum*	Total Cell Count	719452	58	SL	RPD 26.7 TIE was initiated on 2/2/08 and concluded that non-polar organics was the probable cause of toxicity. Resampled on 01/30/08; toxicity was not persistent.
Deadman Creek @ Hwy 59	E	01/25/08	12:00	*Selenastrum capricornutum*	Total Cell Count	550114	44	SL	TIE was initiated on 2/2/08 and concluded that non-polar organics was the probable cause of toxicity. Resampled on 01/30/08; toxicity was not persistent.
Dry Creek @ Rd 18	E	01/25/08	11:10	*Selenastrum capricornutum*	Total Cell Count	439393	36	SL	TIE was initiated on 2/2/08 and since all toxicity was lost, no conclusions could be made. Site was not resampled due to laboratory communication error.
Dry Creek @ Rd 18	E	02/25/08	11:10	*Selenastrum capricornutum*	Total Cell Count	452419	77	SL	Resampled on 03/4/08.
Dry Creek @ Rd 18	RS	03/04/08	10:00	*Selenastrum capricornutum*	Total Cell Count	188642	35	SL	Resample due to *S. capricornutum* toxicity on 02/25/08; toxicity was persistent.
Dry Creek @ Wellsford Rd	E	02/26/08	8:30	*Selenastrum capricornutum*	Total Cell Count	494753	33	SL	TIE initiated on 3/11/08 and concluded that non-polar organics was the probable cause of toxicity. Resampled on 03/04/08; toxicity was not persistent.
Dry Creek @ Wellsford Rd	E	03/04/08	8:20	*Hyalella azteca*	Survival (%)	80	88	SG	Resampled on 03/28/08; toxicity was not persistent.
Hatch Drain @ Tuolumne Rd	E	01/24/08	10:00	*Selenastrum capricornutum*	Total Cell Count	833429	74	SL	Resampled on 1/30/08; toxicity was not persistent.
Hatch Drain @ Tuolumne Rd	E	02/26/08	9:20	*Selenastrum capricornutum*	Total Cell Count	90947	6	SL	TIE initiated on 3/11/08 and concluded that non-polar organics was the probable cause of toxicity. Resampled on 03/04/08.
Hatch Drain @ Tuolumne Rd	E	03/04/08	10:30	*Hyalella azteca*	Survival (%)	0	0	SL	Resampled on 03/28/08.

Station Name	Sample Type Code	Sample Date	Sample Time	Species	Toxicity End Point	Mean	Percent Control	Toxicity Significance	Summary Comments
Hatch Drain @ Tuolumne Rd	FD	03/04/08	10:30	*Hyalella azteca*	Survival (%)	0	0	SL	RPD 0 Resampled on 03/28/08.
Hatch Drain @ Tuolumne Rd	RS	03/04/08	10:30	*Selenastrum capricornutum*	Total Cell Count	357980	73	SL	Resample due to *S. capricornutum* toxicity on 02/26/08; toxicity was persistent.
Hatch Drain @ Tuolumne Rd	RS	03/28/08	13:40	*Hyalella azteca*	Survival (%)	2	2	SL	Resample due to *H. azteca* toxicity on 03/04/08, toxicity was persistent.
Highline Canal @ Hwy 99	E	02/26/08	13:00	*Selenastrum capricornutum*	Total Cell Count	817147	72	SL	Resampled on 03/04/08; toxicity was not persistent.
Highline Canal @ Hwy 99	E	03/04/08	12:40	*Hyalella azteca*	Survival (%)	82	90	SG	Resampled on 03/28/08; toxicity was not persistent.
Highline Canal @ Lombardy Ave	E	01/24/08	12:50	*Ceriodaphnia dubia*	Survival (%)	40	40	SL	TIE was initiated on 1/30/08 and concluded that pyrethroid insecticides was the probable cause of toxicity. Resampled on 1/30/08.
Highline Canal @ Lombardy Ave	RS	01/30/08	12:20	*Ceriodaphnia dubia*	Survival (%)	30	30	SL	Resample due to *C. dubia* toxicity on 01/24/08; toxicity was persistent.
Highline Canal @ Lombardy Ave	E	02/26/08	12:00	*Pimephales promelas*	Survival (%)	90	90	SG	Resampled on 03/04/08.
Highline Canal @ Lombardy Ave	RS	03/04/08	13:20	*Pimephales promelas*	Survival (%)	0	0	SL	Resample due to *P. promelas* toxicity on 02/26/08; toxicity was persistent.
Highline Canal @ Lombardy Ave	E	03/04/08	13:20	*Hyalella azteca*	Survival (%)	83	91	SG	Resampled on 03/28/08; toxicity was not persistent.
Hilmar Drain @ Central Ave	E	03/04/08	16:40	*Hyalella azteca*	Survival (%)	83	91	SG	Resampled on 03/28/08; toxicity was not persistent.
Livingston Drain @ Robin Ave	E	02/26/08	12:50	*Selenastrum capricornutum*	Total Cell Count	690143	61	SL	Resample not taken; site dry.
Livingston Drain @ Robin Ave	FD	02/26/08	12:50	*Selenastrum capricornutum*	Total Cell Count	732478	65	SL	RPD 5.9 Resample not taken; site dry.
Merced River @ Santa Fe	E	01/24/08	11:40	*Ceriodaphnia dubia*	Survival (%)	0	0	SL	TIE was initiated on 1/27/08 and concluded that OP insecticides was the probable cause of toxicity. Resampled on 1/30/08.
Merced River @ Santa Fe	RS	01/30/08	11:40	*Ceriodaphnia dubia*	Survival (%)	0	0	SL	Resample due to *C. dubia* toxicity on 01/24/08; toxicity was persistent.
Miles Creek @ Reilly Rd	E	01/25/08	13:40	*Ceriodaphnia dubia*	Survival (%)	0	0	SL	TIE was initiated on 1/30/08 and concluded that pyrethroid insecticides was the probable cause of toxicity. Resampled on 01/30/08.
Miles Creek @ Reilly Rd	RS	01/30/08	10:40	*Ceriodaphnia dubia*	Survival (%)	19	19	SL	Resample due to *C. dubia* toxicity on 01/25/08; toxicity was persistent.
Mustang Creek @ East Ave	E	01/24/08	10:40	*Ceriodaphnia dubia*	Survival (%)	0	0	SL	TIE was initiated on 1/27/08 and concluded that pyrethroid insecticides was the probable cause of toxicity. Resampled on 1/30/08.

Station Name	Sample Type Code	Sample Date	Sample Time	Species	Toxicity End Point	Mean	Percent Control	Toxicity Significance	Summary Comments
Mustang Creek @ East Ave	RS	01/30/08	12:40	*Ceriodaphnia dubia*	Survival (%)	0	0	SL	Resample due to *C. dubia* toxicity on 01/24/08; toxicity was persistent.
Mustang Creek @ East Ave	E	02/26/08	9:50	*Selenastrum capricornutum*	Total Cell Count	374263	25	SL	TIE initiated on 3/11/08 and sample lost all toxicity. Resampled on 03/04/08; toxicity was not persistent.
Mustang Creek @ East Ave	E	03/04/08	14:00	*Hyalella azteca*	Survival (%)	71	78	SL	Resampled on 03/28/08; toxicity was not persistent.
Prairie Flower Drain @ Crows Landing Rd	E	01/24/08	12:20	*Selenastrum capricornutum*	Total Cell Count	797608	71	SL	Resampled on 1/30/08; toxicity was not persistent.
Prairie Flower Drain @ Crows Landing Rd	E	02/26/08	10:10	*Selenastrum capricornutum*	Total Cell Count	442649	39	SL	TIE initiated on 3/11/08 and sample lost all toxicity. Resampled on 03/04/08; toxicity was not persistent.
Westport Drain @ Vivian Rd	E	02/26/08	8:30	*Selenastrum capricornutum*	Total Cell Count	188642	12	SL	TIE initiated on 3/11/08 and sample lost all toxicity. Resampled on 03/04/08.
Westport Drain @ Vivian Rd	RS	03/04/08	9:50	*Selenastrum capricornutum*	Total Cell Count	361237	66	SL	Resample due to *S. capricornutum* toxicity on 02/26/08; toxicity was persistent.

E = Environmental sample; FD = Field Duplicate; RS = Resample

Interpretation of Results

Monitoring of ambient surface waters is conducted by the Coalition for the purpose of characterizing agricultural discharges in the Coalition area. Over the long term, monitoring data provides insight into general trends in water quality at each of the sample sites.

A series of actions taken by the Coalition to determine the potential sources of exceedances experienced during each monitoring event include:

- analysis of associated toxicity data (for organic chemistry exceedances) or the evaluation of chemistry data (for toxicity exceedances) to determine possible sources of toxicity,
- analysis of relevant Toxicity Identification Evaluation (TIE) results to determine possible causes of toxicity in sample water (for samples with greater than 50% reduction of growth or survival as compared to the control),
- review of PUR data to identify relevant applications of pesticides that occurred within the site subwatershed area prior to the sampling event,
- analysis of associated monitoring data to determine potential processes by which some physical and field exceedances (such as DO, pH, and TDS) may have occurred,
- special studies, where appropriate and cost-effective, and
- additional sampling as outlined in site subwatershed management plans.

These actions were implemented on a case by case basis over the course of the 2008 storm season. All PUR data for exceedances that occurred during the 2008 storm season can be found in Appendix IV.

Toxicity

Water Column Toxicity

Toxicity in the water column can occur as a result of natural or anthropogenic causes, including the discharge, release or re-suspension of metals, pesticides, ammonia or other toxicants in a water body. The three species (*Ceriodaphnia dubia, Selenastrum capricornutum,* and *Pimephales promelas*) used in water column toxicity analyses can often be associated with detections of one or more constituents in the same sample water. Water column toxicity was experienced in 30 samples collected during the 2008 storm monitoring season. Of these samples, two were field duplicate samples and eight were a result of follow-up resampling for *Ceriodaphnia dubia, Pimephales promelas or Selenastrum capricornutum* toxicity. Of the 20 samples that experienced toxicity (not including the field duplicates or toxicity resamples), four were toxic to *Ceriodaphnia*, two to *Pimephales* and 14 to *Selenastrum*.

Every time that a sample was toxic to one or more of the above test species, the site was resampled except for one instance where there was an email error from the laboratory and the wrong site was listed as toxic (see the previous section, Data Interpretation, for details). If complete mortality occurred in a sample, a dilution series was run and acute toxic units (TUa) were calculated. TIEs were conducted on samples with less than 50% growth or survival in the treatment relative to the control. If the original sample triggered a TIE and the resample also triggered a TIE, a TIE was not performed on the resample since the second sampling is to test for toxicity persistence and it is assumed that the toxicity in the resample is due to the same causes as the original sample. However, if the original sample did not trigger a TIE and the resample did, a TIE was conducted on the resample.

There are some situations where TIEs are not performed including cases where DO or ammonia may be causing toxicity and cannot be eliminated to determine if pesticides or metals are also potential causes of toxicity. Due to a laboratory oversight one sample (Dry Creek @ Rd 18 resampled for *Selenastrum* toxicity on March 4, 2008) did not have a TIE performed. A report describing the findings of the TIEs is included in Appendix VI. In addition, PUR data are reviewed to establish a link between applications and toxicity experienced at a site. Queries are performed for applications of pesticides occurring within a relevant time period prior to the date of sampling. The time period is determined by the physical properties of the applied chemical; namely the half-life and the K_{oc}. For water toxicity, the relevant time period for herbicides and insecticides is one month prior to sampling and for applications of metals the time period is three months. Summaries and maps of PUR data for all toxicity and exceedances experienced during the 2008 storm season are provided in Appendix IV.

Toxicity to Ceriodaphnia dubia

Highline Canal @ Lombardy Rd

Samples collected from Highline Canal @ Lombardy Rd during the January 24, 2008 monitoring event tested toxic to *Ceriodaphnia* (40% survival compared to the control). A TIE was performed to identify the causes of toxicity. Results indicated that the water column toxicity was due to a pyrethroid insecticide, however there were no pyrethroid pesticides detected in the chemistry analyses. Chlorpyrifos (0.028 µg/L) and copper (28 µg/L), based on LC_{50} and EC_{50} information, account for all of the toxicity experienced. The resample collected on January 30, 2008 was again toxic to *Ceriodaphnia* (30% survival as compared to the control). There were no applications of chlorpyrifos in the site subwatershed within one month prior to sampling; however, applications of copper, predominantly in the form of copper hydroxide and copper sulfate, occurred on 3,277 acres of orchards in the months of December and January. There were also widespread applications of pyrethroid pesticides including bifenthrin, esfenvalerate, lambda-cyhalothrin and permethrin. It is possible that one or more of these pesticides contributed to the toxicity in samples collected from the Highline Canal. None of these pyrethroids were detected in the sample collected for chemical analysis.

Merced River @ Santa Fe

Samples collected from the Merced River @ Santa Fe site during the January 24, 2008 monitoring event were toxic to *Ceriodaphnia dubia* leading to complete mortality. A dilution series was performed and a TIE was conducted to identify the causes of toxicity. The dilution series indicated that 11.1 TUa were present in the sample and the TIE indicated that toxicity was due to an organophosphate pesticide. Chlorpyrifos (0.59 µg/L) was detected in the sample water and accounts for the majority of the toxic units (7.4 out of 11.4 TUa). Diazinon was detected (0.01 µg/L) and accounted for less than 0.1 TUa. In addition to the organophosphate pesticides, copper was detected in the water at 22 µg/L. A query was run on relevant PUR data for applications of chlorpyrifos, copper or other pesticides toxic to *Ceriodaphnia*. One chlorpyrifos application occurred two weeks prior to sampling within a TRS located near the outer boundary of the site subwatershed (refer to Appendix IV for a map showing all applications). The pesticide, Lorsban-4E, was applied on 550 acres of almond orchards. There were also numerous applications of copper-based pesticides within three months prior to sampling. A total of 20,702 Ibs of copper-based pesticides, including copper hydroxide, copper oxide and copper sulfate, were applied to 2,676 acres of orchards. It is likely that one or more of these pesticides contributed to the toxicity and exceedances detected at the Merced River monitoring site. This site was resampled on January 30, 2008 and resulted in complete mortality to *Ceriodaphnia*. No additional applications were reported between the original sample and the resample.

Miles Creek @ Reilly Rd

Complete mortality to *Ceriodaphnia* was experienced in samples collected from the Miles Creek @ Reilly Rd on January 25, 2008. A dilution series and TIE were performed. Although the baseline test did not indicate that toxicity was still present, an addition of piperonyl butoxide (PBO) elevated the level of toxicity in the sample water indicating that pyrethroids were present in the sample water at low concentrations. There were no detections of pyrethroid pesticides in the water. Exceedances of methidathion (2.3 µg/L) and copper (15 µg/L) were experienced in the samples, however, results from the TIE indicate that these constituents were not responsible for the toxicity. It is possible that the pyrethroid pesticides that initially caused toxicity may have become adsorbed to the surface of the laboratory container. Initially the concentration of pyrethroids was sufficient to cause toxicity but the propensity to bind to container walls resulted in a lack of toxicity by the time the TIE was initiated (3 days later) and the chemistry analysis conducted (up to 7 days later). Approximately 1,615 acres of field crops and orchards were treated with pyrethroid pesticides in the site subwatershed within three months of sampling, including bifenthrin, permethrin, beta-cyfluthrin, lambda-cyhalothrin and esfenvalerate. It is likely that one or more of these pesticides contributed to the toxicity in the sample water from this site. Resampling was conducted on January 30, 2008 and resulted in 15% survival in comparison to the control. The only application reported between the January 25 and January 30 was for paraquat dichloride (150 pints on 100 acres).

Mustang Creek @ East Ave

Ceriodaphnia dubia experienced complete mortality in samples collected from Mustang Creek @ East Ave site on January 24. A dilution series and TIE were performed. The TIE indicated that there were 1.7 TUa in the sample water most likely due to a pyrethroid pesticide. There were no detections of pyrethroid pesticides in the sample water. Toxicity resamples were collected one week after the original sample date and there was 100% mortality of *Ceriodaphnia* (0% survival as compared to the control). Since a TIE was conducted on the original sample, a TIE was not performed on the resample. The sample collected on January 24 had detections of chlorpyrifos (0.067 µg/L), diazinon (0.065 µg/L) and simazine (4.2 µg/L). There were no applications of chlorpyrifos, diazinon or simazine within one month prior to sampling, however four applications of two pyrethroids, esfenvalerate and gamma-cyhalothrin, occurred in January on 775 acres of almond orchard. Neither esfenvalerate nor lambda-cyhalothrin was detected in the water samples collected from the Mustang Creek sample site (water samples were not tested for gamma-cyhalothrin). As with the sample from the site described above, it is possible that pyrethroid pesticides that initially caused toxicity in the water column may have adsorbed to the surface of the laboratory container, thus eliminating detection at the chemistry laboratory. The pyrethroids reported in the PUR data may be responsible for the initial toxicity even though they were not detected in the chemistry analysis. The organophosphates (chlorpyrifos and diazinon) may have also had an effect on the initial toxicity.

Toxicity to Pimephales promelas

Cottonwood Creek @ Rd 20

Samples collected from the Cottonwood Creek @ Rd 20 site experienced toxicity to *Pimephales* (45% survival as compared to the control) and also experienced exceedances in copper (24 µg/L), lead (5.4 µg/L), chlorpyrifos (0.019 µg/L) and diuron (68 µg/L). Due to the fact that toxicity to other, more sensitive test species did not occur, it is unlikely that the toxicity in the sample water was a result of the pesticides/metal detected. None of the constituents in the sample water are known to be acutely toxic to *Pimephales* at the detected concentrations. Toxicity was not detected in the TIE baseline however the SPE add-back recovered (amplified) the toxicity, indicating that a non-polar organic toxicant was present in the sample water at sublethal concentrations. PUR data were reviewed for applications of constituents within the relevant time frame prior to sampling; there were no reported applications of pesticides known to be toxic to *Pimephales* within three months of the sample collection date. Ammonia is the most common cause of toxicity to *Pimephales* however the ammonia measured in this sample (0.32 mg/L) was not at a level that would cause mortality. As a result, the cause of toxicity to *Pimephales* in this sample is unknown. Cottonwood Creek was resampled on January 30, 2008 and the toxicity to *Pimephales* was not persistent.

Highline Canal @ Lombardy

Samples collected from the Highline Canal @ Lombardy Rd site on February 26, 2008 experienced toxicity to *Pimephales* (90% survival as compared to the control). The amount of survival in the sample (90%) is above criteria used for control tests and therefore this toxicity is not considered ecologically significant. Ammonia was detected in the sample water (1.7 mg/L) and may have contributed to the 10% mortality. Though other constituents were detected in the sample, none of these are known to be acutely toxic to *Pimephales* at the detected concentrations. Resampling occurred at this site one week after the original samples were collected (March 4, 2008) and resulted in complete mortality to the test species. There were no chemistry analyses coinciding with the resampling event, but tests at the toxicity laboratory showed levels of ammonia at 56 mg/L. The high concentration of ammonia is the most likely cause of the *Pimephales* toxicity. If a TIE is not conducted on the original sample, the laboratory is supposed to conduct a TIE on the resample if the resample is less than 50% survival as compared to the control. A TIE was not conducted on this sample since it would be impossible to know if the toxicity was due to ammonia or another constituent.

Toxicity to Selenastrum capricornutum

Black Rascal Creek @ Yosemite Rd
Samples collected from the Black Rascal Creek @ Yosemite Rd site on February 25, 2008 experienced toxicity to *Selenastrum* (38% growth as compared to the control). There were no exceedances of constituents relevant to this toxicity detected in the sample water. Toxicity was lost prior to or during the TIE and therefore the evaluation was inconclusive. Cyanazine was present at 0.14 µg/L, which is a concentration not known to be toxic to *Selenastrum*. No metals analysis was conducted for this site since it is in Phase I sampling. PUR data for this site indicate that there were no applications of products known to be toxic to *Selenastrum* in January and February 2008. The last application of any relevant pesticides occurred on December 18, 2007, however the half-life and retention in the soil of herbicides make it unlikely that they would be detected in February 2008. As a result, the cause of toxicity at this site is unknown. Resampling was conducted on March 4, 2008 and toxicity was not persistent.

Deadman Creek @ Gurr Rd
Samples collected from the Deadman Creek @ Gurr Rd site on February 25, 2008 experienced toxicity to *Selenastrum* (47% growth compared to the control). The growth is determined using absorbance values and then converted to cell/mL as per ILRP requirements. The percent growth compared to control was originally calculated as 50% based on absorbance values and therefore a TIE was not triggered. The amount reported in Table 32 and in this discussion is based on the conversion to cells/mL. Samples collected from the same site also experienced an exceedance of arsenic (13 µg/L). The level of arsenic detected in the sample water was not at a concentration known to be toxic to algae. Other metals detected in the water column at levels below WQTLs include boron (31 µg/L), copper (3.4 µg/L), lead (0.4 µg/L), nickel (3.3 µg/L), and zinc (6 µg/L). Diuron was also detected in the water (0.49 µg/L). PUR data indicate numerous applications of herbicides and copper that occurred in February, 2008 including copper hydroxide, dimethylamine salt, carfentrazone-ethyl, glyphosate,

oxyfluorfen, paraquat dichloride, pendimethalin and simazine. Resampling occurred on March 4, 2008; toxicity was not persistent.

Deadman Creek @ Hwy 59

Both the grab sample and the duplicate sample collected from Deadman Creek @ Hwy 59 on January 25, 2008 experienced toxicity to *Selenastrum* (44% and 58% growth compared to the control). The environmental and field duplicate samples also contained diuron (6.2 µg/L and 6.3 µg/L, respectively) and simazine (25 µg/L and 19 µg/L, respectively). Diuron and simazine are herbicides known to be toxic to phytoplankton and therefore are likely sources of the toxicity experienced in these samples. TIE results indicate that the source of toxicity is a non-polar organic. There were applications of both diuron and simazine within the site subwatershed during the month of January. Diuron applications occurred on 509 acres of alfalfa and grapes and simazine applications occurred on 866 acres of almonds and grapes. It is likely that the exceedances of diuron and simazine, as well as the toxicity, were a result of these applications. Resampling was conducted on January 30, 2008 and toxicity was not persistent.

Dry Creek @ Rd 18

Samples collected from the Dry Creek @ Rd 18 on January 25 and February 25, 2008 experienced toxicity to *Selenastrum* (36% and 77% growth compared to the control, respectively). A TIE was conducted on the January 25 sample and toxicity was lost resulting in an inconclusive evaluation. Diuron was detected in the water (2.1 µg/L) which is close to the reported EC_{50} of 2.4 µg/L. Copper was also detected in the water at 20 µg/L (an exceedance of the hardness-based WQTL). Probable causes of toxicity include both diuron and copper. PUR data indicate that diuron was not applied in the site subwatershed within one month prior to sampling, however applications of copper hydroxide, copper oxide and copper sulfate were reported. Approximately 900 Ibs of copper-based pesticides were used within the site subwatershed during the month of January. Resampling occurred for the January event at the wrong location due to a lab miscommunication and therefore it is unknown if the toxicity was persistent. The storm sample collected on February 25 contained copper (33 µg/L) and diuron (2.1 µg/L) similar to samples collected one month earlier. Diazinon (0.24 µg/L) and chlorpyrifos (0.034 µg/L) were also detected, however these constituents are less likely to have an effect on *Selenastrum* since these chemicals act as acetylcholinesterase inhibitors. Due to 77% growth as compared to the control no TIE was conducted on the February sample. Relevant PUR data for applications that occurred within the site subwatershed include 2,000 Ibs of copper hydroxide and copper sulfate applied on 743 acres of almonds and flower crops during the month of February. One application of diuron occurred on February 14 totaling 17 Ibs of product applied on 8.5 acres of grapes. Resampling occurred on March 4, 2008 resulting in persistent toxicity (35% growth as compared to the control). A TIE was not conducted on this sample due to an oversight by the laboratory.

Dry Creek @ Wellsford Rd

Samples collected from the Dry Creek @ Wellsford Rd site experienced toxicity to *Selenastrum* during the second storm sampling event in February (33% growth compared to the control). Copper (11 µg/L), cadmium (0.05 µg/L) and lead (1.8 µg/L) were found in the sample. A TIE was performed to identify the cause of toxicity. Results indicate that the source of toxicity was likely a non-polar organic pesticide (herbicide) and/or cationic metal. There were no exceedance-level detections of any pesticides at this site however detections of both diuron (0.24 µg/L) and simazine (0.48 µg/L) did occur. PUR data include applications of numerous herbicides and fungicides within the site subwatershed during the month of February. Copper was applied as copper hydroxide and copper oxide on 894 acres. Some of the more common herbicides applied include diethanolamine salt, carfentrazone-ethyl, copper hydroxide, glyphosate, dimethylamine salt, oryzalin, oxyfluorfen, paraquat dichloride, pendimethalin, and simazine. Resampling occurred on March 4, 2008 and toxicity was not persistent.

Hatch Drain @ Tuolumne

Samples collected from Hatch Drain @ Tuolumne Rd experienced toxicity to *Selenastrum* during the first and second storm monitoring events on January 24 and February 26 (74% and 6% growth as compared to the control, respectively). The field duplicate collected on January 24 was also toxic to *Selenastrum* (73% growth as compared to the control). The January resample (collected on January 30, 2008) was not toxic although the February resample (collected on March 4, 2008) was toxic (73% growth as compared to the control). A TIE performed on the environmental sample collected on February 26 concluded that both non-polar organics and cationic metals were responsible for toxicity. There were no pesticides detected in the March samples. Samples collected during the January and February sampling events experienced arsenic exceedances (15 and 16 µg/L, respectively). Copper was detected in January at a concentration of 4.7 µg/L in the environmental sample and 4.4 µg/L in the field duplicate. In the February sample, copper was detected at a concentration of 4.5 µg/L. Copper toxicity is dependent on hardness and none of the detections experienced at Hatch Drain in January or March were above WQTLs. PUR data for applications that occurred within the Hatch Drain site subwatershed were reviewed for pesticides that may have been responsible for the toxicity. Numerous herbicides were applied within one month prior to each of the sampling events, including dimethylamine salt, carfentrazone-ethyl, glyphosate, pendimethalin, rimsulfuron and copper hydroxide.

Highline Canal @ Hwy 99

Toxicity to *Selenastrum* occurred in samples collected on February 26, 2008 at Highline Canal @ Hwy 99 (72% growth compared to the control). Exceedances of ammonia (8.3 µg/L), cadmium (0.096 µg/L) and copper (81 µg/L) were present in the water. The amount of copper detected is two times the EC_{50} (43 µg/L) and is the most likely cause of decreased growth. Relevant PUR data indicate that 7839 lbs of copper-based pesticides were applied on 753 acres of peach and almond orchards. It is likely that one or more of these applications may have caused the exceedance of copper and toxicity at the Highline Canal sample site. Resampling occurred on March 4, 2008 and the toxicity was not persistent.

Livingston Drain @ Robin Ave

Both the grab and field duplicate samples collected from Livingston Drain @ Robin Ave experienced toxicity to *Selenastrum* during the second storm event on February 26, 2008 (61% and 65% growth as compared to the control, respectively). The environmental and field duplicate water contained hardness-based exceedances of copper (15 and 18 µg/L, respectively) and lead (1.1 and 0.93 µg/L, respectively). The only pesticide detected in the water was diazinon (0.068 µg/L in the environmental sample and 0.079 µg/L in the field duplicate). The detected concentrations of diazinon would not be toxic to *Selenastrum* (EC_{50} = 6,400 µg/L). PUR data for applications of herbicides and fungicides include copper hydroxide, copper oxide and copper sulfate. During this time 2,457 Ibs of copper product was applied on 384 acres of almond and peach orchards. It is likely that one or more of these applications may have caused the exceedance of copper and toxicity at the Livingston Drain sample site. Resampling was attempted on March 4, 2008, however the site was dry.

Mustang Creek @ East Ave

Samples collected from Mustang Creek @ East Ave experienced toxicity to *Selenastrum* (25% growth as compared to the control) during the second storm event on February 26. 2008. An exceedance of simazine (17 µg/L) was detected in the water and may have contributed to the toxicity (EC_{50} = 100 µg/L). No tests were performed for metals since the site is in Phase I monitoring. A TIE was performed to identify the cause(s) of toxicity, however sample toxicity was lost and no conclusions could be made. Five applications of simazine were made on 610 acres of almonds. 4,897 lbs of copper hydroxide and copper oxide were applied on 925 acres in January and February. One or more of these applications may have caused the exceedance of simazine and toxicity at the Mustang Creek sample site. Resampling occurred March 4, 2008; toxicity was not persistent.

Prairie Flower Drain @ Crows Landing Rd

Samples collected from Prairie Flower Drain @ Crows Landing Rd experienced toxicity to *Selenastrum* during the first and second storm events on January 24 and February 26, 2008 (71% and 39% growth as compared to the control, respectively). A TIE was performed to identify potential cause(s) of toxicity. Toxicity was lost resulting in an inconclusive evaluation. Detections of pesticides and metals below water quality limits include boron (360 µg/L), copper (9.2 µg/L), nickel (6.0 µg/L), selenium (1.1 µg/L), zinc (20 µg/L), and diuron (0.31 µg/L) in the January sample and boron (440 µg/L), copper (9.1 µg/L), nickel (6.5 µg/L), selenium (1.4 µg/L), zinc (4 µg/L), diuron (0.3 µg/L) and simazine (2.5 µg/L). Although none of these detections are at high enough concentration to cause toxicity the combination of these may have contributed to the reduced growth in the January and February samples. Resampling occurred on January 30 and March 4; toxicity was not persistent in either resample. PUR data indicate applications of carfentrazone-ethyl, diglycolamine salt of 3,6-dichloro-o-anisic acid, diuron, hexazinone, dimethylamine salt and paraquat dichloride. The exact source of toxicity is uncertain; however runoff of one or more of these applications may have contributed to the toxicity at the Prairie Flower Drain sample site.

Westport Drain @ Vivian Rd

Samples collected from Westport Drain @ Vivian Rd experienced toxicity to *Selenastrum* during the second storm monitoring event on February 26, 2008 and again in the resample collected one week later. A TIE was performed to identify the source of toxicity, however toxicity was lost. There were no exceedance-level detections of pesticides or metals that could cause *Selenastrum* toxicity. However, it may be that a constituent not tested by the Coalition was the cause of toxicity. PUR data indicate that applications of herbicides were made including dimethylamine salt, copper hydroxide, copper oxide, glyphosate, oxyfluorfen, paraquat and pendimethalin. One or more of these applications could be responsible for the toxicity experienced at the Westport Drain sample site.

Sediment Toxicity

Storm sediment samples were collected for the analysis of toxicity to *Hyalella azteca* on March 4, 2008. A resample was collected on March 28, 2008. Sediment samples did not undergo chemistry analyses or TIEs. The Coalition relied on PUR data to determine possible sources of sediment toxicity. Applications of pesticides with a high soil organic carbon partitioning coefficient (K_{oc}) are summarized and mapped for each of the sites that experience toxicity (Appendix IV). The relevant time frame during which applications could have an effect on the sediment at the time of sampling is six months prior to the sample collection date for pyrethroid pesticides and three months prior to sampling for all other pesticides. A discussion of each of the sediment toxicity exceedances and possible sources of toxicity are provided below.

Cottonwood Creek @ Rd 20

Samples collected at Cottonwood Creek @ Rd 20 were toxic to *Hyalella* during the storm sediment sampling event. A resample was collected three weeks after the original sampling and sediment toxicity was not persistent. Ambient water samples collected one week prior to sediment sampling revealed exceedance-level detections of copper (21 µg/L), lead (1.9 µg/L), chlorpyrifos (0.036 µg/L), diazinon (0.24 µg/L), diuron (65 µg/L) and simazine (5.1 µg/L). Chlorpyrifos is capable of binding to sediment and may have contributed to the *Hyalella* toxicity, though at the level detected it is unlikely to be the only source of toxicity. Copper could also contribute to the toxicity but the current analysis is for total metals and includes both sediment bound and dissolved compounds. Consequently it is unclear how much of the copper would have been deposited in the sediment. There were no applications of chlorpyrifos however applications of esfenvalerate occurred within one month prior to the sample collection date. Other products used within this time period include glyphosate and oxyflourfen.

Dry Creek @ Wellsford Rd

Samples collected from Dry Creek @ Wellsford Rd experienced toxicity to *Hyalella* during the storm sediment sampling event. A resample for toxicity was collected three weeks after the original sampling and sediment toxicity was not persistent. Ambient water samples collected one week prior to sediment sampling revealed exceedance-level detections of cadmium (0.05 µg/L), copper (11 µg/L) and lead (1.8 µg/L). At the levels detected it is unlikely that any of these constituents caused sediment toxicity at the Dry Creek site, although it is possible that one or more of the metals could have contributed to the toxicity. Applications of pendimethalin occurred between the months of January and March. Other products used within this time period include glyphosate, oxyflourfen, and cyprodinil. It is likely that one or more of these applications were the cause of toxicity at this site.

Hatch Drain @ Tuolumne Rd
Samples collected from Hatch Drain @ Tuolumne Rd caused complete mortality to *Hyalella*. A resample was collected three weeks after the original sampling and sediment toxicity was persistent in the drain (2% survival relative to the control in the resample). Ambient water samples collected one week prior to sediment sampling had an exceedance-level detection of arsenic (16 µg/L), however arsenic is not known to cause toxicity at the concentration detected. It is likely that the constituents responsible for the sediment toxicity are bound to the sediment and not found in the water column. PUR data from the Hatch Drain site subwatershed indicate that seven applications occurred between February and March including glyphosate, oxyfluorfen, cyprodinil, chlorpyrifos and lambda-cyhalothrin on 61 acres of almonds and alfalfa. Though pesticide use was minimal in the site subwatershed, it is likely that one or more of these applications were the cause of toxicity at this site.

Highline Canal @ Hwy 99
Samples collected from Highline Canal @ Hwy 99 experienced toxicity to *Hyalella* during the sediment sampling event. A resample was collected three weeks after the original sampling and sediment toxicity was not persistent. Ambient water samples collected one week prior to sediment sampling revealed exceedance level detections of cadmium (0.096 µg/L) and copper (81 µg/L). At the level detected, cadmium is unlikely to cause sediment toxicity at the site although it is possible that one or more of the metals could have contributed to the toxicity. The level of copper in the sample water could contribute to the toxicity but the current analysis is for total metals and includes both sediment-bound and dissolved compounds. Consequently it is unclear how much of the copper would be deposited in the sediment. PUR data from the Highline Canal @ Hwy 99 site subwatershed show numerous pyrethroid pesticide applications (predominantly esfenvalerate) occurring between the months of December and January. Numerous applications of other pesticides, including fungicides, herbicides and insecticides, occurred up to the date of sampling and are summarized in Appendix IV. The exact cause of the toxicity is not certain, however it is likely that one or more of these applications were the cause of toxicity at this site.

Highline Canal @ Lombardy Rd
Samples collected from Highline Canal @ Lombardy Rd experienced toxicity to *Hyalella*. A resample was collected three weeks after the original sampling and sediment toxicity

was not persistent. Ambient water samples collected one week prior to sediment sampling had exceedance level detections of cadmium (0.09 µg/L), copper (32 µg/L), lead (2.7 µg/L) and simazine (12 µg/L). The concentration of metals in the sample water could contribute to sediment toxicity but includes both sediment-bound and dissolved compounds. Consequently it is unclear if the metals would be deposited in the sediment. PUR data from the Highline Canal @ Lombardy Rd site subwatershed indicate that numerous pyrethroid pesticide applications (predominantly esfenvalerate) occurred between the months of December and January. Similar to the downstream site along Highline Canal (Highline Canal @ Hwy 99), numerous applications of other pesticides, including fungicides, herbicides and insecticides, occurred in the site subwatershed prior to the date of sampling. The exact source of the toxicity is not certain, however it is likely that one or more of these applications were the cause of toxicity at this site.

Hilmar Drain @ Central Ave

Samples collected from Hilmar Drain @ Central Ave were toxic to *Hyalella*. A resample was collected three weeks after the original sampling and sediment toxicity was not persistent in the drain. Ambient water samples collected one week prior to sediment sampling did not have exceedance-level detections of any constituents known to be toxic to *Hyalella*. PUR data from the Hilmar Drain site subwatershed indicate six pesticide applications occurring between the months of January and March including pendimethalin, oxyfluorfen, paraquat dichloride and bromoxynil octanoate. The exact cause of the toxicity is not certain, however it is likely that one or more of these applications were the cause of toxicity at this site.

Mustang Creek @ East Ave

Samples collected from Mustang Creek @ East Ave were toxic to *Hyalella* during the storm sediment sampling event. A resample was collected three weeks after the original sampling and sediment toxicity was not persistent. Ambient water samples collected one week prior to sediment sampling had exceedance-level detections of chlorpyrifos (0.028 µg/L) and simazine (17 µg/L). Of these constituents, only chlorpyrifos is likely to bind to sediment and cause toxicity, however it is not likely that the toxicity would have been caused only by chlorpyrifos at the level detected. Furthermore, there were no applications of chlorpyrifos reported in the site subwatershed within 3 months prior to sampling. Current PUR data from the Mustang Creek site subwatershed show pesticide applications occurring between the months of January and March, 2008 and include glyphosate, pyraclostrobin and esfenvalerate. It is likely that one or more of these pesticides were the cause of toxicity at this site.

Pesticides

A total of 2084 individual analyses for pesticides were conducted during the 2008 storm monitoring season and a total of 26 exceedances occurred. Two of the 26 exceedances were field duplicate results and one of the exceedances was of DDT. Field duplicate exceedances are not considered separately unless an exceedance occurs in the duplicate sample and not in its accompanying grab sample. In addition, DDT is a legacy pesticide not currently used by agriculture. Given these considerations, 23 of the 26 detected exceedances are considered relevant for the purpose of monitoring agricultural discharge during the 2008 storm season. These 23 exceedances occurred at 10 of the 23 Coalition monitoring sites during the storm sampling events that occurred on January 24-25 and February 25-26, 2008.

Herbicides accounted for 11 of the 23 pesticide exceedances, with six exceedances of diuron and five exceedances of simazine (plus field duplicate exceedances for each of these) detected across six of the sample sites. Organophosphate pesticides accounted for the other 12 of the 23 pesticide exceedances with nine exceedances of chlorpyrifos, two exceedances of diazinon and one exceedance of methidathion at eight of the sampling sites.

Pesticide applications are identifiable to township, range and section (TRS) through the use of PURs. Monitoring results obtained from sampling over the 2008 storm season were analyzed against PURs, which were received from the Merced County, Madera County and Stanislaus County Agricultural Commissioner's office as soon as they became available. Exceedances were compared to applications that occurred within the site subwatershed. Specific crops may also correlate with particular exceedances and were also identifiable through PURs. All PUR data are included in Appendix IV.

Cottonwood Creek @ Rd 20

Exceedances of chlorpyrifos and diuron were experienced at Cottonwood Creek @ Rd 20 during the first (0.019 µg/L and 68 µg/L, respectively) and second storm monitoring events of 2008 (0.036 µg/L and 65 µg/L, respectively). The last reported application of chlorpyrifos occurred in October of 2007, during which less than 30 gallons of product were used on 45 acres of orange orchards and grapes. Diuron applications occured in December 2007 and February 2008. No applications were reported for diuron in January 2008. In December, approximately 500 Ibs of diuron were used on 150 acres of orange, walnut and tangelo orchards. In February, over 1000 Ibs were applied on 500 acres of alfalfa, grapes, tangelos and oranges.

Exceedances in diazinon and simazine were experienced at Cottonwood Creek @ Rd 20 for the first time during the second storm monitoring event (0.24 µg/L and 5.1 µg/L, respectively). Diazinon is used on orchards during the dormant season and simazine can be used on a variety of crops including orchards and grapes. PUR data from the site subwatershed show applications of both diazinon and simazine within one month of sampling. One hundred and two Ibs of diazinon were applied on 315 acres of various fruit and nut orchards. Simazine applications were more widespread and occurred over 1,711 acres of grape vineyards during the month of February. It is likely that runoff of one or more of these products were the source of the exceedances.

Deadman Creek @ Gurr Rd

The exceedance of DDT that occurred at Deadman Creek @ Gurr Rd on February 25 is a result of applications in the past. DDT is a pesticide that is no longer registered or applied but persists because of its exceptionally high K_{oc} and long half life. It is estimated that the K_{oc} for DDT is between 100,000 and 1,000,000 depending on the source, and the half-life in aquatic systems is probably over 150 years (http://www.speclab.com/compound/c50293.htm). Remnants of this pesticide may be bound to sediment in the creek and mobilized periodically by unknown mechanisms. This is the first time and only time that DDT has been detected at this site since it was first monitored in May 2006.

Deadman Creek @ Hwy 59

Exceedances of diuron and simazine were detected in sample water collected from the Deadman Creek @ Hwy 59 site on January 25th in both the environmental and the field duplicate samples. Toxicity to *Selenastrum* was also experienced in the sample water and may be attributed to the detected herbicides. The TIE indicated that a non-polar organic toxicant, such as an herbicide (or more than one herbicide), was the likely cause of toxicity. According to the PURs, there were applications of both diuron and simazine in the site subwatershed during the month of January. Diuron applications occurred on 509 acres of alfalfa and grapes and simazine applications occurred on 866 acres of almonds and grapes. It is likely that the exceedances in diuron and simazine experienced in the creek were a result of these applications.

Dry Creek @ Rd 18

Exceedances of diuron were detected in samples collected during the first and second storm events from Dry Creek @ Rd 18 (21 µg/L and 2.1 µg/L, respectively). PUR data indicate that there were no applications of diuron in January; the last application of diuron was in November 2007. Two applications of diuron occurred on February 14, totaling 17 Ibs of product applied on 8.5 acres of grapes. During the second storm event, chlorpyrifos (0.034 µg/L) and diazinon (0.24 µg/L) were detected above WQTLs in addition to diuron. On January 18 and 19, a total of 17.5 Ibs of chlorpyrifos was applied on 35 acres of almond orchards. Three applications of diazinon occurred during the month of February amounting to 97.5 Ibs of product applied on 780 acres of fig orchards. Two applications of diuron occurred on February 14, totaling 17 Ibs of product applied on 8.5 acres of grapes.

Highline Canal @ Hwy 99

Exceedances of chlorpyrifos (0.019 µg/L) and diuron (3.2 µg/L) were detected in samples collected from the Highline Canal @ Hwy 99 sample site during the first storm monitoring event. There was no toxicity experienced in these samples. PUR data for the site subwatershed indicate that there were no applications of chlorpyrifos or diuron in the three months prior to sampling. It is unlikely that applications occurring prior to three months would persist sufficiently long to cause these detections. As a result, the source(s) of these exceedances are unknown.

Highline Canal @ Lombardy Ave
Exceedances of chlorpyrifos (0.028 µg/L) during the first storm event and simazine (12 µg/L) were detected at the Highline Canal @ Lombardy Rd. PUR data indicate no reported use of chlorpyrifos in the site subwatershed from August of 2007 to January 25, 2008. Applications of simazine occurred within the site subwatershed during late January and through February, with a total of 1183 acres of almond and walnut orchards treated.

Livingston Drain @ Robin Ave
One exceedance of chlorpyrifos (0.02 µg/L) was detected at the Livingston Drain @ Robin Ave during the first 2008 storm monitoring event. There was no associated toxicity in these samples. PUR data indicate that there was no reported use of chlorpyrifos in the site subwatershed between August of 2007 and January 25, 2008.

Merced River @ Santa Fe
One exceedance of chlorpyrifos (0.59 µg/L) was detected in the Merced River @ Santa Fe sample during the first 2008 storm event. Toxicity was also experienced in samples collected from this site. The concentration of chlorpyrifos accounts for the majority of the toxic units experienced in the *Ceriodaphnia* TIE analysis. PUR data for the site subwatershed show one application of chlorpyrifos occurred on January 10, two weeks prior to sampling. A total of 2,200 pints of product were applied on 550 acres of almond orchards. It is likely that the exceedance and toxicity detected at this site was a result of this pesticide application. Follow-up actions occurred as a result of these exceedances and are discussed in the following section, "Activities, Events and Deliverables."

Miles Creek @ Reilly Rd
An exceedance of methidathion was detected in samples collected from the Miles Creek @ Reilly Rd sample site on January 25, 2008 (2.3 µg/L). Toxicity to *Ceriodaphnia* was also experienced in samples collected from this site. Methidathion is an organophosphate pesticide known to be toxic to invertebrates. The level of methidathion in the sample water may have contributed to the water flea toxicity. The TIE conducted in the laboratory showed enhanced toxicity with treatment of PBO, indicative of a pyrethroid insecticide as the source contaminant. It may be the case that a pyrethroid pesticide that is not analyzed by the Coalition was apparent in the sample water at a more toxic concentration than the methidathion, thus resulting in enhanced toxicity with the PBO treatment. PUR data for the Miles Creek @ Reilly Rd site subwatershed show no applications of methidathion anytime over the past year.

Mustang Creek @ East Ave
Chlorpyrifos and simazine were detected in samples collected from the Mustang Creek @ East Ave sample site during both the first and second storm monitoring events. According to the PUR data for this site, there were no reported applications of chlorpyrifos in the Mustang Creek site subwatershed during the month of January, 2008. The last application shown in the PUR data was on October 23, 2007. PUR data indicate that 785 acres of almond orchard were treated with simazine in January, prior to the

first sampling event, and an additional 620 acres treated prior to the second storm sampling event. It is likely that one or more of these applications were the source of the exceedances at this site.

Metals

Metals can be divided into two groups: those metals which are currently registered for use by agriculture, and those that are not registered or currently applied. During the 2008 storm season, exceedances of arsenic, cadmium, copper, lead and nickel were experienced. Among the five metals, only copper is known to be currently used by agriculture within the Coalition region. Each time an exceedance of copper occurred, PUR data for parcels of land upstream of the sample site were reviewed for applications of products containing the particular metal within three months of the sample date. If applications had occurred then it was assumed that these applications could contribute to the exceedance experienced at the sample site. There are numerous sources that have the potential to release metals into the environment, and it is important that the Coalition investigate all possible sources to fully understand how exceedances can be addressed.

A total of 56 exceedances of metals were experienced during the 2008 storm season (not including field duplicate exceedances). Four of the exceedances were detections of arsenic, 12 of cadmium, 16 of lead, four of nickel and 20 of copper. These exceedances and their relevance to pesticide applications that occurred in the upstream subwatershed are described in more detail below.

Cadmium

Twelve exceedances of cadmium occurred at nine monitoring sites during the two storm monitoring events of 2008. Few exceedances of cadmium occurred in the past, however due to a change in the water quality trigger limit in March of 2008 exceedances of cadmium have increased.

Cadmium is often found in the parent material processed to generate phosphate fertilizers. Cadmium may result from the erosion of peat soils and bedrock, atmospheric deposition, discharge from industrial operations or leakage from landfills and contaminated sites. The element can be found in NiCd batteries used for wireless devices such as telephones and power tools. Cadmium has high tendency to adsorb to sediments and persists indefinitely in the environment. Identifying the potential source(s) of cadmium is possible by identifying the stable isotopes of cadmium in the sample. Different sources typically have different ratios of isotopes which allow a source designation. However, the cost of the analysis is substantial and the Coalition is unable to conduct the analysis at this time.

Copper

Copper was detected at concentrations above the WQTL 20 times at 13 sites during the storm monitoring events. Copper is commonly applied throughout the Coalition region and is considered an organic herbicide, fungicide, and algaecide. Copper products include copper, copper hydroxide, copper sulfate and copper sulfate pentahydrate. Copper can enter water bodies through the weathering of rocks and soils that naturally contain metals. Copper is known to contribute to the toxicity of *Selenastrum*. Since copper does not degrade, it is possible that applications can cause exceedances more than one month after application. When exceedances of copper occur, PUR data are reviewed for applications within three months of the date of sampling. Exceedances that occurred during the storm season are analyzed by site subwatershed below. Refer to Appendix IV for detailed PUR data and maps showing copper applications relevant to the exceedance.

Arsenic

Arsenic was detected above the water quality trigger limit during both storm monitoring events at two sites, Deadman Creek @ Gurr Rd and Hatch Drain @ Tuolumne Ave. Arsenic is found in sodium cacodylate which is applied by agriculture for broadleaf weed control and as a cotton defoliant. The registrations on many products with this active ingredient have been cancelled. However, there are four products currently registered for use on citrus, for weed control around ditches, for use on ornamental plants, for nonagricultural weed control, and for weed control around buildings, driveways, sidewalks, rights-of-way, and fencerows. Several products are available for use by homeowners and nonagricultural users (e.g. county road maintenance) (http://www.pesticideinfo.org/List_Products.jsp?Rec_Id=PC34358&Chem_Name=Sodium%20cacodylate&PC_Code=012502) and the product may have been purchased for use by local homeowners for use on their property. California Department of Pesticide Regulation records indicate minimal use of sodium cacodylate across the Coalition region between 1996 and 2006, and in the Deadman Creek @ Gurr Rd and Hatch Drain @ Tuolumne Ave, where the exceedance occurred, there is no record of any sodium cacodylate application.

At this point the source of arsenic is unclear although native soils can contain elevated concentrations of arsenic. The Coalition is presently investigating methods for establishing background levels of arsenic in surface waters. The Coalition will work with the Regional Board to determine if it is feasible to obtain the necessary data to establish background levels.

Lead

Lead exceedances were experienced in 16 samples collected at 10 sites. Lead is a legacy of any of a number of potential sources including deposition from leaded gasoline, disposal of lead-based products such as paints, electronic components, and batteries, and old applications of lead arsenate pesticides. Currently, there are no pesticides applied that contain lead, although lead arsenate was used in the past. Lead arsenate was used generally only until the 1960s and has been banned on all food crops since 1991. Currently, the most probable source is contaminated soils that originated from old pesticide applications, disposal of products containing lead, or the deposition of automobile exhaust along roadways. Contaminated soils may have caused contaminated sediment and that sediment may be moved into the water body during storm events. Lead is predominantly particulate bound and not bioavailable in that form. Major roads and highways within a subwatershed may contribute to the leaching of lead into receiving waterways. In addition, disposal of lead paint or leaching lead from lead arsenate deposition could contribute to lead detections.

Nickel

Four exceedances of nickel occurred at three sites during the 2008 storm monitoring events. Nickel is a naturally occurring metal that is found in soils as a normal constituent. It is also applied by agriculture as a foliar nutrient on crops such as cotton and pecans to improve nitrogen utilization when nitrogen is applied as urea. Nickel is also a constituent in fertilizers originating with wastes from industry and sewage treatment plants. It can also be released into the environment from the disposal of nickel-cadmium batteries, and in fact all nickel exceedances detected during the storm monitoring events were accompanied by cadmium exceedances (though this may simply be a coincidence). Metallic nickel is insoluble in water but complexes with several other compounds in oxidation states from -1 to +4; the most common oxidation state is +2. Ni^{2+} can be found in the dissolved state and its bioavailability is determined by the amount of organic carbon in the water body. Nickel is a potential contaminant in sediments where its bioavailability is determined by the amount of organic carbon and acid volatile sulfides. The amount of nickel applied in the Coalition region is unknown but because urea is not a commonly used form of nitrogen fertilizer its use is assumed to be low.

Site Subwatershed Analysis

Bear Creek @ Kibby Rd

Exceedances of copper occurred at the Bear Creek @ Kibby Rd site during the first and second storm season events (8.6 µg/L and 7.2 µg/L, respectively). Copper is commonly applied throughout the Coalition region and is considered an organic herbicide, fungicide, and algaecide. PUR data for the upstream subwatershed show no reported use of copper within six month prior to either sampling event. Cadmium exceeded the WQTL in samples collected during the second storm event (0.08 µg/L). Cadmium in the creek may come from a number of sources, as described above. It is not certain what the most likely sources of cadmium and copper are in the Bear Creek site subwatershed and these exceedances will be addressed in the Coalition Management Plan.

Cottonwood Creek @ Rd 20

Exceedances of copper and lead occurred in samples collected at the Cottonwood Creek @ Rd 20 site during the first and second 2008 storm monitoring events. Lead in the creek may come from number of sources, as described above. However, it is not certain what the most likely source of lead is in the Cottonwood Creek. PUR data for the upstream site subwatershed indicate that applications of copper hydroxide, copper oxide and copper sulfate occurred throughout the months of January and February 2008. Between January 10 and January 25 over 3,000 acres of orchards (predominantly almonds) were treated with copper-based pesticides. After that time, but prior to the second sampling event on February 25, 408 acres (mostly fruit orchards) were treated with copper. It is probable that one or more of these applications was the source of copper detected in the creek during the storm sampling events.

Deadman Creek @ Gurr Rd
Exceedances of arsenic, cadmium, copper, lead and nickel occurred at the Deadman Creek @ Gurr Rd sample site during the first 2008 storm monitoring event. Arsenic was also detected above the WQTL in samples collected during the second storm event. With the exception of copper, previous exceedances of metals at this site have predominantly occurred during storm season events indicating that the source of the exceedances are probably unrelated to fertilizer or pesticide applications that occur during the irrigation season. Sources of arsenic, cadmium, lead and nickel are explained above. PUR data indicate that there were no applications of copper just prior to sampling in the month of January; however copper hydroxide was applied on 312 acres of ornamental plant farms and peach orchards in November and December, 2007. During that time, a total of 2,323 Ibs of product were applied. It is probable that one or more of these applications was the source of copper detected in the creek during the first storm monitoring event.

Dry Creek @ Rd 18
Exceedances of copper occurred in samples collected from the Dry Creek @ Rd 18 site during the 2008 first and second storm events (20 µg/L and 33 µg/L, respectively). Applications of copper hydroxide, copper oxide and copper sulfate occurred for dormant season pest control throughout the month of January and February 2008. In January, approximately 1,700 acres of orchard (predominantly almonds) were treated with copper-based pesticides. Between the first and second sampling events, a total of 743 acres of almonds and ornamentals were treated with copper. It is probable that one or more of these applications was the source of copper detected in the creek during the storm sampling events.

Dry Creek @ Wellsford Rd
During the first monitoring event, one exceedance of lead occurred in samples collected from Dry Creek @ Wellsford. Exceedances of cadmium, copper and lead occurred in samples collected from the second event on February 26, 2008. Applications of copper hydroxide and copper oxide occurred between the months of December 2007 and February 2008. During this time, 1,187 acres (predominantly almonds) were treated with copper-based pesticides.

Duck Slough @ Gurr Rd and Duck Slough @ Hwy 99

Samples collected from Duck Slough @ Hwy 99 had exceedances of cadmium, copper, lead and nickel in both storm events. Downstream of Highway 99, the Duck Slough @ Gurr Rd was sampled and contained exceedance levels of cadmium, copper and lead during the second storm event. A gravel extraction facility is located in close proximity to the water body (www.maps.google.com). It is difficult to determine the type of operations that occur at this facility and whether discharge is released into the slough, however it's possible that trace minerals are being released from the extraction and/or rinsing processes at the site. Applications of copper occurred within the site subwatershed between December 2007 and January 2008. A total of 1,202 Ibs of product were applied on 179 acres. The copper exceedance experienced during storm monitoring in Duck Slough may have been a result of one or more of these applications.

Hatch Drain @ Tuolumne Rd
Exceedances of arsenic were experienced in samples collected from the Hatch Drain @ Tuolumne Rd site on January 24 (environmental sample = 15 µg/L, field duplicate = 16 µg/L) and February 26 (16 µg/L). The source of arsenic is unclear at this point, although native soils can contain elevated concentrations of arsenic in the Coalition region. Arsenic has been detected at exceedance levels in the Hatch Drain during almost every sampling event since monitoring at that site began. Consistent exceedances at this site are an indication that the native soils within the site subwatershed may contain elevated levels of arsenic or that there is a contaminated site somewhere within the watershed that is the source. The Coalition is presently investigating methods for establishing background levels of arsenic in surface waters within the Coalition region.

Highline Canal @ Hwy 99 and Highline Canal @ Lombardy Rd
In the Highline Canal subwatershed, detections of cadmium, copper and lead at levels above the WQTLs occurred in both 2008 storm monitoring events for both sampling locations except for lead which was detected below the WQTL on February 26 at the Highline Canal @ Hwy 99 site. Detections across storms are an indication that the presence of metals in the canal is persistent. Field observations indicate that the slough contained murky, brown water at the time that samples were collected at both locations. There are two sources of water to the Highline Canal system during the winter storm season; urban runoff and runoff from agricultural operations. Unfortunately, storm water from the urban areas is not characterized and it is unclear how much of the contribution originates in the urban areas. Copper, cadmium, and lead are all common constituents of runoff from urban areas. Applications of copper occurred predominantly during the month of January on peach and almond orchards. 25,900 Ibs of product were applied in January on 3,790 acres. It is likely that one or more of these applications contributed to the detections found at monitoring sites along the Highline Canal.

Livingston Drain @ Robin Ave
Exceedances of copper and lead occurred at the Livingston Drain sample site during the first and second 2008 storm monitoring events. Copper exceedances have been detected in several samples collected at this site since monitoring was initiated during

the irrigation season of 2007. Between the months of December 2007 and January 2008, 2,167 Ibs of copper were applied on 338 acres of almond and peach orchards. Three additional applications occurred between the first and the second storm monitoring event, and include 370 Ibs of product applied on 56 acres of almond orchard. One or more of these applications may be responsible for detections found in the Livingston Drain.

Merced River @ Santa Fe

Exceedances of cadmium, copper and lead occurred at the Merced River @ Santa Fe sample site during the first storm event. Exceedances of metals have only occurred during the storm season from the Merced River site. Copper hydroxide, copper sulfate and copper oxide applications occurred between November 2007 and January 2008 with 20,702 Ibs of product applied on 2,676 acres of almond and stone fruit orchards. It may be that one or more of these applications contributed to the detections found in samples collected from the Merced River.

Miles Creek @ Reilly Rd

Exceedances of cadmium, copper, lead and nickel occurred at the Livingston Drain sample site during the first and second 2008 storm monitoring events. Elevated flows during storm events mobilize sediment resulting in exceedances of sediment bound constituents, such as metals. Six applications of copper were made during the month of January. 1580 Ibs of product were applied on 191 acres of peach and almond orchards. It is possible that one or more of these applications contributed to the detections found in samples collected from Miles Creek.

Nutrients (Ammonia, Nitrate)

Ammonia

Ammonia can enter a water body through two sources, direct discharge from agricultural fertilizers or animal waste, or from discharges from waste water treatment plants. Ammonia in fertilizer is typically converted to nitrite and then nitrate in soils over a short period of time and discharge of ammonia from fertilizer would have to be immediate to detect ammonia in the receiving water body. Exceedances of ammonia occurred at both Highline Canal monitoring sites and during both storm monitoring events, indicating that the source of the ammonia in the canal may be persistent. There is no waste water treatment plan discharge to Highline Canal and therefore the source of ammonia is unknown at this time.

Nitrate

High levels of nitrate and nitrite in the Coalition region are not uncommon. Potential sources of nitrates in surface waters include runoff of fertilizers or organic matter from irrigated pasture, leaking septic systems, waste-treatment facility effluent, and inputs from dairies. These sources can move to surface waters through above ground runoff or shallow subsurface flows.

Exceedances of nitrate occurred consistently at three sites, Hatch Drain @ Tuolumne Rd, Prairie Flower Drain @ Crows Landing Rd and Westport Drain @ Vivian Ave, during both 2008 storm monitoring events. Elevated detections of nitrate at these three sites are not uncommon. There are no wastewater treatment plants upstream of these sites however there are a number of animal waste sources including dairies. Dairies and feedlots are common in this part of the Coalition region and historically waste lagoons were not lined allowing movement of soluble nitrates into shallow ground water. The three drains intercept shallow ground water, especially during the winter. Consequently, legacy nitrate discharges to shallow ground water may be contributing to the current nitrate exceedances.

Physical Parameters (Color and Dissolved Solids)

Color is a derived parameter in that it is not delivered to surface waters from any single source, with the possible exception of color derived from suspended sediments. Color is a result of other constituents (e.g. organic carbon) or processes (e.g. photosynthesis, turbulent flow and resuspension of particulate matter). Consequently, management of color is not possible unless the process(es) that contribute to color are understood. Color exceedances at different water bodies may be a result of different factors. As the Coalition conducts the special studies to determine the cause(s) of exceedances of constituents such as DO and pH, information may become available that will allow us to address color exceedances.

TDS describes all solids (usually mineral salts) that are dissolved in water and are frequently associated with exceedances of EC. Potential sources of EC and TDS are minerals leached from soils by upstream surface water and ground water, or drain water from irrigated agriculture. There are two general sources of EC (or TDS) in agricultural landscapes; fertilizers and native soils. A commercial fertilizer can be made up of dozens of different chemicals, each of which ionize and contribute to the EC of the solution. Different fertilizer can use different chemicals to make up the total formula indicating that there will not be a universal signal for fertilizer-generated EC or TDS.

Elevated levels of EC and TDS were detected consistently across five sites, Hatch Drain, Hilmar Drain, Prairie Flower Drain, Westport Drain and Highline Canal. These five sites are located close to the San Joaquin River where depth to ground water is shallow and local field drains remove high salinity ground water to lower the water table and allow plant growth. In addition, with the exception of the Highline Canal, these drains are not concrete lined and can be recharged directly from shallow ground water. In fact, many of the unlined drains in the vicinity were dug to directly drain shallow ground water. Data developed by the Modesto Irrigation District suggests that the exceedances of TDS/EC are a function of ground water in the region and have been for almost a century. Geologically, the ground water from both the east and west side of the Valley moves toward the San Joaquin River trough, the low point in the Valley that is naturally high in salts. The movement of water down gradient toward the San Joaquin River creates a shallow ground water table, as evidenced by the numerous wetlands that are in the vicinity of the river. This shallow ground water appears to be the cause of the salinity problems in the ESJWQC region close to the river.

The CVRWQCB recognizes that EC/TDS is a region-wide problem and must be solved at that level. The Coalition will work with the CVRWQCB to address the problem over the next several years.

E. coli

E. coli is an indicator of fecal contamination in surface waters. There were 29 exceedances (27 environmental samples, 2 field duplicates) across 17 sites of the *E. coli* water quality trigger during the 2008 storm season in a total of 39 samples (36 environmental samples, 3 field duplicates) tested. Potential sources of *E. coli* include deposition or runoff from irrigated pasture, dairies, leaky sewer lines, leaky septic systems, application of manure, biosolids and liquid dairy waste, and a large array of wildlife. Results of a special study conducted in 2006 indicated that the source of the bacteria in the water samples was a combination of human and bovine fecal matter (as well as a small amount from poultry), depending on the location. The Coalition anticipates participating in a region-wide study to further investigate the fate and transport of *E. coli*. The study is still being developed in collaboration with Regional Board staff.

Field Parameters (pH, DO, EC)

There were 12 exceedances of the DO water quality objective across six of the Coalition monitoring sites. Exceedances of DO are common and have been present throughout the Coalition region since monitoring was implemented. Four exceedances of pH occurred during the storm season, all of which were measured above the upper water quality objective. One exceedance was experienced each at Bear Creek @ Kibby Rd, Deadman Creek @ Gurr Rd, Duck Slough @ Hwy 99 and Highline Canal @ Hwy 99.

DO and pH are expected to vary diurnally and can exceed the standards as a result of natural processes in the water column such as changing water temperature, photosynthesis and respiration. These processes can be exacerbated by the addition of nutrients which stimulate productivity and eventually release the organic matter into the water column and sediment where it is broken down by microbial activity (biological oxygen demand or BOD). The Coalition conducted a special study focusing on BOD which attempted to determine if BOD was the cause of the low DO. Results from this study showed that BOD and TOC were moderately positively correlated and TOC was used as a surrogate for BOD in a multiple regression analysis. Water temperature, BOD, and nitrate in the water column were all significant predictors of dissolved oxygen. As water temperature and BOD increased, dissolved oxygen decreased. As nitrate increased, dissolved oxygen increased although the explanation for this latter relationship is not clear. It is clear that both water temperature and BOD are significant factors causing the decrease in DO although other, as yet unknown factors are also important.

There were 19 exceedances of the specific conductance (EC) water quality trigger during the two storm monitoring events. These exceedances occurred consistently across four monitoring sites including Hatch Drain @ Tuolumne Rd, Hilmar Drain @ Central Ave, Prairie Flower Drain @ Crows Landing Rd and Westport Drain @ Vivian Rd. The persistence of elevated EC at these sample sites indicates that EC is a water quality impairment that is a result of the natural conditions in the region. Exceedances were also experienced one time each at Highline Canal @ Hwy 99, Highline Canal @ Lombardy Ave and Mustang Creek @ East Ave. Information regarding the source(s) of EC in the Coalition region, as it is related to TDS, was discussed previously in this section.

Summary of Management Practices

One of the primary goals of the Coalition is to gather information on best management practices (BMPs) that are demonstrated to benefit water quality and to provide information and support to growers to facilitate the implementation of these management practices. Over the last several years, the Coalition has collaborated with groups such as the Natural Resources Conservation Service (NRCS), University of California Agricultural Cooperative Extension (UC Extension), the Coalition for Urban and Rural Environmental Stewardship (CURES), pesticide registrants and pest control advisors (PCAs) to gather information on the most up-to-date management practices to reduce the potential for pesticide runoff. Information is provided to growers regularly throughout the year by means of Coalition outreach meetings, mailings, personal communication with growers, and the Coalition website. Each management practice is viewed as one tool in a collective tool box and the management practices (tools) that are most beneficial to a particular farming operation will depend on factors such as the size of the farm, the drainage system, soil type, crop type and the crop pests that must be controlled.

A working list of best management practices is provided in Table 33 below. BMPs are described based on the goal (e.g. water conservation, waste discharge reduction) and the mechanism of the practice. The ESJWQC Management Plan will include specific information on management practices that have been provided to the Coalition members and growers. Management practices are continually developing and changing and therefore the information will be updated in the ESJWQC Management Plan as new data becomes available.

Table 33. Table of best management practices (BMPs), target constituents, mechanism and possible improvements to water quality.

BMP	BMP Endpoint	BMP Target(s)	BMP Mechanism	Effected water/sediment quality monitoring parameter(s)
Sediment basin	Reduce discharge	PI, PS, K, S, NP	Removal of sediment, pesticides bound to sediments; allow time for biodegradation of pesticides	Color, turbidity, EC, TDS, metals, short half-life pesticides, high Koc pesticides, total phosphorous
Landguard[TM]	Reduce discharge	PI, PS (organophosphate specific)	Improve hydrolysis of organophosphate pesticides	Organophosphate pesticides
Vegetated buffers	Reduce discharge	PI, PS, K, S, NP, NN	Remove sediment, nutrients, pesticides bound to sediments, or any contaminants with low solubility	Color, turbidity, EC, TDS, metals, pesticides, nutrients
Cover crop, dormant season vegetation	Reduce discharge	K, S, NP	Remove sediment, pesticides bound to sediments, or any contaminants with low solubility; protect soils and soil nutrients for growing season	Color, turbidity, EC, TDS, metals, pesticides, nutrients
Sprayer calibration	Reduce discharge	D	Reduce potential for spray drift	All pesticides
Polyacrylamide (PAM)	Reduce discharge	PI, K, S, NP	Removes sediment from the water column, removing pesticides bound to sediments	Color, turbidity, metals, pyrethroid pesticides, total phosphorous
Dormant season field retainers	Reduce discharge	PS, S	Reduce/eliminate storm runoff	Color, turbidity, EC, TDS, copper, pyrethroid pesticides, organophosphate pesticides
Microspray and drip irrigation	Reduce water use & discharge	D,W	Increase water use efficiency, eliminate potential for spray drift	All pesticides, copper

BMP	BMP Endpoint	BMP Target(s)	BMP Mechanism	Effected water/sediment quality monitoring parameter(s)
Tail water return	Reduce water use & discharge	PI , PS, K, S, W, NP, NN	Re-use of irrigation water, eliminate discharge completely	Color, turbidity, EC, TDS, metals, all pesticides, all nutrients

BMP Targets Code:

D: Chemical (pesticide) drift

PS: Dormant spray pesticide storm runoff

S: Sediment runoff

NP: Nutrients: phosphorous

PI: Pesticide runoff from irrigation

K: High K_{oc} pesticide runoff

W: Water use efficiency

NN: Nutrients: nitrate, nitrite or Kjeldhal nitrogen

Management Practices Implementation

When exceedances of water quality standards occur at a sample site more than once, the Coalition is required to develop a Management Plan to address those exceedances. The ESJWQC Management Plan contains goals and actions that are designed to address problems specific to a subwatershed upstream of a sampling site and the crops grown there. Performing grower outreach and implementation of BMPs are important components of the plan. The Management Plan provides a prioritization scheme and sequence by which management actions occur. Based on this plan, growers are encouraged to adopt management practices in their operations through general outreach at county and/or subwatershed meetings and in higher priority subwatersheds on an individual grower and/or grower group basis. In some cases, Coalition representatives visit individual farms to investigate potential sources of exceedances and to personally speak with growers or applicators about potential practices. After outreach or contact occurs, all the growers met with to date have expressed willingness to cooperate with the Coalition and change practices to avoid contributing to problems in the future.

The Coalition is in the process of documenting implementation of management practices in the Coalition region. This is being done by asking growers to complete a management practices survey if they operate in watersheds under Management Plans. Conversations with growers indicate that they are changing practices but often do not report the changes to the Coalition. Changing chemicals, application methods (e.g. timing of application, calibrating nozzles), or implementing structural BMPs are occurring in the Coalition region but are difficult to track. Once data from the management practice surveys are compiled, the Coalition will report those results to the Regional Water Board. .

Actions Taken to Address Water Quality Impacts

Monitoring of ambient surface waters is conducted by the Coalition for the purpose of characterizing discharges from agriculture in the Coalition area. Over the long term, monitoring data provide insight on the general trends in water quality at each of the sample sites. Results from each event within a monitoring season can help to identify constituents detected at sample sites, and which agricultural lands, crops and/or particular pesticides need to be addressed to reduce or eliminate input from agriculture. A series of actions taken to determine the potential sources of exceedances experienced during each monitoring event include 1) the use of PURs to identify relevant applications that occurred upstream of the sample site and within a specified time period prior to the sampling event, 2) an analysis of monitoring data to determine the potential mechanism associated with exceedances of physical and field parameters such as DO, pH, and TDS, and 3) special studies where appropriate and cost effective to determine the sources of constituents such as *E. coli* or the potential causes of exceedances such as low DO.

As follow-up to exceedances, each Coalition members receive results of the monitoring by mailing the Coalition annual report of the previous season. Results are also disseminated at grower outreach meetings and, in some cases, by personal communication when evidence such as PUR indicates the likely contributor to a detection or exceedance. The Coalition also provides growers with information on best management practices to reduce runoff of irrigation water and sediments into receiving water bodies. Additional relevant management practices are presented at meetings, such as alternative pesticides, structural changes to manage drain water or pesticide application practices for minimizing spray drift.

Reporting was also conducted to inform the CVRWQCB and stakeholders of Coalition monitoring results and progress. The monitoring and reporting activities are summarized in Table 34 in the next section. Further detail describing all of the actions explained above is provided in this section.

Outreach and Education

Based on the results of the monitoring, the Coalition held workshops, meetings and presentations to provide useful information to all growers in the Coalition region. Outreach and education activities are an important component of the Coalition monitoring program. The Coalition continues to make a strong effort to provide information to growers at regular meetings, as well as at meetings conducted by the County Agricultural Commissioner, and by personal contact. Coalition presentations over the 2008 storm season provided members with general information, site subwatershed specific monitoring results, and management practices that have proven to be effective to reduce the discharge of pesticides to water bodies.

In December of 2007 meetings were held in the Coalition regions to present monitoring results from the 2007 storm and irrigation season, and discuss management practices to reduce the potential for runoff of pesticides and sediment. Outreach occurred again to follow up on storm runoff exceedances during the months of February 2008 and June 2008 in advance of the major pesticide application season in July. Due to a large amount of chlorpyrifos detected in the Merced River and associated toxicity, the ESJWQC issued a press release notifying the public of the situation and the corrective actions that the Coalition was pursuing (Figure 13). A meeting with growers regarding the exceedances and toxicity experienced in the Merced River occurred on February 29, 2008. Attendees included Coalition members within that site subwatershed, Coalition representatives, Ag Commissioners and Regional Board staff including a representative from the ILRP Compliance Unit. A discussion of Coalition member responsibilities and program enforcement was presented and 13267 letters were distributed for reference to growers that attended. In November and December of 2007, the staff from the Stanislaus County Ag Commissioner's office walked the shore line of four creeks that the Coalition currently monitors: Dry Creek (Stanislaus County), Hatch Drain, Westport Drain and Prairie Flower Drain. While walking the creeks the Ag Commissioner's staff photo documented and marked the locations using GPS where there was the possibility for direct discharge into the stream. This information was matched with member parcel information and letters were sent inviting land owners to a meeting to discuss the impacts of direct discharge (example in Figure 14). On June 18, the Coalition held a meeting at the Stanislaus Farm Bureau to discuss the four creeks and relevant exceedances of WQTLs that had occurred during Coalition monitoring. Requirements to stay in compliance of the ILRP were also discussed with growers.

With each meeting conducted, growers become familiar with the Coalition representatives. The meetings are often followed by individual discussions of monitoring results and management practices that may help prevent problems. Follow-up discussions such as these have led to management practice implementation by growers, especially in site subwatersheds where exceedances have occurred more than once for a particular pesticide.

The Coalition also hosts a Coalition website: http://www.esjcoalition.org/home.asp. This website has served as a clearing house for Coalition activities and outreach on management practices. Information provided on the website has functioned as a useful supplement to regular grower contacts and meetings.

Pest Control Advisors, Agricultural Commissioners, and Registrants

For the Coalition to be most effective in providing recommendations on management practices that will reduce or eliminate discharge, collaboration with County Agricultural Commissioners, PCAs and pesticide registrants is important. During the 2008 storm season the Coalition worked with each of these entities as needed to follow-up on exceedances. Ag Commissioners from the various counties are active participants as non-voting members of the ESJWQC Board of Directors. The Stanislaus Ag Commissioner has been active in the last year with the initiation of creek walks within the Stanislaus County with Merced and Madera County Ag Commissioners planning to perform similar reconnaissance of waterways sampled by the Coalition in their counties later in 2008.

Figure 13. News clipping submitted by ESJWQC on January 31, 2008 for the Merced River storm water quality exceedances.

East San Joaquin Water Quality Coalition

Water Sampling Finds Toxicity in Merced River Following Rainstorm

January 31, 2008 -- Water sampling of the Merced River at Santa Fe Ave. on January 24 showed toxicity to the test organism *Ceriodaphnia dubia*. Further analysis of the sample showed the toxicity was caused by a non polar organic chemical which often indicates a pesticide. The "water flea," as *C. dubia* is known, is a laboratory test organism that is sensitive to very low pesticide levels in water.

The water sample was taken the day following a storm where ¾ inch of rain fell upstream of the sampling site. The Coalition is required to sample two "storm events" each winter following the start of orchard dormant sprays. Farm land upstream of the sample site consists of vineyards, almond, peach and walnut orchards as well as alfalfa and other field crops. Almonds and peaches are often sprayed in January with a dormant spray that can include an organophosphate insecticide. In part due to the Coalition's encouragement in recent years and pest pressure, orchard growers in the region have been using fewer dormant insecticide sprays, instead applying only copper, zinc or spray oil in the winter treatments.

Under the Irrigated Lands Regulatory Program (ILRP), the East San Joaquin Water Quality Coalition, which performed the sampling, must report the toxicity to the Central Valley Regional Water Quality Control Board. A report was sent to the Regional Water Board on Wednesday, January 30, 2008.

Coalition members who farm orchards upstream of the sampling site will be formally notified of the toxicity event later this winter after the pesticide has been positively identified. Water quality laboratories typically release results of pesticide analysis tests 4-5 weeks after a water sample is taken. Results from toxicity tests are provided to the Coalition 96 hours after a sample is delivered.

When coalition members are contacted this spring, they will also be provided information on management practices that can be used to prevent pesticide runoff when dormant sprays are applied next year. Several management practices, including making dormant spray applications in December before the rainy season begins, will be encouraged for use in the watershed.

Should the toxicity be positively identified as a pesticide, the exceedance will trigger a Management Plan requirement for the Merced River under the ILRP. Management Plans typically require additional water monitoring of the waterway, increasing costs for coalition members. The plans also raise enforcement scrutiny by the Regional Water Board. The Water Board says it will be contacting non-coalition members in the area through 13267 enforcement orders, which hold the potential for fines if not completed. A Merced County grower was fined $3000 by the Water Board in December for ignoring a 13267 order.

The Coalition also plans to hold grower workshops in the watershed later this Spring to discuss farm management practice options with landowners.

Coalition Background

The ESJWQC is a non-profit organization formed in 2003 to represent landowners under the Irrigated Lands Regulatory Program mandated by the Central Valley Regional Water Quality Control Board. The Coalition's Board of Directors is committed to: implementing an economical and scientifically valid water monitoring program for area waterways (as required by the ILRP); communicating to landowners where water monitoring indicates problems and work to solve those problems; and to maintain ILRP coverage for coalition members. As of February 2007, more than 2600 farmers with more than 640,000 irrigated acres in Stanislaus, Merced, Madera, Mariposa and Tuolumne Counties (east of the San Joaquin River) are ESJWQC members. With an estimated 1.1 million acres of irrigated cropland in the Coalition region, more than 40% of irrigated acreage is not enrolled in the Coalition and may be out of compliance with the California Water Code.

Coalition website: www.esjcoalition.org

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For additional information contact:

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Figure 14. Example letter sent to growers with direct drainage into select creeks.

East San Joaquin Water Quality Coalition
1201 L Street
Modesto, CA 95354
www.esjcoalition.org

May 9, 2008

re: Property draining upstream of the following locations:

- Dry Creek @ Wellsford Road
- Hatch Drain @ Tuolumne Road
- Westport Drain @ Vivian Road
- Prairie Flower Drain @ South Morgan Rd

Name
Address
City

Dear Mr. Jones;
Over the past four years, the ESJWQC has performed water quality monitoring in the waterways listed above. Results from numerous sampling events indicate these waterways do not meet standards set by the Central Valley Regional Water Quality Control Board for several parameters (pesticides, E. coli, metals).

Despite numerous mailings to landowners along these waterways, we continue to find exceedances of water quality standards. Since the ESJWQC and its members are committed to solving water quality problems, the coalition contracted with the County Agricultural Commissioner's office to "walk the creeks" and identify and record locations where pipes, conduits or drainage enters these waterways. ***You have been identified as a property owner where such a potential discharge point is located -- see enclosed map for discharge site locations.***

Landowners within the Central Valley who have irrigation water and/or stormwater leaving their irrigated lands **must** obtain regulatory coverage. These discharges of irrigation or storm water may potentially contribute "waste" (as defined in the California Water Code) to surface waters (rivers, creeks, sloughs, lakes). Pesticide residues, nutrients and sediment are examples of waste that are typically discharged. The Water Board allows landowners and/or operators of irrigated lands to obtain regulatory coverage required by the California Water Code by:

- Joining a Water Board-approved Coalition Group that forms on behalf of individual growers; or
- Obtaining individual coverage under the Individual Discharger Conditional Waiver.

Some of you receiving this letter are already members of ESJWQC, while others are not. In order to more fully explain your responsibilities as a discharger, the Coalition has scheduled a workshop at the location below. Please plan to attend (or send someone representing you).

Wednesday, June 18, 2008, 10 am – 12 pm
Stanislaus County Farm Bureau office
1201 L Street, Modesto, CA

If you have questions, please contact us at the numbers below.
Regards,

Parry Klassen
Executive Director
559-646-2224

Wayne Zipser
Co-Chairman
209-522-7278

Activities, Events and Deliverables

Table 34 and 35 provide Coalition activities, events and deliverables that have occurred during the 2008 storm monitoring season. Entries include the date in each month in which the activity was performed. Exceedance and Communication Reports are listed as are the general class of constituent(s) (i.e. field parameters, pesticides, *E. coli*/metals/physical parameters, water column toxicity, and sediment toxicity) covered by the reports.

Table 34. Calendar of events and deliverables for the ESJWQC relevant to the 2008 storm season.

Storm monitoring events are numbered in chronological order starting with Storm1 which occurred on January 24 and 25, 2008.

Date	Action Item
1/24/2008	Storm1 Normal Monitoring Event
1/25/2008	Storm1 Normal Monitoring Event
1/25/2008	Field Exceedance Report - Storm1 Normal Monitoring
1/26/2008	Field Exceedance Report - Storm1 Normal Monitoring
1/30/2008	Storm1 Resampling Event
1/30/2008	Toxicity Exceedance Report - Storm1 Normal Monitoring
1/30/2008	Field Exceedance Report - Storm1 Resampling
2/5/2008	Toxicity Exceedance Report - Storm1 Resampling
2/25/2008	Storm2 Normal Monitoring Event
2/26/2008	Storm2 Normal Monitoring Event
2/26/2008	Field Exceedance Report - Storm2 Normal Monitoring
2/27/2008	Field Exceedance Report - Storm2 Normal Monitoring
3/4/2008	Storm2 Resampling Event
3/4/2008	Storm Sediment Event
3/4/2008	Toxicity Exceedance Report - Storm2 Normal Monitoring
3/5/2008	Field Exceedance Report - Storm2 Resampling and Sediment Sampling
3/7/2008	Pesticides Exceedance Report - Storm1 Normal Monitoring
3/10/2008	E. coli/Metals/Physical Parameters Exceedance Report - Storm1 Normal Monitoring
3/13/2008	Toxicity Exceedance Report - Storm2 Resampling
3/27/2008	Toxicity Exceedance Report - Storm Sediment
3/28/2008	Storm Sediment Resampling Event
3/31/2008	Field Exceedance Report - Storm Sediment Resampling
4/3/2008	Toxicity Communication Report - Storm1 Normal Monitoring
4/10/2008	Pesticides Exceedance Report - Storm2 Normal Monitoring
4/14/2008	E. coli/Metals/Physical Parameters Exceedance Report - Storm2 Normal Monitoring
4/17/2008	Toxicity Exceedance Report - Storm Sediment Resampling

Date	Action Item
4/30/2008	Field Communication Report - Storm2 Normal Monitoring
5/7/2008	Toxicity Communication Report - Storm2 Normal Monitoring and Resampling
5/9/2008	Pesticides Communication Report - Storm1 Normal Monitoring
5/13/2008	E. coli/Metals/Physical Parameters Communication Report - Storm1 Normal Monitoring
6/2/2008	Sediment Toxcity Communication Report - Storm Normal Monitoring
6/13/2008	Pesticides Communication Report - Storm2 Normal Monitoring
6/16/2008	E. coli/Metals/Physical Parameters Communication Report - Storm2 Normal Monitoring

Table 35. Table of ESJWQC actions and deliverables dealing with grower notification of exceedances and management practices relevant to the 2008 storm monitoring season.

County	Site(s)	Date	Category	Description	Who
Merced	Merced River @ Santa Fe	4-Feb-08	Media	Notification of toxicity in Merced River published in Merced Sun Star newspaper[1].	Parry Klassen
Madera	Merced River @ Santa Fe	4-Feb-08	Media	Notification of toxicity in Merced River published in Madera Tribune newspaper[1].	Parry Klassen
Fresno	Merced River @ Santa Fe	4-Feb-08	Media	Notification of toxicity in Merced River published in Fresno Bee newspaper[1].	Parry Klassen
Merced	Merced River @ Santa Fe	29-Feb-08	BMP Outreach and Education	Meeting with growers regarding toxicity experienced in Merced River - discussion on Coalition member responsibilities and program enforcement, 13267 letters distributed.	Parry Klassen, MLJ-LLC, CVRWQCB
Stanislaus	Dry Creek (Stanislaus), Hatch Drain, Westport Drain, Prairie Flower Drain	09-May-08	Grower Notification	Notification to all direct dischargers in the upstream subwatershed to discuss compliance with ILRP and invite growers to upcoming meeting[2].	Parry Klassen
Stanislaus	Dry Creek (Stanislaus), Hatch Drain, Westport Drain, Prairie Flower Drain	18-Jun-08	BMP Outreach and Education	Grower meeting at Farm Bureau inviting all direct dischargers in the upstream subwatershed to discuss compliance with ILRP.	Parry Klassen, Mike Johnson

[1] A copy of the article is provided in Figure 13.
[2] A copy of the notification letter to growers is provided in Figure 14.

Exceedance, Communication, and Evaluation Reports

Exceedance and Communication Reports

Exceedance reports were submitted for all exceedances experienced during the 2008 storm season monitoring events except for cadmium exceedances experienced in samples collected on January 24 and 25 for six locations plus one field duplicate (see Data Interpretation section for details). Communication Reports have also been submitted for all exceedances that occurred for the first time at a site except for a Communication Report that was due on May 8, 2008 as a result of field exceedances that occurred during sediment sampling on March 4, 2008 and reported in an Exceedance Report on March 5, 2008. A copy of these reports is provided in Appendix V.

Evaluation Reports

Evaluation Reports were not required for exceedances experienced during the 2008 storm season events. Management Plans have superceded Evaluation Reports and been submitted for each site subwatershed where two or more exceedances of a specific constituent were experienced during Coalition monitoring. Table 36 summarizes the schedule of Management Plans submitted for each site-subwatershed. Management Plans will be reviewed and edited on a yearly basis to incorporate results from the previous years sampling and special studies. An updated Management Plan that will address the entire Coalition region is scheduled to be submitted by September 2008.

Table 36. Schedule of Management Plans that have been submitted for each site subwatershed.

Sample Site	Management Plan Due Date
Highline Canal @ Hwy 99 Highline Canal @ Lombardy Ave	11/17/2006 Revised 4/2/2007
Dry Creek @ Wellsford Road	4/2/2007
Duck Slough @ Gurr Rd Duck Slough @ Hwy 99	11/17/2006 Revised 4/2/2007
Ash Slough @ Ave 21	11/17/2006 Revised 4/13/2007
Berenda Slough along Rd 18 1/2	4/13/2007
Jones Drain @ Oakdale Rd	4/13/2007
Silva Drain @ Meadow Drive	4/13/2007
Cottonwood Creek @ Road 20	4/27/2007
Bear Creek @ Kibby Rd	4/27/2007
Merced River @ Santa Fe	11/17/2006 Revised 4/27/2007
Dry Creek @ Rd 18	4/27/2007
Aug Rd Drn upstrm Crows Landing	5/11/2007
Black Rascal Crk @ Yosemite Rd	5/11/2007
Deadman Creek @ Gurr Rd	5/11/2007
Deadman Creek @ Hwy 59	
Mustang Creek @ East Ave	5/11/2007
South Slough @ Quinley Road	5/11/2007
Hilmar Drain @ Central Ave	5/11/2007
Prairie Flower Drain @ Crows Landing	5/11/2007

Conclusions and Recommendations

Conclusions

Over the 2008 storm season, the Coalition was able to meet its monitoring program objectives:

- Determine the concentration and load of waste in discharges to surface waters.
  - The completeness of the analytical data was sufficient to determine concentration and load for all samples collected.
  - Quality control issues were present for a small number of samples, but the batches were evaluated using all LABQA results and were determined to be acceptable.
- Evaluate compliance with existing narrative and numeric water quality triggers to determine if implementation of additional management practices is necessary to improve and/or protect water quality.
  - The data for all constituents for which criteria exist were compared to the appropriate water quality trigger.
  - If samples existed in which the constituent exceeded the objective, it was determined that outreach would be performed and growers were encouraged to implement additional management practices.
  - A series of meetings with growers was held in which additional management practices were presented and growers were encouraged to implement the practices to protect water quality.
- Assess the impact of storm water discharges from irrigated agriculture to surface water.
  - Comparisons of monitoring data with water quality triggers allowed an evaluation of whether the water body was impacted by irrigated agriculture.
  - The level of impairment is difficult to determine solely from the data collected as ecosystem function is assumed to be impaired, but the mechanism of impairment is difficult to assess.
- Determine the degree of implementation of management practices to reduce discharge of specific wastes that impact water quality in receiving waters of the Coalition region.
  - The Coalition compiled responses from its BMP survey and is incorporating the results into the Management Plan to be submitted later in the summer.
- Determine the effectiveness of management practices and strategies to reduce discharges of wastes that impact water quality.
  - While the Coalition still does not have adequate data to evaluate the effectiveness of management practices implemented in the Coalition region, positive steps are being taken to obtain the necessary data. These steps include:

        - Obtain Coalition region-specific information on management practice effectiveness.
        - Create Coalition region-specific management practice handbooks for Coalition members.
        - Obtain information from growers in regards to implemented management practices and when they were implemented.
        - Create a database to track implemented management practices.
        - Link implemented management practices to changes in water quality as outlined in the Management Plan.
    - The Coalition initiated development of a member/parcel/crop relational database whose goal is to enable tracking of members by parcel, TRS, and crop on a real-time basis.
        - Classifying growers by location or crop will facilitate more immediate notification of exceedances and tracking of potential sources.
        - Knowledge of current crops grown by members allows the Coalition to provide growers with crop specific management practices.

To meet the Coalition's monitoring and reporting objectives, it is necessary for the monitoring data collected during the storm 2008 season to meet completeness objectives as outlined in the MRP.

- Two planned sample events were captured.
- Chemical testing met the Regional Board's Reporting Limit requirements.
- Discharge measurements were collected from all sites at which it was possible to collect measurements.

The monitoring program provided the following technical conclusions:

- The most common exceedances were dissolved oxygen, *E. coli*, TDS/EC, cadmium, chlorpyrifos, diazinon, diuron, and toxicity.
    - Exceedances of diazinon will trigger a management plan for the Dry Creek @ Road 18 watershed.
    - Exceedances of chlorpyrifos will trigger a management plans for the Cottonwood Creek @ Road 20 and the Mustang Creek @ East Ave watersheds.
    - Other exceedances triggering management plans are diuron at Cottonwood Creek @ Road 20, Deadman Creek @ Highway 59, Dry Creek @ Road 18, Highline Canal @ Hwy 99, simazine at Deadman Creek @ Highway 59 and Mustang Creek @ East Ave, *Selenastrum* toxicity at Deadman Creek @ Highway 59, Deadman Creek @ Gurr Road, Dry Creek @ Road 18, Hatch Drain @ Tuolumne Road, Highline Canal @ Hwy 99, and Prairie Flower Drain @ Crows Landing Road, and *Ceriodaphnia* toxicity at Mustang Creek @ East Ave and Miles Creek @ Reilly Road, *Pimephales* toxicity at Highline Canal @ Lombardy Road, and *Hyalella* toxicity at Hilmar Drain @ Central Ave.

- The cause of the *Pimephales* toxicity at Highline Canal @ Lombardy Road is unknown but has tentatively been attributed to animal waste. The Coalition will attempt to determine the cause and source of the exceedance before building a management plan for the toxicity.

- The increase in cadmium exceedances is due to a reduction of the concentration of the WQTL.
  - Cadmium is a common detection in the region but the source of the cadmium is unknown.
  - Peat soils (http://www.speclab.com/elements/cadmium.htm), industrial emissions (i.e. burning of fossil fuels) and agriculture (i.e. phosphate base fertilizers) potentially contribute cadmium to aquatic systems.
    - Sources are distinguishable using stable isotopes but the cost of the analyses is substantial and the Coalition does not anticipate using this technique to identify the source(s).
- There have been an increased number of herbicide exceedances relative to previous years, particularly simazine and diuron.
  - A partial explanation is the large, non forecasted storm in January.
  - Herbicides have continued to be found at concentrations above the WQTL into the 2008 irrigation season suggesting that storm runoff is not the sole explanation for winter exceedances.
  - An increased number of *Selenastrum* toxicities support the conclusion that herbicides are impacting water quality.
- Sites with a majority of the exceedances to date continued during the storm 2008 season to experience exceedances for the same constituents.
- In most of the site subwatersheds, sufficient data have been collected over the last several years to allow a more detailed analysis of pesticide use.
  - Multiple exceedances of pesticides at the same location over several years can be analyzed for commonalities in use patterns with exceedances.
  - Preliminary analysis for selected watersheds indicates that concentrations of chemicals in samples are correlated with the total pounds of active ingredient applied in the watershed.
    - These results suggest that the exceedances are the result of cumulative applications and not runoff from a subset of parcels.
  - Complete analyses will be presented in the Management Plan.

The winter of 2008 was very dry compared to 2007 which was in turn, drier than 2006. The circumstances surrounding the first storm in 2008 were unusual. The storm occurred over a three-day holiday weekend and was not predicted until just prior to the beginning of rainfall. The fast moving storm system virtually materialized over Northern and Central California within a 48 hour period bringing substantial amounts of rainfall to the ESJWQC region. Many growers were finishing dormant sprays or applications of herbicides for weed control and were caught unaware by the storm. As a result, many applications were made immediately prior to the unpredicted storm event leading to conditions that maximized runoff.

Recommendations

The Coalition evaluates monitoring results and identifies opportunities for outreach. Outreach during the storm 2008 season included two grower meetings, three media releases and member notification of exceedances. Meetings have been held at regional, group and individual levels to inform growers of current water quality problems and management practices that can be used to reduce/eliminate water quality impairments due to agriculture. Although these meetings would not have affected runoff during the winter storm season, contacts with individual growers appear to be a promising avenue for reducing runoff. The Coalition makes the following recommendations for its Monitoring and Reporting Program.

- Examine PUR reports from previous years to identify parcels that have been associated with repeated exceedances of pesticides.
- Associate exceedances of pesticides with crops known to use the products to further refine the search for sources.
- If applicable, follow the Management Plan monitoring plan by adding upstream sites to identify potential sources.
- Focus outreach on small groups of growers identified as potential sources.

The Coalition is in the process of developing a Management Plan that will identify agriculture sources, implemented management practices, and performance goals in response to water quality impairments. The Management Plan will be updated on a yearly basis to include monitoring results from the previous year and evaluate improvements in water quality due to outreach efforts and implemented management practices. The updates will also evaluate any new water quality impairments. The results from this SAMR will be included in the April 2008 Management Plan update and will review the recommendations provided above.

There are five main Coalition monitoring program plan objectives which are listed above in the conclusions. The Coalition Management Plan will supplement this monitoring report to meet the last three objectives:

- Assess the impact of waste discharges from irrigated agriculture to surface water.
  - For each site subwatershed within the Management Plan, all water quality data over all years of monitoring is reviewed to assess trends in and magnitude of exceedances.
- Determine the degree of implementation of management practices to reduce discharge of specific wastes that impact water quality in watersheds within the coalition region.
  - BMP surveys were conducted in 2007 and will be evaluated on a site subwatershed basis in the Management Plans.

    - The Coalition is developing a document to record management practices used by growers which will be filled out by a Coalition representative when contacting growers.
    - Information of management practices implemented by growers will be housed within the Coalition member database.
- Determine the effectiveness of management practices and strategies to reduce discharges of wastes that impact water quality.
    - The Coalition will first focus on high priority subwatersheds as described in the Management Plan to determine what management practices have been implemented.
    - The Coalition intends to link management practice information with water quality data obtained from monitoring as described in the MRP and Management Plan monitoring. The Management Plan will outline measures by which to evaluate improvements in water quality based on known management practices implemented within the area.

The Coalition is creating a strategy to document and evaluate current management practices within the Coalition area and will first focus on priority subwatersheds as outlined in the Management Plan. These include Dry Creek @ Wellsford Rd, Highline Canal @ Highway 99, Prairie Flower Drain @ Crows Landing Road, and Duck Slough @ Gurr Road. It is the goal of the Coalition to link past water quality exceedances within these subwatersheds with crop types and inform growers of management practices that can be implemented specific to the crops in question. Although the Coalition conducted BMP surveys in 2007, the Coalition plans to supplement that information with more detailed information obtained from individual grower contacts starting with priority subwatersheds.

In response to repeated exceedances in watersheds in the Coalition region, The Coalition entered into a contract with the Stanislaus County Agricultural Commissioner to conduct a series of "creek walks." These walks involved walking upstream from the Coalition sample point, locating all pipes or conveyances that could deliver discharge, recording the location with a GPS instrument, and photographing the pipes for documentation. Pipes were located that could convey discharge from irrigated agriculture as well as nonagricultural discharges including pipes from local residential dwellings. Plotted in GIS, the discharge points were matched to individual parcels and the owners were identified and contacted. A meeting was held on June 18 in Modesto to discuss the exceedances in the watersheds and provide additional information on management practices. Regional Board staff personnel were present to discuss enforcement activities. Several growers had already plugged their pipes from the field end, and other growers, e.g., Gallo Farms, were in the process of removing pipes. County Ag Commissioners from Madera and Merced counties are in the process of developing contracts to perform similar creek walks. It is anticipated that creek walks in these counties will commence in the fall of 2008. These activities should result in improvements in water quality in both the irrigation season as well as the storm season.