Priority D Constituents

Selenastrum toxicity

Selenastrum toxicity and diuron management are closely tied, as the two of the four *Selenastrum* toxicity events are associated with diuron exceedances. A third *Selenastrum* exceedance occurred on February 21, 2007, a sample date between the two exceedances discussed above and therefore also associated with the diuron applications in January and February 2007. There was one additional diuron application on March 4, 2007, three days prior to the sample date for the fourth *Selenastrum* exceedance. Several other soluble herbicides were also applied during this period including copper hydroxide, glyphosate, oryzalin, oxyfluorfen, MCPA dimethylamine salt, diglycolamine salt, norflurazon, hexazinone, and simazine.

Due to the correlated toxicity and application of low K_{oc} herbicides such as diuron in the Unnamed Drain to Lone Tree Creek, the Coalition's strategy for eliminating *Selenastrum* toxicity will involve focusing on diuron and other low K_{oc} herbicides. If these constituents can be prevented from entering storm water during the winter rainy season, the Coalition believes that *Selenastrum* toxicity may also be reduced or eliminated.

Priority E Constituents

The following priority E constituents are listed under the Unnamed Drain to Lone Tree Creek Management Plan: dissolved oxygen, *E. coli* , specific conductance, color and dissolved solids.

DO

The amount of dissolved oxygen in surface waters is a function of the processes of algal (and additional aquatic vegetation) photosynthesis and respiration, water temperature, turbulent flow, and biological oxygen demand (BOD), the respiration that accompanies degradation of organic carbon. In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for BOD during the September 2006, February, April and July 2007 monitoring events. Two of the five samples collected at the Unnamed Drain to Lone Tree Creek @ Jack Tone Rd contained measurable amounts of BOD (Table III-14). The conclusion of the BOD study was that BOD was important in establishing DO levels, although many sites had no BOD. Because BOD was present at a somewhat elevated level for the one sample with DO below the WQTL of 7.0 mg/L, it is possible that BOD contributed to the low DO in the sample. BOD measurements were made only for one exceedance, and it is not possible to determine if BOD was a contributor to the other exceedances. An elevated positive correlation between BOD and TOC suggested that TOC could be used as a surrogate for BOD and consequently, the Coalition used TOC in an analysis to determine the potential effect of organic carbon/BOD on DO for the samples in the site subwatershed. DO was regressed on water temperature and discharge and the residual variation, the variation in DO unexplained by water temperature or discharge, was regressed on TOC to account for the effects of organic carbon/BOD. The regression of temperature and discharge was significant ($F = 4.306$, $p = 0.039$, $df = 2, 12$) although the regression coefficients

had the wrong sign compared to expectations (DO = 4.708 - .0655*discharge + 0.2287*temperature). The regression coefficient for discharge was negative indicating that the greater the flow, the lower the DO, and the regression coefficient for temperature was positive indicating that the lower temperature, the lower the measured DO. The signs of the regression coefficients suggest that other factors are driving DO and that discharge and temperature are playing a minor role. The residuals and TOC were used in a regression analysis to determine if the residual variation could be explained by organic carbon. The regression was not significant ($F = 1.77$, $p = 0.21$, $df = 1, 13$) indicating that TOC was not a significant predictor of the residual variation, meaning DO dynamics were not controlled by organic carbon. These results indicate that BOD and TOC are not well correlated in this watershed, or photosynthetic rate is the primary factor influencing DO. At some time in the future, the Coalition may be able to undertake a larger study to more fully understand the dissolved oxygen dynamics in the watershed. At this point, it is unclear what can be managed to eliminate low DO and the Coalition will not attempt to provide outreach to growers in an attempt to manage DO.

Table III-14. Unnamed Drain to Lone Tree Creek @ Jack Tone Rd. BOD, pH and dissolved oxygen results for September 2006-February 2007 sampling events.

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	9/19/2006	7.26	NA	ND
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	2/11/2007	7.44	7.26	19
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	2/28/2007	7.63	9.52	17
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	4/10/2007	7.45	9.57	ND
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	7/10/2007	7.22	7.83	ND

NA – Not applicable, measurement not taken.
ND – No detection.

E. coli

The Coalition performed a pilot study to understand the sources of *E. coli* in the site subwatershed. Samples were not collected from the Unnamed Drain to Lone Tree Creek, but were collected from the adjacent Lone Tree Creek and Littlejohns Creek and the downstream French Camp Slough sample sites. Molecular markers were used to distinguish human, bovine, and avian sources. Upstream sampling was conducted and the results indicated that there was no relationship between the amount of coliform bacteria in the system and the presence of human or bovine bacteria. Human, bovine, and avian molecular markers were found in the watershed indicating active inputs from all three species (Table III-15). Because this study was performed at a single time of the year with a limited set of potential hosts, a further study may be initiated to more fully understand bacterial contamination in the watershed. Until such time as the study is completed, the Coalition will not actively manage for *E. coli*. Once a better understanding of the *E. coli* dynamics is obtained, the Coalition will re-evaluate management options.

Table III-15. Results of *Bacteroides* analysis. The baseline sites, Lone Tree Creek @ Jack Tone Rd and Littlejohn Creek, were sampled three times daily for three consecutive days. All other sites were sampled only once. A + indicates the DNA was detected but at too low of a concentration to estimate a percentage.

Station Name	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
Lone Tree Creek @ Jack Tone Rd	8/16/2006	11:40	Grab	100	0.097656	+
Lone Tree Creek @ Jack Tone Rd	8/16/2006	16:40	Grab	50	0	+
Lone Tree Creek @ Jack Tone Rd	8/16/2006	21:50	Grab	50	0.048828	+
Lone Tree Creek @ Jack Tone Rd	8/17/2006	10:50	Grab	50	0	25
Lone Tree Creek @ Jack Tone Rd	8/17/2006	14:50	Grab	25	0	25
Lone Tree Creek @ Jack Tone Rd	8/17/2006	19:30	Grab	25	0	50
Lone Tree Creek @ Jack Tone Rd	8/18/2006	9:30	Grab	+	0	+
Lone Tree Creek @ Jack Tone Rd	8/18/2006	14:30	Grab	100	0.097656	+
Lone Tree Creek @ Jack Tone Rd	8/18/2006	19:30	Grab	50	0	25
Lone Tree Creek @ Brennan Rd	8/31/2006	12:30	Grab	100	0.390625	+
Lone Tree Creek @ Steingol Rd	8/31/2006	12:50	Grab	100	0.097656	+
Lone Tree Creek @ Henry Rd	8/31/2006	13:30	Grab	12.5	0.097656	0

The other priority E constituents listed for the Unnamed Drain to Lone Tree Creek include specific conductance, color and dissolved solids. It is likely that the EC/TDS exceedances are associated with dairy discharges and color is not possible to manage. The Coalition will not attempt to manage these constituents in the site subwatershed.

Upstream Monitoring

As outlined in the introduction, upstream sampling may be implemented to facilitate source identification for discharges of chlorpyrifos. Currently the Coalition conducts Management Plan monitoring only during the irrigation season. As a result there will be no upstream monitoring for diuron or *Selenastrum* toxicity, both of which have been detected in samples only during the storm season. The Upstream Management Plan sampling schedule for 2008 is provided in Table III-16 and a map of the Upstream Management Plan site is provided in Figure III-9. Table III-17 shows the locations of all sampling locations within the Unnamed Drain to Lone Tree Creek site subwatershed. These locations were based on a review of PUR data indicating likely upstream sources. The upstream monitoring site was selected to divide the watershed into smaller areas which will allow an analysis of the contribution of each portion of the watershed to the load measured at the Jack Tone Road site. The Coalition is not currently conducting management plan monitoring during the storm seasons.

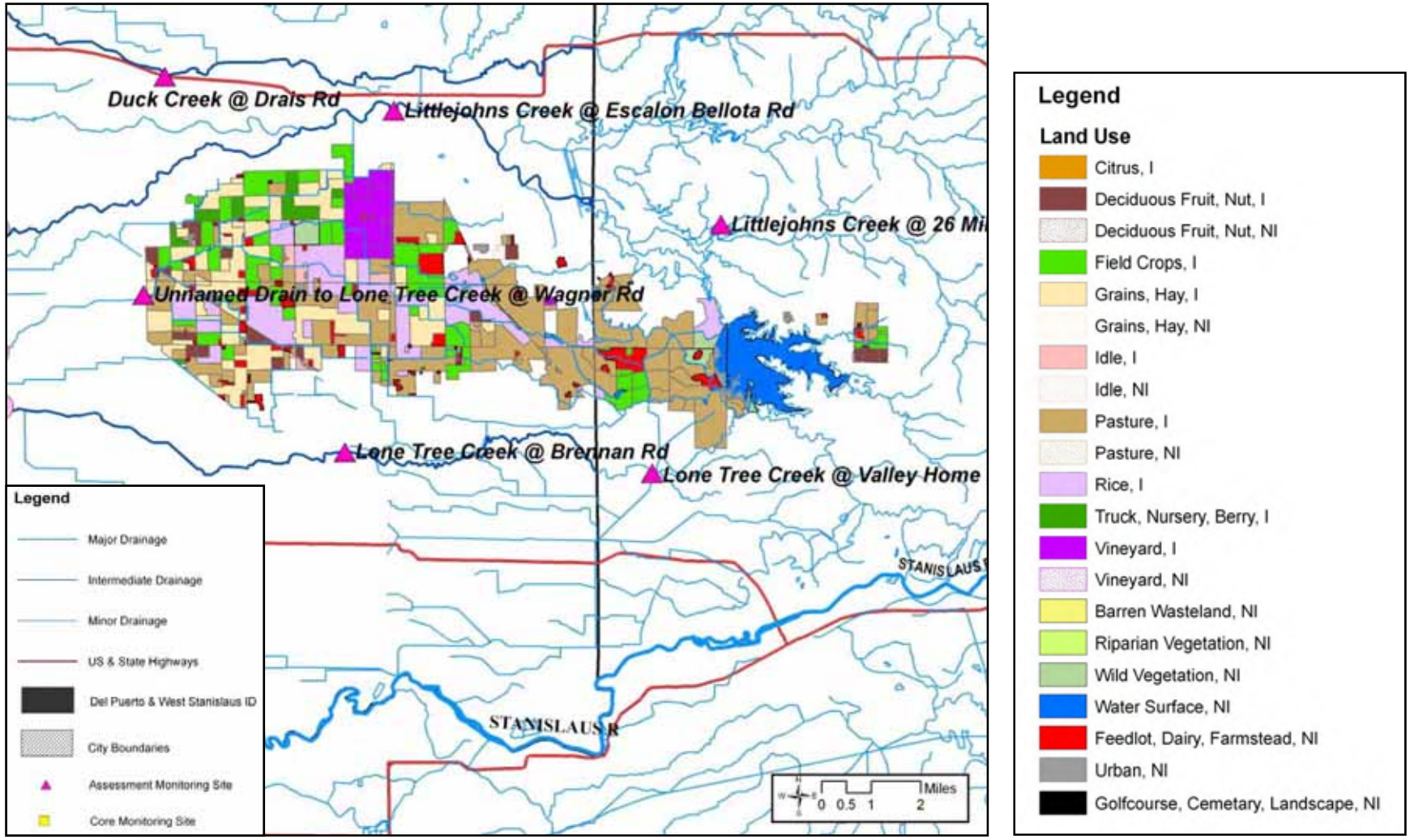
Table III-16. 2008 Management Plan sampling schedule. U = upstream sampling.

Sample Site	Month	Type	Chlorpyrifos
Unnamed Drain to Lone Tree Creek @ Wagner Rd	July	U	**x**
Unnamed Drain to Lone Tree Creek @ Wagner Rd	September	U	**x**

Table III-17. Two Unnamed Drain to Lone Tree Creek sites in the SJCDWQC region that have been used for Coalition sampling.

Station Name	Station Code	Target Lat	Target Long
Unnamed Drain to Lone Tree Creek @ Wagner Rd	531UDLTWR	37.8709	-121.0911
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	531UDLTAJ	37.8536	-121.1457

Figure III-9. Site subwatershed map of land use for the upstream Management Plan monitoring site, Unnamed Drain to Lone Tree Creek @ Jack Tone Rd sample site.



Outreach

The Coalition outreach includes grower meetings and mailing/distribution of information. The Coalition conducts three types of meetings: general grower meetings on a county level, grower group meetings (groups may be specified by crop, chemical use or seasonal practices) and individual contacts.

General grower meetings were held for Stockton County growers in October 2007 and May 2008. The Coalition anticipates conducting grower meetings in the various Coalition counties prior to the irrigation season to address irrigation water quality concerns and management practices and again between October and December focusing on dormant spray practices and presenting Coalition data from the previous year of monitoring.

Grower group meetings were held for growers in the Unnamed Drain to Lone Tree Creek subwatershed and focused on walnut, vineyard and corn growers (Table III-18). Water quality exceedances of chlorpyrifos and herbicides within the Unnamed Drain to Lone Tree Creek subwatershed were discussed and crop specific management practices were presented. Discussions with growers after the meeting allowed Coalition representatives to gain additional information about local application practices and will use this information to focus future outreach.

Grower group meetings will be conducted between October 2008 and April 2009. The grower group meetings will focus on management practices that can reduce spray drift of aerial applications and management practices for chlorpyrifos use. In October 2008, a publication of Best Management Practices information, developed by the Center for Urban/Rural Environmental Stewardship (CURES), will go out to all members with 15 or more acres enrolled in the program. The handbooks were originally designed for the Westside Coalition and contain information on farming practices such as sediment basins, polyacrylamide (PAM), enzyme treatments, tail water return systems, vegetative ditches, irrigation scheduling and others (Attachment I, example of Westside handbook). These documents are summaries of technical reports developed by the California Water Institute, Ducks Unlimited, California Department of Pesticide Regulation and others.

Table III-18. Grower group meetings conducted in the Unnamed Drain to Lone Tree Creek site subwatershed.

Location	Date	Description	Who
Unnamed Drain to Lone Tree Creek Subwatershed	May 16, 2007	Outreach to Walnut growers in the Lone Tree Creek subwatershed (including Unnamed Drain to Lone Tree Creek), exceedances and relevant MPs presented, alternative materials and MPs for the upcoming irrigation season discussed among growers.	Terry Prichard

Location	Date	Description	Who
Unnamed Drain to Lone Tree Creek Subwatershed	July 15, 2008	Corn, alfafa and tomato growers meeting to discuss water management strategies in regards to organophosphates.	Mike Wackman, Terry Prichard, CURES
Unnamed Drain to Lone Tree Creek Subwatershed	July 16, 2008	Tree and vine growers meeting to discuss water management strategies in regards to organophosphates and pyrethroids focusing on management of codling moth and vine mealeybug outbreaks.	Mike Wackman, Terry Prichard, CURES

Evaluation

The Unnamed Drain to Lone Tree Creek site subwatershed is one of the rotating Assessment Monitoring locations within the SJCDWQC French Camp Slough @ Airport Way Zone. This subwatershed will not be rotated into the SJCDWQC monitoring program until 2017. However the Coalition will continue to monitor for Management Plan constituents as outlined in Table III-16. This subwatershed is one of the three priority subwatersheds within the SJCDWQC and therefore the Coalition is focusing its resources on identifying the sources of agricultural discharge within this subwatershed that could lead to water quality impairments, extending outreach to individual Coalition members and setting evaluation goals. Members will be contacted individually based on their proximity to the waterway, number of applications co-occurring with WQTL exceedances and amount of acres farmed.

The Coalition sent general management practice surveys to members in May 2007. This survey was intended to collect baseline information from growers to understand current management practices conducted and implemented within the Coalition region. The Coalition plans to build upon the baseline survey results by conducting individual contacts with growers and fill out more detailed checklists that can be used to gain specific parcel information in regards to agricultural discharge and management practices currently implemented. At that time the Coalition will offer resources (i.e. management practice handbooks, information to obtain NRCS funds) to the grower to aid them in performing additional management practices. The Coalition will return in a year to interview the grower again and determine if any additional management practices were performed.

Individual contacts are time and money intensive. The Coalition's strategy for the Unnamed Drain to Lone Tree Creek subwatershed was to first conduct a grower group meeting this summer (June 15 and 16, 2008) and speak with individual growers who attended the meeting about current irrigation and dormant spray practices (Table III-18). The Coalition verbally obtained valuable information about specific parcel practices within this area and was able to discuss with growers management practices that could potentially reduce runoff of chlorpyrifos on an individual grower level. The Coalition realizes the importance of keeping track internally of specific practices and therefore is developing a series of checklists to use during

conversations/interviews with growers through individual contacts or at grower group meetings. The Coalition is developing these checklists with the aid of UC Davis Extension and will be developed by categories such as nutrient management, organophosphate management, herbicide management, copper management and additional checklists on a broader level for overall irrigation and dormant season management. Information will remain confidential between the Coalition and the member and used at a site subwatershed level to evaluate management practice effectiveness. The details of the checklists are still being developed but the goal is to have a documentation tool to allow the Coalition to keep track of specific management practices as they pertain to water quality impairments within that particular subwatershed. Parcel specific information will remain confidential between the member and the Coalition and used to evaluate effectiveness of management practices at a subwatershed level.

The Coalition is also conducting "tail-gate" meetings with large growers within the entire Coalition region to discuss overall management practices. Large growers are selected by Coalition representatives based on number of acres that they manage and availability to meet with Coalition representatives, regardless of current monitoring locations or specific water quality information. For example, a large grower may be contacted within a subwatershed that the Coalition has not yet sampled for water quality. This method will allow the Coalition to speak with specific growers about current Coalition wide water quality impairments, discuss current management practices and also inform the owner/grower of additional management practices that can be used to reduce/eliminate agricultural discharge. The Coalition will also present CURES booklets on management practices and resources for obtaining management practice implementation funds (such as NRCS funds). By focusing on large growers, any updates to management practices as a result of these meetings will affect large areas within the Coalition region impacting overall Coalition area water quality.

The Coalition and UC Davis Extension will use the checklists while contacting specific growers within the Duck Creek @ Hwy 4 subwatershed (also a high priority subwatershed) during the 2008/2009 winter season. The results of the checklists will be entered into a database that will be used internally by the Coalition. After the first round of contacts using the checklists, the checklist format and information will be evaluated based on the amount of information obtained that can be used to track and assess management practices within the Duck Creek @ Hwy 4 subwatershed. If this method is deemed effective, the Coalition will continue to use the checklists with future individual contacts within the Unnamed Drain to Lone Tree Creek subwatershed. Contacts within the Unnamed Drain to Lone Tree Creek subwatershed are anticipated to occur prior to the irrigation season of 2009.

In addition, the Coalition will continue to conduct grower meetings by county during the winter of 2008/2009 to inform all members of current water quality impairments and Coalition activities. The Coalition will record the number of attendees at the meeting to evaluate the effectiveness of these outreach meetings.

Low priority Site Subwatersheds

Exceedances in the low priority site subwatersheds will receive a reduced level of analysis, outreach, and evaluation compared to the high priority site subwatersheds. Because the reduced level of analysis precludes identifying specific applications or parcels for focused outreach, the outreach is broadly targeted to a wider audience. Evaluation of management practice effectiveness is less rigorous in low priority site subwatersheds. The Coalition outreach and evaluation strategies are the same for all lower priority site subwatersheds and are summarized below.

Outreach

The Coalition conducts numerous types of outreach to its membership in low priority site subwatersheds:

- General grower meetings on a county level,
- Subwatershed specific grower meetings,
- Crop specific grower meetings (may be specified by crop, chemical use or seasonal practices i.e. dormant season orchard),
- Mailings of crop specific BMP literature.

The focus of outreach activities is on categories of constituents that share the same mode of transport. For exceedances of constituents with high K_{oc} values such as pyrethroid pesticides and copper, and therefore have a high tendency to bind to sediment, growers will be provided with information on management practices that prevent the movement of sediment to surface waters. For exceedances of high K_{oc} constituents, growers will be provided with information on management practices that prevent the movement of storm water or irrigation tail water to surface waters. Manure and nutrient management will continue to be outreach topics at grower meetings.

The Coalition anticipates conducting grower meetings in the various Coalition counties between October 2008 and January 2009 focusing on dormant spray practices and presenting Coalition data from the previous year of monitoring. Additional meetings will be scheduled prior to the irrigation season 2009 to address irrigation water quality concerns and management practices. Discussions with growers after the meeting allowed Coalition representatives to gain additional information about local application practices and will use this information to focus future outreach.

During October 2008 the Coalition will mail out Best Management Practice (BMP) Handbooks developed by the Center for Urban/Rural Environmental Stewardship (CURES) to all members. The handbooks were originally designed for the Westside Coalition and contain information on farming practices such as sediment basins, polyacrylamide (PAM), enzyme treatments, tail water return systems, vegetative ditches, irrigation scheduling and others. These documents

are summaries of technical reports developed by the California Water Institute, Ducks Unlimited, California Department of Pesticide Regulation and others.

Evaluation

Evaluation of management practice effectiveness relies primarily on self reporting by members attending meetings and comparisons to the baseline surveys completed over the last two years. The last mailing occurred during membership renewal and remaining a member in good standing required the completion of the survey. This survey was intended to collect baseline information from growers to understand current management practices conducted and implemented within the subwatershed area. During the grower meetings the Coalition will offer resources (i.e. management practice handbooks, information to obtain NRCS-EQIP funds) to aid them in implementing additional management practices if it is determined that additional practices are needed. The Coalition will work with individual growers from low priority site subwatersheds if they request information or individual consultation.

The Coalition anticipates conducting creek walks in all site subwatersheds over the next several months. Using information gathered from creek walks upstream of the sampling sites, the Coalition will identify potential discharge points into Coalition surface waters. Landowners with potential discharge points who are Coalition members will be contacted to attend meetings discussing alternatives to direct discharge to surface waters. Names of non members who are identified in the creek walk with discharges will be forwarded to the Regional Water Board.

In addition the Coalition will conduct a grower subwatershed group meeting in the winter of 2008/2009 to address dormant sprays and applications of herbicides. Additional meetings will be held during the spring prior to the irrigation season. At both meetings, the Coalition will ask growers to fill out parcel specific checklists with the aid of Coalition representatives. The Coalition will record the number of attendees at the meeting and the number of checklists filled out to evaluate the effectiveness of this grower group meeting.

The Coalition will continue to conduct its annual member meetings by county, the next scheduled in December 2008, to inform all growers of current water quality impairments and Coalition activities. The Coalition will record the number of attendees at the meeting to evaluate the effectiveness of these outreach meetings.

IV. FRENCH CAMP SLOUGH

Management Plan Constituents

Priority A

- Chlorpyrifos

Priority C

- Copper
- Thiobencarb

Priority D

- *Ceriodaphnia dubia* water column toxicity
- *Hyalella azteca* sediment toxicity

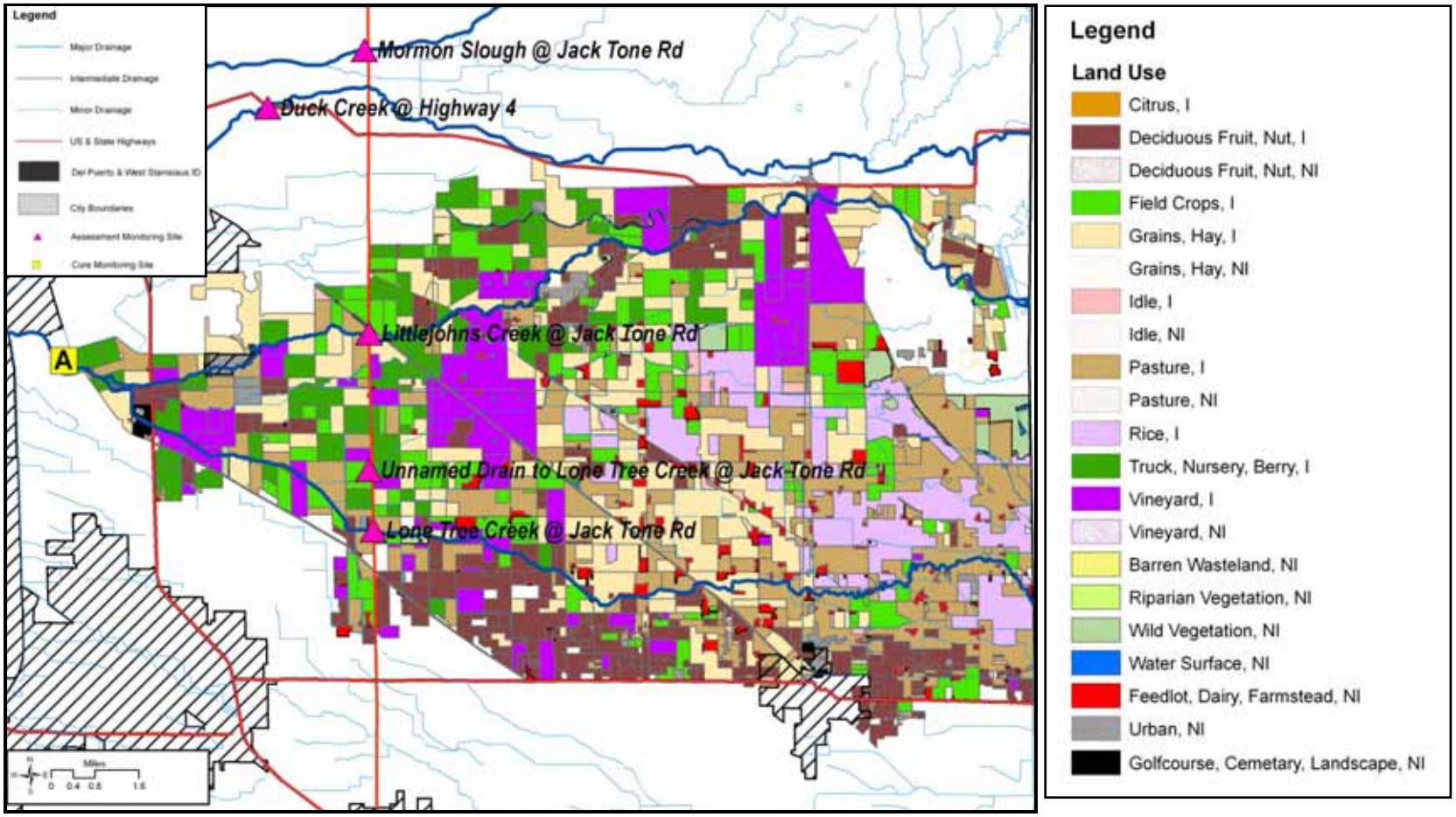
Priority E

- Dissolved Oxygen
- pH
- Color
- *E. coli*
- Cadmium
- Lead

Description of French Camp Slough @ Airport Way Site Subwatershed

French Camp Slough @ Airport Way (68,502 irrigated acres) – French Camp Slough is the largest watershed that the Coalition samples. The main water bodies that drain to this site subwatershed are Littlejohns Creek and Lone Tree Creek, which merge to form French Camp Slough. This site was selected as a downstream companion site to the Littlejohns Creek @ Jack Tone Road and Lone Tree Creek @ Jack Tone Road sites. These water bodies drain agricultural land to the east of Manteca and Stockton and eventually flow through urban areas prior to their discharge to the San Joaquin River. This site represents all of the major types of agriculture present in the Coalition region including field crops, orchards, grains and hay, vineyards and irrigated pasture (Figure IV-1).

Figure IV-1. Site subwatershed map of land use for sample site at French Camp Slough @ Airport Way (A). The highlighted points mark current sampling sites.



Subwatershed Monitoring History

Monitoring was initiated in this watershed in the storm season of 2005 (Tables IV-1, IV-2). Exceedances of field, organic and inorganic parameters as well as toxicity have occurred. Details on these exceedances are provided in Table IV-3 and discussed in the next section. French Camp Slough is not considered impaired in the current Basin Plan, however Lone Tree Creek, a tributary to French Camp Slough, is listed as impaired for ammonia, biological oxygen demand and electrical conductivity. The potential source is listed as dairies.

French Camp Slough @ Airport Way will be a Core Monitoring location under the new MRPP. In addition to Core Site monitoring, the Coalition will continue to conduct management plan monitoring at the upstream sites along Lone Tree Creek and Littlejohns Creek. Management Plan monitoring is described in better detail later in this document.

Table IV-1. French Camp Slough @ Airport Way. Number of sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Events Sampled	None	2	5	2	5	2	6

Table IV-2. French Camp Slough @ Airport Way. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Field and Physical Parameters						
pH	3	5	4	5	4	10
Electrical Conductivity	3	5	4	5	4	10
Dissolved Oxygen	3	5	4	4	4	10
Total Dissolved Solids	2	5	2	5	2	6
Turbidity	2	5	2	5	2	7
E. coli	2	5	2	5	2	7
Color	2	5	2	5	2	7
Total Organic Carbon	2	5	2	6	2	6
Biological Oxygen Demand				1	2	2
Carbamates						
Aldicarb				5	2	6
Carbaryl				5	2	6
Carbofuran				5	2	6
Methiocarb				5	2	6
Methomyl				5	2	6
Oxamyl				5	2	6
Organochlorines						
DDD				5	2	6

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
DDE				5	2	6
DDT				5	2	6
Dicofol				5	2	6
Dieldrin				5	2	6
Endrin				5	2	6
Methoxychlor				5	2	6
Organophosphates						
Azinphos methyl				5	2	6
Chlorpyrifos	2	5	2	5	2	8
Diazinon	2	5	2	5	2	6
Dimethoate				5	2	6
Disulfoton				5	2	6
Malathion				5	2	6
Methamidophos				5	2	6
Methidathion				5	2	6
Parathion, Methyl				5	2	6
Phorate				5	2	6
Phosmet				5	2	6
Pyrethroids						
Bifenthrin		1	2	5	2	6
Cypermethrin	2	5	2	5	2	6
Cyhalothrin, lambda	2	5	2	5	2	6
Permethrin	2	5	2	5	2	6
Cyfluthrin		1	2	5	2	6
Esfenvalerate/ Fenvalerate	2	5	2	5	2	6
Triazines						
Atrazine				5	2	6
Cyanazine				5	2	6
Diuron				5	2	6
Glyphosate				5	2	6
Linuron				5	2	6
Molinate				5	2	6
Paraquat dichloride				5	2	6
Simazine				5	2	6
Thiobencarb				5	2	6
Metals						
Arsenic				5	2	6
Boron				5	2	6
Cadmium				5	2	6
Copper				5	2	9
Lead				5	2	6
Nickel				5	2	6
Selenium				5	2	2
Zinc				5	2	6
Nutrients						
Nitrate as NO3				5	2	6
Nitrite as Nitrogen				5	2	6

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Ammonia				5	2	6
Hardness				6	2	9
Total Phosphorus				5	2	6
Orthophosphate				5	2	6
TKN				5	2	6
Toxicity						
Ceriodaphnia dubia	2	5	3	5	3	7
Pimephales promelas	2	5	2	5	2	7
Selenastrum capricornutum	3	5	2	5	2	7
Hyalella azteca		5	1	1	1	2

Exceedance History

Between 2005 and 2007, exceedances of field, organic and inorganic parameters as well as toxicity have occurred. These exceedances include DO (7), pH (1), color (22), *E. coli* (16), copper (12), cadmium (3), lead (4), chlorpyrifos (4), thiobencarb (2), and one each of azinphos methyl, diazinon, dieldrin, diuron, methidathion, and nickel. Water from this site was toxic to *Ceriodaphnia* and *Selenastrum* once each, and sediment was toxic to *Hyalella* twice.

All exceedances are listed in Table IV-3 by season and date and are based on water quality trigger limits (WQTL) listed in the overall introduction of the SJCDWQC Management Plan. The priority level (A-E) assigned to each constituent is listed in the bottom row of Table IV-3 for those analytes with two or more exceedances within the last three years.

Table IV-3. All exceedances experienced in samples collected from the French Camp Slough @ Airport Way Coalition monitoring site between February 2005 and September 2007. Thiobencarb is not a priority for the Coalition because the Rice Coalition is responsible for rice herbicides.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	pH, none	Color, color units	E. coli, MPN/100 mL	Copper[1,2], µg/L	Cadmium, µg/L	Nickel, µg/L	Lead[1,2], µg/L	Azinphos methyl[1], µg/L	Chlorpyrifos, µg/L	Diazinon, µg/L	Dieldrin[1], µg/L	Diuron[1], µg/L	Methidathion[1], µg/L	Thiobencarb[1], µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Selenastrum capricornutum, Total Cell Count
French Camp Slough @ Airport Way	Irrigation	17/May/2005		9.02	100	500														
French Camp Slough @ Airport Way	Irrigation	21/Jun/2005			120	300														
French Camp Slough @ Airport Way	Irrigation	19/Jul/2005	6		120	1600						0.033								
French Camp Slough @ Airport Way	Irrigation	16/Aug/2005	5.8		150	1600						0.043								
French Camp Slough @ Airport Way	Irrigation	20/Sep/2005	4.8		100	300														
French Camp Slough @ Airport Way	Irrigation	16/May/2006			55	340	8.4 (4.8)			1.5 (1.18)										
French Camp Slough @ Airport Way	Irrigation	20/Jun/2006	6.8		60	550	6.6 (6)				0.13									
French Camp Slough @ Airport Way	Irrigation	18/Jul/2006	6.1		60	1200	7 (6.2)					0.027								
French Camp Slough @ Airport Way	Irrigation	15/Aug/2006	6.8		60	920	8 (6.2)													
French Camp Slough @ Airport Way	Irrigation	19/Sep/2006			35															
French Camp Slough @ Airport Way	Irrigation	10/Apr/2007			60															
French Camp Slough @ Airport Way	Irrigation	22/May/2007			45	310	5.9 (5.3)										0.18			
French Camp Slough @ Airport Way	Irrigation	12/Jun/2007			40		5.9 (4.6)			1.2 (1.12)							0.16			
French Camp Slough @ Airport Way	Irrigation	20/Jun/2007					6.7 (5.7)													
French Camp Slough @ Airport Way	Irrigation	10/Jul/2007			40		5.4 (5.3)							0.0053						
French Camp Slough @ Airport Way	Irrigation	30/Jul/2007					6.9 (5.2)													
French Camp Slough @ Airport Way	Irrigation	07/Aug/2007			35	260		0.08												
French Camp Slough @ Airport Way	Irrigation	09/Aug/2007																	32	
French Camp Slough @ Airport Way	Irrigation	28/Aug/2007					5.9 (5.3)													
French Camp Slough @ Airport Way	Irrigation	04/Sep/2007			45	290														
French Camp Slough @ Airport Way	Storm	16/Feb/2005			380	1600														1410000
French Camp Slough @ Airport Way	Storm	21/Mar/2005			75															
French Camp Slough @ Airport Way	Storm	27/Feb/2006			50							0.037								
French Camp Slough @ Airport Way	Storm	15/Mar/2006			600	1600												0		
French Camp Slough @ Airport Way	Storm	27/Apr/2006																	91.25	
French Camp Slough @ Airport Way	Storm	11/Feb/2007	0.91		380	2400	30 (14.7)	0.2	15	4		0.049	0.11		3.2	1.4		0		
French Camp Slough @ Airport Way	Storm	28/Feb/2007			150	2400	11 (10.1)	0.06		2.5										
Constituent Priority			**E**	**E**	**E**	**E**	**C**	**E**		**E**		**A**					**NP**	**D**	**D**	

[1]Montitoring for this analyte was not initiated until May of 2006.
[2]Water quality trigger for each sample is based on hardness and is shown in parenthesis.

NP- not prioritized; thiobencarb is only applied to rice and therefore will be managed under the Rice Coalition.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at the French Camp Slough @ Airport Way monitoring site for the constituents copper and chlorpyrifos. Table IV-4 shows monitoring results for these constituents from all sampling events during the 2007 irrigation season and indicates which constituents were being targeted in each management plan monitoring event.

Table IV-4. French Camp Slough @ Airport Way Normal monitoring (NM) and Management Plan monitoring (MPM) results for copper and chlorpyrifos from the 2007 irrigation season. Exceedance values are in bold.

Management Plan Constituent	NM	NM	NM	MPM	NM	MPM	NM	MPM	NM
	4/10/07	5/22/07	6/12/07	6/20/07	7/10/07	7/30/07	8/07/07	8/28/07	9/04/07
Copper (ug/L)	5.7	**5.9**	**5.9**	**6.7**	**5.4**	**6.9**	5	**5.9**	4.5
Chlorpyrifos (ug/L)	0.013	<0.00259	0.013	NA	0.014	0.011	<0.003	<0.003	<0.003

NA- no management plan monitoring occurred for this constituent.

Load Calculations

Loads were calculated for the chlorpyrifos, copper, and lead detections based on the following formula (Table IV-5):

Load = Discharge (cfs) X 28.317L/ft^3 X Concentration (milligram/L X 1000 or µg/L).

The load values presented for constituents 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 a normalization of the concentrations by flow for various constituents at the time the samples were collected.

Table IV-5. Loads of chlorpyrifos, copper and lead calculated from concentration and discharge measured for each detection at the French Camp Slough @ Airport Way monitoring site.

Analyte	Exceedance Date	Discharge (cfs)	Concentration (µg/L)	Load (µg/sec)
Chlorpyrifos	7/19/2005	59.4	0.033	55.51
Chlorpyrifos	8/16/2005	NA—too deep	0.043	NA
Chlorpyrifos	2/27/2006	NA—too deep	0.037	NA
Chlorpyrifos	7/18/2006	77.96	0.027	59.6
Chlorpyrifos	2/11/2007	70.48	0.049	97.79
Copper	5/16/2006	54.83	8.4	13041.56
Copper	6/20/2006	NA—too deep	6.6	NA
Copper	7/18/2006	77.96	7	15452.61

Analyte	Exceedance Date	Discharge (cfs)	Concentration (µg/L)	Load (µg/sec)
Copper	8/15/2006	90.95	8	20602.72
Copper	2/11/2007	70.48	30	59871.35
Copper	2/28/2007	NA—too deep	11	NA
Copper	5/22/2007	71.95	5.9	12020.28
Copper	6/12/2007	47.33	5.9	7907.16
Copper	6/20/2007	27.38	6.7	5194.46
Copper	7/10/2007	27.64	5.4	4226.33
Copper	7/30/2007	66.63	6.9	13018.2
Copper	8/28/2007	58.55	5.9	9781.62
Lead	5/16/2006	54.83	1.5	2328.85
Lead	6/12/2007	47.33	1.2	1608.24

Source Identification

Priority A Constituent

Chlorpyrifos

Chlorpyrifos is the only priority A constituent to be managed within the French Camp Slough @ Airport Way site subwatershed. The WQTL for chlorpyrifos (0.015 µg/L) has been exceeded at this site during the months of July, (2005, 2006), August (2006), February (2006, 2007) (Table IV-3). The February 2007 exceedance was associated with *Ceriodaphnia* toxicity. Large amounts of chlorpyrifos were applied across the watershed in all years (Table IV-6, Figure IV-2). The concentrations in the samples suggest that the chlorpyrifos was a result of runoff in storm water or irrigation return flows rather than drift. Large numbers of sections had applications prior to exceedances, and the size of the watershed will require that it be managed via the smaller site subwatersheds upstream (Table IV-7).

Table IV-6. Number of chlorpyrifos applications, pounds applied and acres treated for each month and year of application in the French Camp Slough @ Airport Way site subwatershed between 2005 and 2007.

Month	Number of Chlorpyrifos Applications	Pounds Product Applied	Acres Treated
January 2005	4	388.40	207
March 2005	25	920.35	1584
April 2005	2	95.68	98.2
May 2005	46	2724.31	1522.3
June 2005	51	5502.82	2920.1
July 2005	97	5809.77	4380.6

Month	Number of Chlorpyrifos Applications	Pounds Product Applied	Acres Treated
August 2005	28	1167.38	1372.2
September 2005	7	197.79	390
December 2005	5	575.63	288.4
January 2006	10	667.97	356
March 2006	12	536.36	813
April 2006	13	526.42	854
May 2006	54	4191.62	2559.3
June 2006	56	4798.76	3307.6
July 2006	69	4442.84	3323.5
August 2006	35	1719.71	1757
September 2006	12	526.27	648
October 2006	3	297.59	152.4
November 2006	2	249.02	134
January 2007	11	1227.00	658
March 2007	24	1266.04	1640
April 2007	10	577.26	498
May 2007	48	3264.38	2321
June 2007	29	1885.35	1501
July 2007	11	434.67	545
August 2007	5	215.77	217
2004 Total	52	2758.05	2387.18
2005 Total	265	17382.13	12762.8
2006 Total	266	17956.56	13904.8
2007 Total	138	8870.47	7380
TOTAL	**721**	**46967.21**	**36434.78**

Figure IV-2. Pounds of chlorpyrifos added to TRS within the French Camp Slough @ Airport Way site subwatershed by month for 2005-2007. Asterisk (*) denotes months in which chlorpyrifos exceedances were detected at the site.

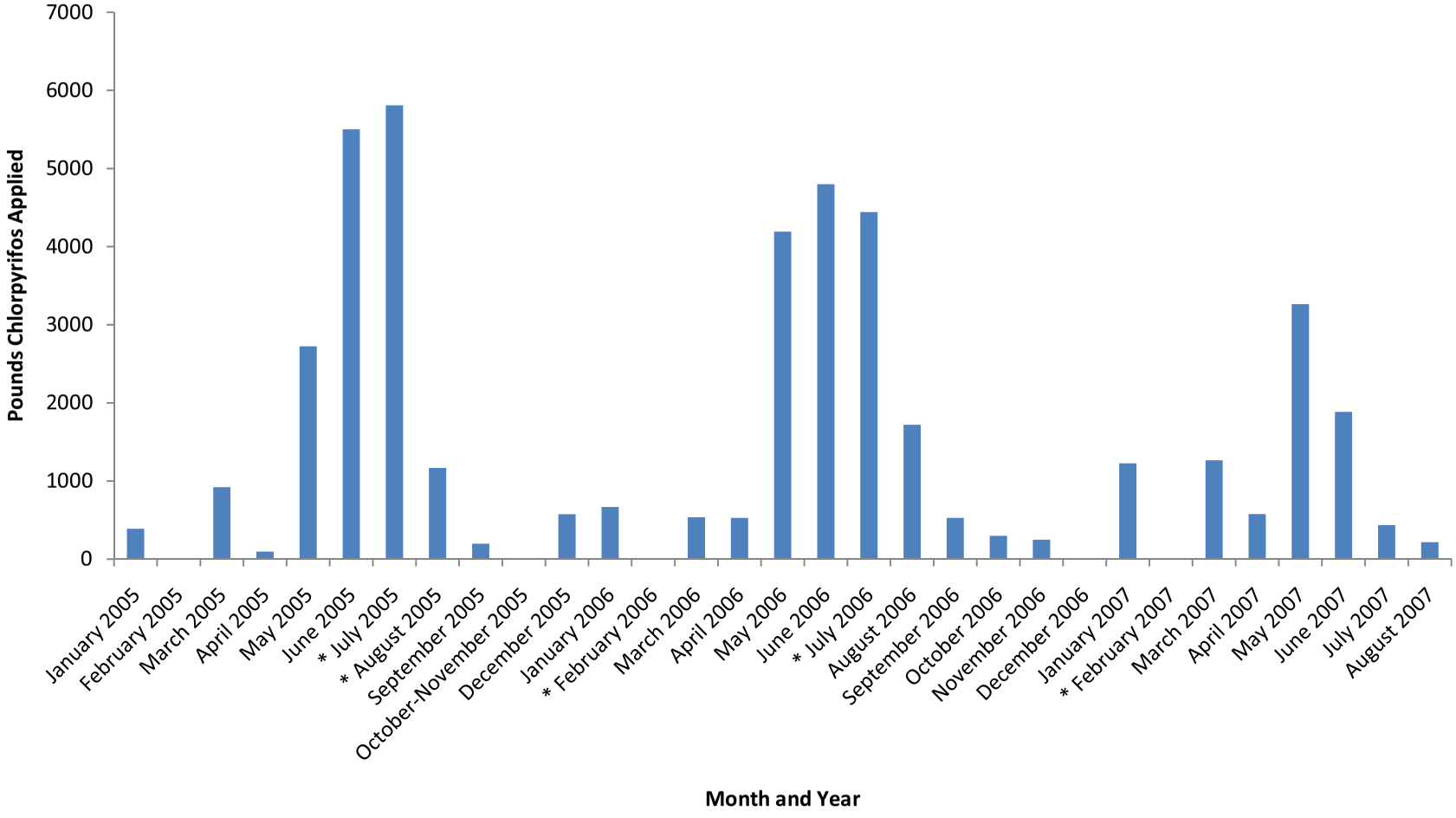


Table IV-7. French Camp Slough @ Airport Way. All TRS that had more than one application associated with exceedances of chlorpyrifos. Table includes the number of applications associated with the exceedance for a given TRS.

TRS	Date of Associated Exceedance			
	7/19/2005	8/16/2005	7/18/2006	2/11/2007
1N7E36	1	1		
1N8E14	2		1	
1N8E16		2		
1N8E29	1	3	1	
1N8E34	3		1	
1N9E17	1	4	1	
1N9E18	2	1	1	
1N9E19	2	2	1	
1N9E35	1		1	
1N9E36	1		2	
1S7E11	2		2	
1S7E12	1	1	2	
1S7E14	2	4		
1S7E23	1			2
1S7E25	1	1		2
1S7E3		2		
1S7E36			1	2
1S7E6		1	1	
1S8E13	1		1	
1S8E17	3			
1S8E2	2	1		
1S8E20			2	
1S8E22	1	3		
1S8E23		2	1	
1S8E24	1		3	
1S8E25	2		3	
1S8E27		2		
1S8E29	1	1	1	
1S8E3	5		2	
1S8E30				2
1S8E31	2	1		
1S8E33		2	1	
1S8E34	1	2		
1S8E35	4	3	3	1
1S8E6	1		1	
1S9E10	1	1	1	
1S9E12	1		1	
1S9E15		2		
1S9E21		2	1	
1S9E26	2		1	
1S9E30	1		3	
1S9E32	2			

TRS	Date of Associated Exceedance			
	7/19/2005	8/16/2005	7/18/2006	2/11/2007
1S9E33			2	
1S9E34	3		5	
1S9E35	3		2	
1S9E6		2		
2S8E2	1	2	5	
2S8E3	1	1	1	
2S9E1	1	2	1	
2S9E2	3		2	1
2S9E5	2	1	3	
2S9E6	5	1	1	

Priority C Constituent

Copper

Twelve exceedances of the copper WQTL occurred in the French Camp Slough site subwatershed in May through August 2006 and 2007, and in February 2007. None of the exceedances was associated with toxicity to *Selenastrum*. Copper is applied in almost every month of the year in this watershed but peak applications are in March-June (Table IV-8, Figure IV-3). Copper appears to be mobilized during winter storm water discharges and through irrigation return flows. Copper is heavily used in the watershed with numerous applications being made across numerous sections (Table IV-9).

Table IV-8. Number of copper applications, pounds applied and acres treated for each month and year of application in the French Camp Slough @ Airport Way site subwatershed between 2005 and 2007.

Month	Number of Copper Applications	Pounds Product Applied	Acres Treated
January 2005	81	18223.88	3505.75
February 2005	55	4344.00	1590.8
March 2005	57	6634.71	1802.19
April 2005	125	27034.71	5924.3
May 2005	94	22525.83	4598.35
June 2005	21	2056.94	933.3
July 2005	8	462.42	392.9
August 2005	5	248.06	229
September 2005	10	510.47	332
October 2005	14	1059.62	709
December 2005	28	6032.94	832.5
January 2006	116	20669.81	4539
February 2006	37	1163.06	855.8
March 2006	43	1878.92	1379
April 2006	112	19104.56	5029.04

Month	Number of Copper Applications	Pounds Product Applied	Acres Treated
May 2006	72	20992.33	3571.7
June 2006	19	4443.52	1189
July 2006	12	1292.34	794.8
August 2006	4	184.27	115
September 2006	12	779.07	524.5
October 2006	14	968.66	626
December 2006	21	2338.65	340.5
January 2007	80	13630.40	3454
February 2007	31	2540.28	1048
March 2007	43	5959.30	1634
April 2007	136	23286.77	4903
May 2007	36	13874.94	2058
June 2007	11	1091.08	622
July 2007	7	240.34	475
August 2007	1	138.80	43
2005 Total	498	89133.57	20850.09
2006 Total	462	73815.19	18964.34
2007 Total	345	60761.90	14237
TOTAL	1305	223710.67	54051.43

Figure IV-3. Pounds of copper added to TRS within the French Camp Slough @ Airport Way site subwatershed by month for 2005-2007. Asterisk (*) denotes months in which chlorpyrifos exceedances were detected at the site.

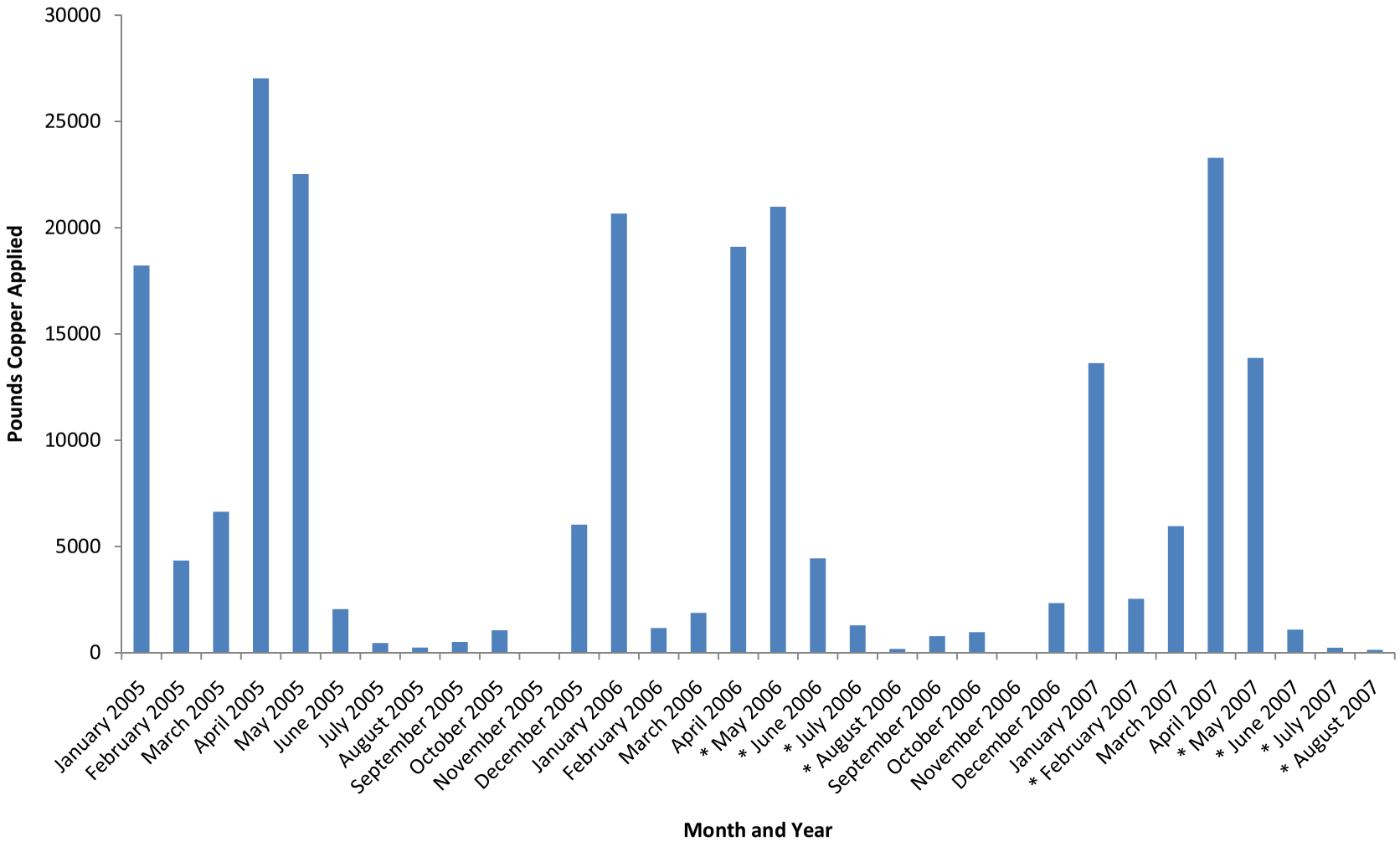


Table IV-9. French Camp Slough @ Airport Way. All TRS that had more than one application associated with exceedances of copper (for copper, associated applications are within three months of the exceedance date). Table shows the number of applications associated with the exceedance for a given TRS.

TRS	Date of Associated Exceedance												
	2/11/2007	2/28/2007	5/22/2007	5/16/2006	6/20/2006	7/18/2006	8/15/2006	5/22/2007	6/12/2007	6/20/2007	7/10/2007	7/30/2007	8/28/2007
1N7E27								2	4	6	8	9	7
1N7E35				2	2	3	2	4	6	6	6	6	5
1N8E13				6	7	5	1	5	5	5	3	1	
1N8E14	1	1		1	2	4	3	4	4	4	3		
1N8E15						1	1	4	4	4	4		
1N8E16				2	2	2		4	4	4	2		
1N8E19				2	2	2		1	1	1	1	1	
1N8E20					1	1	1				1	1	1
1N8E21				2	2			2					
1N8E24				5	5	4		2	2	2	1		
1N8E25				2	3	3	1	6	6	6	4	1	
1N8E26				3	3	3		1	1	1			
1N8E29				3	5	4	2	2	2	2	1		
1N8E30				2	2	2	1						
1N8E32					5	10	11						
1N8E33	1	1						2	2	2	1		
1N8E34				9	10	7	1	3	3	3	2		
1N8E35				1				2	2	2	2		
1N9E16	1	1		2	1			4	2	2	2		
1N9E17				3	4	2	1	6	6	6	4		
1N9E18				6	6	4		9	9	9	2		
1N9E19				14	13	11		20	19	19	13	5	
1N9E25					1	1	1	2	2	2	1		
1N9E26					1	1	1	4	4	4	2		
1N9E29				2	2	1							
1N9E30				8	9	7	1	8	8	8	5	1	
1S7E10				8	11	13	6	5	5	6	3	3	2
1S7E11				2	3	3	1	3	3	3	3		

TRS	Date of Associated Exceedance												
	2/11/2007	2/28/2007	5/22/2007	5/16/2006	6/20/2006	7/18/2006	8/15/2006	5/22/2007	6/12/2007	6/20/2007	7/10/2007	7/30/2007	8/28/2007
1S7E12				2	2	2		4	4	5	6	3	2
1S7E15	1	1		1	1	1		1	1	1	1		
1S7E16	6	7		4	4	2		9	7	7	4	1	
1S7E2	1	1		2	3	3	1	2	2	2			
1S7E23	4	4		3	4	3	2	3	3	3	3	1	
1S7E24		1		1	1								
1S7E25	3	3		3	4	3	1	4	2	2	1		
1S7E36	3	3											
1S7E4				1	2	2	1	3	3	3	2	1	
1S7E6					1	1	1	1	1	1			
1S7E8								2	2	2	2		
1S7E9				1	1	1		1	1	1			1
1S8E11	1	2	1	2									
1S8E12				1	2	2	1	3	3	3	3	3	2
1S8E14				3	2								
1S8E15				2	2	1		1	1	1	1		
1S8E16				2	2								
1S8E17				2	2								
1S8E20				5	5	5		11	9	9	5		
1S8E21				4	4	1		3	1	1	1		
1S8E22				1	1	1		1	1	1	1		
1S8E26	1	1		4	4	2		1	1	1	1		
1S8E27	1	5						1	1	1	1		
1S8E28	6	8		2	2	1							
1S8E29	2	2			1	1	1	2	2	2	1		
1S8E30	3	3		1				1	1	1	1		
1S8E31	4	4		2	2	1							
1S8E32	2	2						1	1	1	1		
1S8E33	4	6		2	3	3	2	3	3	3	2	1	
1S8E34	3	3		1	1								
1S8E35	5	5		7	3			7	6	6	5		
1S8E36	1	2											

TRS	Date of Associated Exceedance												
	2/11/2007	2/28/2007	5/22/2007	5/16/2006	6/20/2006	7/18/2006	8/15/2006	5/22/2007	6/12/2007	6/20/2007	7/10/2007	7/30/2007	8/28/2007
1S8E4				2	2	2							
1S8E6				7	10	8	4	7	7	7	5	2	
1S8E8				1	1	1		4	2	2	1		
1S8E9				3	3	2		3	1	1			
1S9E10	1	1		1									
1S9E13	1	1			2	2	2	1	1	1	1	1	
1S9E14					2	2	2	3	3	3	3	3	
1S9E15				2	3	1	1	2	3	3	3	2	1
1S9E16					2	2	2	1	1	1	1	1	
1S9E17					1	1	1	1	1	1	1	1	
1S9E18	2	2		2									
1S9E22					3	3	3	3	3	3	3	3	
1S9E23				4	1	1	1						
1S9E24					2	2	2	3	4	4	3	3	
1S9E25					4	4	4	1	1	1	1	1	
1S9E31	6	6		4				1	1	1	1		
1S9E32	1	1		4									
1S9E34	5	5		4	1			1	1	1	1		
1S9E35	3	3		2									
2S8E1	4	5	1	2				1	1	1	1		
2S8E2	3	4	1	5	4	2		2	2	2	2		
2S8E3	1	1		2	2			3	3	3	3		
2S8E4	3	3		3	3	3		1	1	1	1		
2S9E1	7	7		1	1	1							
2S9E10	7	7		2	1			1					
2S9E2	6	6		1	1			3	3	3	2		
2S9E3	2	2		2				1	1	1			
2S9E4				2	1			2	1	1	1		
2S9E5	3	3						1	1	1			
2S9E6	3	3		4	3	2	1	4	4	4	2		

Priority D Constituents

Ceriodaphnia dubia toxicity

Ceriodaphnia toxicity was experienced in March 2006 and February 2007 (Table IV-3). The February toxicity event was associated with exceedances of chlorpyrifos and diazinon. The TIE indicated that a metabolically activated pesticide was the cause of toxicity and the combination of diazinon and chlorpyrifos accounted for the toxicity. The March toxicity was not associated with any exceedance of a chemical. The TIE indicated PBO did not reduce toxicity and that a C18 column removed the toxicity indicating that the cause of the toxicity was a non-organophosphate organic compound. Controlling the movement of soluble pesticides to the slough will prevent the toxicity to *Ceriodaphnia*.

Hyalella azteca toxicity

Hyalella toxicity has occurred at this site in April 2006 and August 2007 (Table IV-3). August 2007 toxicity was with a very low mortality rate (< 10%) and this toxicity is not considered to be biologically meaningful. The April 2006 toxicity was significant but sediment chemistry analyses were not performed and the exact constituent causing the toxicity and the source(s) are unknown.

Priority E Constituents

Cadmium

Since the time of this exceedance, the WQTL for cadmium has increased to 5 µg/L and the exceedances listed above are no longer considered exceedances. As a result, the Coalition will not develop a strategy to manage cadmium.

DO

In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. One of the samples collected at French Camp Slough contained measurable amounts of BOD and experienced an exceedance of the DO WQTL. The three samples with no detectable BOD did not experience an exceedance of the DO WQTL (Table IV-10). A final BOD sample had no comparable DO measurement due to equipment failure. These results do not point to BOD as a cause of low DO and it is not clear what the cause of low DO at this site is. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Table IV-10. French Camp Slough @ Airport Way. BOD, pH and dissolved oxygen results for September 2006 – July 2007. ND = non-detect.

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
French Camp Slough @ Airport Way	9/19/2006	7.42	-88	ND

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
French Camp Slough @ Airport Way	2/11/2007	7.24	0.91	41
French Camp Slough @ Airport Way	2/28/2007	7.24	9.38	ND
French Camp Slough @ Airport Way	4/10/2007	7.52	9.2	ND
French Camp Slough @ Airport Way	7/10/2007	7.53	7.78	ND

E. coli

E. coli exceedances occurred 16 times since 2005 in both the storm and irrigation seasons (Table IV-3). There are a large number of dairies upstream and manure may be applied as fertilizer. There are some small cities that can contribute coliform bacteria.

The Coalition performed a pilot study to understand the sources of E. coli in the site subwatershed. Molecular markers were used to distinguish human, bovine, and avian sources. Human, bovine, and avian molecular markers were found in the watershed indicating active inputs from all three species (Table IV-11, IV-12). Because this study was performed at a single time of the year with a limited set of potential hosts, a further study may be initiated to more fully understand bacterial contamination in the watershed. Until such time as the study is completed, the Coalition will not actively manage for *E. coli*. Once a better understanding of the *E. coli* dynamics is obtained, the Coalition will re-evaluate management options.

Table IV-11. Results of Bacteroides analysis. The French Camp subwatershed site sampled only once. A + indicates the DNA was detected but at too low of a concentration to estimate a percentage.

Station Code	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
531SJC504	8/31/2006	11:40	Grab	50	0.048828	50

Table IV-12. Values of E. coli, fecal coliform, and total coliform in MPN/100mL., and the average C_T value for the All bacteria, human Bacteroides, bovine Bacteroides, and chicken Bacteroides. C_T values are not comparable across samples and are not absolute measures of the quantity of DNA in the sample.

Station Code	Sample Date	Sample Time	Sample Type	E. coli	Fecal Coliform	Total Coliform	Avg All Bac	Avg Human	Avg. Bovine	Avg Chicken
531SJC504	8/31/06	11:40	Grab	490	1300	22000	26.59	27.7	37.82	27.48

Color/pH

Color and pH are non-conserved indicators of biological and physical inputs to the system and are not possible to manage unless the causes are known. Determining the causes of color or changes in pH is not a priority and the Coalition will not attempt to manage these constituents.

Lead

Lead is a legacy of any of a number of potential sources including deposition from leaded gasoline, disposal of lead-containing 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 prior to the initiation of the Pesticide Use Reporting system. Consequently, it is not possible to identify where past applications of lead-based pesticide occurred. 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 subwatersheds may contribute to the leaching of lead into the waterways. In addition, disposal of lead paint in the vicinity, burial of old buildings with lead paint, or leaching lead from lead arsenate deposition could all be contributors to lead detections. The particular sources of this metal are unknown, and the Coalition will address the lead exceedances when they become a higher priority.

2008 Management Plan Monitoring

Additional Management Plan monitoring was conducted in 2007 for copper and chlorpyrifos. Exceedances continued to occur during the 2007 irrigation season for copper. The Coalition will continue to monitor at Lone Tree Creek, Littlejohns Creek and Unnamed Drain to Lone Tree Creek for chlorpyrifos and copper during the irrigation season and therefore no additional upstream sampling will occur.

V. GRANT LINE CANAL NEAR CALPACK ROAD

Management Plan Constituents

Priority A

- Chlorpyrifos

Priority D

- *Ceriodaphnia dubia* water column toxicity
- *Selenastrum capricornutum* water column toxicity
- *Hyalella azteca* sediment toxicity

Priority E

- Cadmium
- Nickel
- Arsenic
- Dissolved Oxygen
- Specific Conductivity
- Color
- Total Dissolved Solids
- *E. coli*

Description of Grant Line Canal near Calpack Road Site Subwatershed

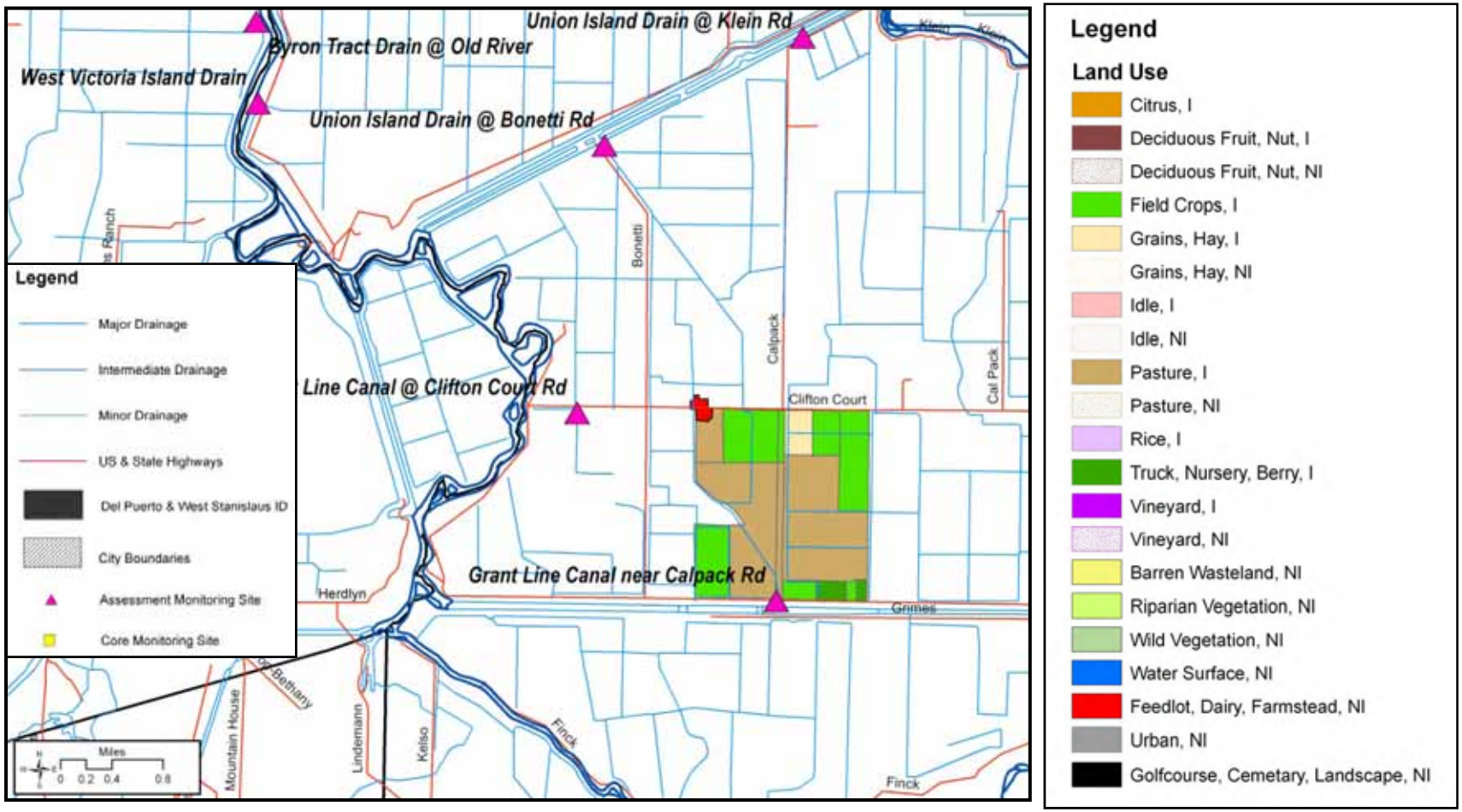
Grant Line Canal near Calpack Road (1,676 irrigated acres) is located on the south west section of Union Island. The site is adjacent to Grant Line Canal at a pumping station and drains fields immediately north and east. The crops grown are primarily alfalfa, field crops, tomatoes and grain (Figure V-1).

The Grant Line Canal (GLC) is located in the Bay-Delta tidal prism and receives water from east and west inputs. Source water of the GLC depends on delta tides, natural flows of large water bodies such as the San Joaquin River (SJR), the operation of agriculture barriers, and the operation of the pumping plants at Clifton Court Forebay.

In normal low flow conditions, water from the San Joaquin River enters Old River and makes its way to GLC via Salmon Slough and Doughty Cut. The GLC is also filled from Old River (just south of Coney Island) when delta tides are coming in. When the pumps are operating, flows in Old and Middle River become negative and the SJR flow is pulled upstream. It should also be noted that the Sacramento River water is pulled across the Delta to the export pumps, and thus the Old River receives input from the Sacramento River source water where it intersects with the western end of GLC. Under normal operating conditions, no GLC water enters Old River to the Central Delta because the flow moves west in the direction of the Aqueduct exports (due to high export demand). Therefore, all of the SJR water which entered Old River and GLC typically

ends up at the pumps regardless of the tides. Only during high flows (flood) does any SJR water enter Paradise cut and contribute to GLC. Paradise is a by-pass for such flows, not naturally connected to the SJR.

Figure V-1. Site subwatershed map of land use for Grant Line Canal near Calpack Rd sample site.



Subwatershed Monitoring History

Monitoring was initiated at Grant Line Canal near Calpack Rd during the storm season of 2005 and was monitored for a total of three years (six seasons) through the irrigation season of 2007 (Table V-1). Samples were collected from this site for field parameters and the analysis of chemistry and toxicity. One sampling event occurs over a one-month period and consists of normal monitoring as well as resampling and management plan monitoring when appropriate. Specific information on the analysis conducted across each of the monitoring seasons is provided below (Table V-2). Exceedances of field and physical parameters, *E. coli*, pesticides, metals and water column and sediment toxicity have been detected at this site. A summary and discussion of these exceedances is provided in the next section (Table V-3, V-4).

The Grant Line Canal is not considered impaired in the current Basin Plan, however the Old River section that runs from the San Joaquin River to the Delta Mendota Canal, parallel to the Canal, is on the 303d list as impaired as a result of low dissolved oxygen. The export waters of the Delta, including the Delta Mendota Canal and the California Aqueduct which receive water from Grant Line Canal, are listed for numerous constituents including chlorpyrifos, DDT, diazinon, electrical conductivity, exotic species, group A pesticides, mercury and unknown toxicity.

Grant Line Canal near Calpack Rd will be an Assessment Monitoring location under the new MRPP and the first monitoring rotation will occur in 2031. Until that time, the Coalition will continue to conduct management plan monitoring at this site. Management Plan monitoring is described in better detail later in this document.

Table V-1. Grant Line Canal near Calpack Rd sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Events Sampled	None	2	5	2	5	2	6

Table V-2. Grant Line Canal near Calpack Rd. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Field and Physical Parameters						
pH	3	6	3	6	4	10
Electrical Conductivity	4	6	3	6	4	10
Dissolved Oxygen	4	6	3	6	4	10
Total Dissolved Solids	2	5	2	5	2	6
Turbidity	2	5	2	5	2	6
E. coli	2	5	2	6	2	7
Color	2	5	2	5	2	6
Total Organic Carbon	2	5	2	5	2	6
Biological Oxygen Demand				1	2	2
Carbamates						
Aldicarb				5	2	6
Carbaryl				5	2	6
Carbofuran				5	2	6
Methiocarb				5	2	6
Methomyl				5	2	6
Oxamyl				5	2	6
Organochlorines						
DDD				5	2	6
DDE				5	2	6
DDT				5	2	6
Dicofol				5	2	6
Dieldrin				5	2	6
Endrin				5	2	6
Methoxychlor				5	2	6
Organophosphates						
Azinphos methyl				5	2	6
Chlorpyrifos	2	5	2	5	2	8
Diazinon	2	5	2	5	2	6
Dimethoate				5	2	6
Disulfoton				5	2	6
Malathion				5	2	6
Methamidophos				5	2	6
Methidathion				5	2	6
Parathion, Methyl				5	2	6
Phorate				5	2	6
Phosmet				5	2	6
Pyrethroids						
Bifenthrin		1	2	5	2	6
Cypermethrin	2	5	2	5	2	6
Cyhalothrin, lambda	2	5	2	5	2	6
Permethrin	2	5	2	5	2	6
Cyfluthrin		1	2	5	2	6
Esfenvalerate/ Fenvalerate	2	5	2	5	2	6
Triazines						

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Atrazine				5	2	6
Cyanazine				5	2	6
Diuron				5	2	6
Glyphosate				5	2	6
Linuron				5	2	6
Molinate				5	2	6
Paraquat dichloride				5	2	6
Simazine				5	2	6
Thiobencarb				5	2	6
Metals						
Arsenic				5	2	6
Boron				5	2	6
Cadmium				5	2	6
Copper				5	2	6
Lead				5	2	6
Nickel				5	2	6
Selenium				5	2	2
Zinc				5	2	6
Nutrients						
Nitrate as NO3				5	2	6
Nitrite as Nitrogen				5	2	6
Ammonia				5	2	6
Hardness				5	2	6
Total Phosphorus				5	2	6
Orthophosphate				5	2	6
TKN				5	2	6
Toxicity						
Ceriodaphnia dubia	3	6	2	6	2	8
Pimephales promelas	2	5	2	5	2	7
Selenastrum capricornutum	3	5	2	5	2	9
Hyalella azteca		5	1	1	2	1

Exceedance History

Exceedances of water quality trigger limits for field and physical parameters, *E. coli,* metals, pesticides, and water column and sediment toxicity have occurred at this site. During the irrigation season of 2007, exceedances detected at the site included dissolved oxygen (10), specific conductance (14), color (8), dissolved solids (8), *E. coli* (5), arsenic (1), cadmium (4), nickel (1), disulfoton (1), and diuron (1). Sediment samples collected during the storm monitoring event tested toxic to *Hyalella azteca*, and water column toxicity to *Selenastrum capricornutum* was detected during two sampling events. Samples collected over the entire three years of monitoring at the Grant Line Canal near Calpack Rd sample site resulted in 25 exceedances of the dissolved oxygen WQTL, 30 of specific conductance, 22 of color, 18 of dissolved solids, 15 of *E. coli*, three of arsenic, one of DDE, one of ammonia, seven of cadmium, one of lead, two of nickel, four of chlorpyrifos, one of disulfoton, one of diuron and one of

linuron. Toxicity in the water column occurred three times to *Ceriodaphnia dubia* and three times to *Selenastrum capricornutum* (plus one resample toxicity). Sediment toxicity to *Hyalella azteca* occurred five times (plus resample toxicity). All exceedances are listed in Table V-3 and Table V-4 by season and date and are based on water quality trigger limits (WQTL) listed in the introduction of the SJCDWQC Management Plan. The priority level (A-E) assigned to each constituent is listed in the bottom row of Table V-3 and Table V-4 for those analytes with two or more exceedances over the last three years.

Table V-3. Field, bacteria, inorganic and legacy pesticide exceedances experienced in samples collected from the Grant Line Canal near Calpack Rd monitoring site.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Arsenic[1], µg/L	DDE(p,p')[1], µg/L
Grant Line Canal near Calpack Rd	Irrigation	17/May/2005	6.3	847	150	550			
Grant Line Canal near Calpack Rd	Irrigation	21/Jun/2005	5.1	835	200	520	1600		
Grant Line Canal near Calpack Rd	Irrigation	19/Jul/2005	4.8		300		500		
Grant Line Canal near Calpack Rd	Irrigation	16/Aug/2005	3.8	1077	150	670	1600		
Grant Line Canal near Calpack Rd	Irrigation	23/Aug/2005	4.2	759					
Grant Line Canal near Calpack Rd	Irrigation	20/Sep/2005	2.9	1390	75	840	500		
Grant Line Canal near Calpack Rd	Irrigation	16/May/2006	1		160		2400	12	
Grant Line Canal near Calpack Rd	Irrigation	25/May/2006	4.1	806					
Grant Line Canal near Calpack Rd	Irrigation	20/Jun/2006	2.88	791	80	530	2400	16	
Grant Line Canal near Calpack Rd	Irrigation	18/Jul/2006	2.2	757	220	590	2000		0.0067
Grant Line Canal near Calpack Rd	Irrigation	15/Aug/2006	1.3	727	65		2400		
Grant Line Canal near Calpack Rd	Irrigation	19/Sep/2006	2.8		50		300		
Grant Line Canal near Calpack Rd	Irrigation	11/Apr/2007	2.76	972	130	610	490		
Grant Line Canal near Calpack Rd	Irrigation	22/May/2007	6.24	1222	65	750			
Grant Line Canal near Calpack Rd	Irrigation	12/Jun/2007	5.48	1209	45	790	980		
Grant Line Canal near Calpack Rd	Irrigation	10/Jul/2007	6.2	1289	80	790	550		
Grant Line Canal near Calpack Rd	Irrigation	17/Jul/2007	3	1123					
Grant Line Canal near Calpack Rd	Irrigation	30/Jul/2007	1.22	998					
Grant Line Canal near Calpack Rd	Irrigation	07/Aug/2007	3.42	956	80	630	980		
Grant Line Canal near Calpack Rd	Irrigation	09/Aug/2007	4.97	1174					
Grant Line Canal near Calpack Rd	Irrigation	28/Aug/2007	2.3	1654					
Grant Line Canal near Calpack Rd	Irrigation	04/Sep/2007	1.89	1225	50	810		12	
Grant Line Canal near Calpack Rd	Storm	16/Feb/2005		1412	200	930	240		
Grant Line Canal near Calpack Rd	Storm	23/Feb/2005	6.8	1834					
Grant Line Canal near Calpack Rd	Storm	21/Mar/2005		1970	50	1200			
Grant Line Canal near Calpack Rd	Storm	04/Apr/2005	4.8	2140					
Grant Line Canal near Calpack Rd	Storm	27/Feb/2006		1910	45	1200			
Grant Line Canal near Calpack Rd	Storm	15/Mar/2006		1660	75	1100			
Grant Line Canal near Calpack Rd	Storm	27/Apr/2006	5	2220					
Grant Line Canal near Calpack Rd	Storm	11/Feb/2007		1583	100	1000	2000		
Grant Line Canal near Calpack Rd	Storm	28/Feb/2007		1505	120	940			
Grant Line Canal near Calpack Rd	Storm	07/Mar/2007		1624					
Grant Line Canal near Calpack Rd	Storm	29/Mar/2007		1200					
Constituent Priority			**E**	**E**	**E**	**E**	**E**	**E**	

[1]Montitoring for this analyte was not initiated until May of 2006.

Table V-4. Nutrients, metals, pesticides and toxicity exceedances experienced in samples collected from the Grant Line Canal near Calpack Rd monitoring site.

Station Name	Season	Sample Date	Ammonia as N[1], mg/L	Cadmium, µg/L	Lead, µg/L	Nickel, µg/L	Chlorpyrifos, µg/L	Disulfoton[1], µg/L	Diuron[1], µg/L	Linuron[1], µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Selenastrum capricornutum, Total Cell Count
Grant Line Canal near Calpack Rd	Irrigation	17/May/2005										43.8	
Grant Line Canal near Calpack Rd	Irrigation	19/Jul/2005					0.053					68.8	
Grant Line Canal near Calpack Rd	Irrigation	16/Aug/2005					0.15				5		
Grant Line Canal near Calpack Rd	Irrigation	20/Sep/2005										88.8	
Grant Line Canal near Calpack Rd	Irrigation	16/May/2006		0.05			0.12				10		
Grant Line Canal near Calpack Rd	Irrigation	20/Jun/2006		0.06									
Grant Line Canal near Calpack Rd	Irrigation	18/Jul/2006		0.09	2.8	15							
Grant Line Canal near Calpack Rd	Irrigation	15/Aug/2006	4.1							1.6			
Grant Line Canal near Calpack Rd	Irrigation	11/Apr/2007		0.08		13							378000
Grant Line Canal near Calpack Rd	Irrigation	19/Apr/2007											685000
Grant Line Canal near Calpack Rd	Irrigation	12/Jun/2007		0.05									
Grant Line Canal near Calpack Rd	Irrigation	10/Jul/2007		0.06									755273
Grant Line Canal near Calpack Rd	Irrigation	07/Aug/2007		0.1				0.083	2.8				
Grant Line Canal near Calpack Rd	Storm	16/Feb/2005											129000
Grant Line Canal near Calpack Rd	Storm	21/Mar/2005					0.076				75		
Grant Line Canal near Calpack Rd	Storm	27/Apr/2006										20	
Grant Line Canal near Calpack Rd	Storm	07/Mar/2007										12.5	
Grant Line Canal near Calpack Rd	Storm	29/Mar/2007										5	
Constituent Priority				**E**		**E**	**A**				**D**	**D**	**D**

[1]Montitoring for this analyte was not initiated until May of 2006.
[2]Water quality trigger for each sample is based on hardness and is shown in parenthesis.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring (MPM) was implemented at the Grant Line Canal near Calpack Rd monitoring site for chlorpyrifos and toxicity to *Ceriodaphnia dubia* (Table V-5). Chlorpyrifos was not detected nor was there any toxicity to *Ceriodaphnia* during any 2007 irrigation sampling including MPM events (Table V-5).

Table V-5. Grant Line Canal near Calpack Rd. Normal monitoring (NM) and Management Plan monitoring (MPM) results for chlorpyrifos and toxicity to *Ceriodaphnia dubia* from the 2007 irrigation season.

Management Plan	**NM**	**NM**	**NM**	**NM**	**MPM**	**NM**	**MPM**	**NM**
Constituent	4/10/07	5/22/07	6/12/07	7/10/07	7/30/07	8/07/07	8/28/07	9/04/07
Chlorpyrifos (ug/L)	<0.00259	<0.00259	<0.00259	<0.003	<0.003	<0.003	<0.003	<0.003
Ceriodaphnia % survival	100	95	95	100	NA	100	100	100

NA- no Management Plan monitoring was conducted for this constituent on this date.

Load Calculations

Loads have been calculated for all chlorpyrifos detections in the site subwatershed based on the following formula (Table V-6):

Load = Discharge (cfs) X 28.317L/ft^3 X Concentration (milligram/L X 1000 or µg/L).

The load values for constituents 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 a normalization of the concentrations by flow for various constituents at the time the samples were collected.

There was no flow during any of the sampling events when exceedances occurred at the Grant Line Canal @ Calpack Rd sample site between 2005 and 2007 (Table V-6). Flow at the sample site is dependent on the operation of local pumps that push water in and out of the site drain.

Table V-6. Instantaneous load calculations for chlorpyrifos (sorted by date).

Sample Date	Analyte	Discharge cfs	Result µg/L	Instantaneous Loading Rate
21/Mar/2005	Chlorpyrifos	0	0.076	0
19/Jul/2005	Chlorpyrifos	0	0.053	0
16/Aug/2005	Chlorpyrifos	0	0.15	0
20/Jun/2006	Chlorpyrifos	0	0.011	0

Source Identification

Priority A Constituents

Chlorpyrifos

Chlorpyrifos the only priority A constituent to be managed within the Grant Line Canal @ Calpack Rd site subwatershed. The WQTL for chlorpyrifos (0.015 µg/L) has been exceeded at this site during the months of March (2005), July (2005), August (2005) and May (2006) (Table V-4). *Ceriodaphnia* toxicity and chlorpyrifos management are closely tied as *Ceriodaphnia* toxicity occurred during three of the four events when chlorpyrifos exceedances were detected at this site (March, August 2005 and May 2006). All exceedances were the result of applications to alfalfa. The Coalition's strategy for eliminating *Ceriodaphnia* toxicity at this site has involved focusing on chlorpyrifos. The grower changed chemicals and there has been no use of chlorpyrifos in the site subwatershed since October of 2006. Over the three years of monitoring, through outreach and personal communication with the grower in the site subwatershed, exceedances of chlorpyrifos and *Ceriodaphnia* toxicity have been eliminated at this site.

Priority D Constituents

Ceriodaphnia dubia toxicity

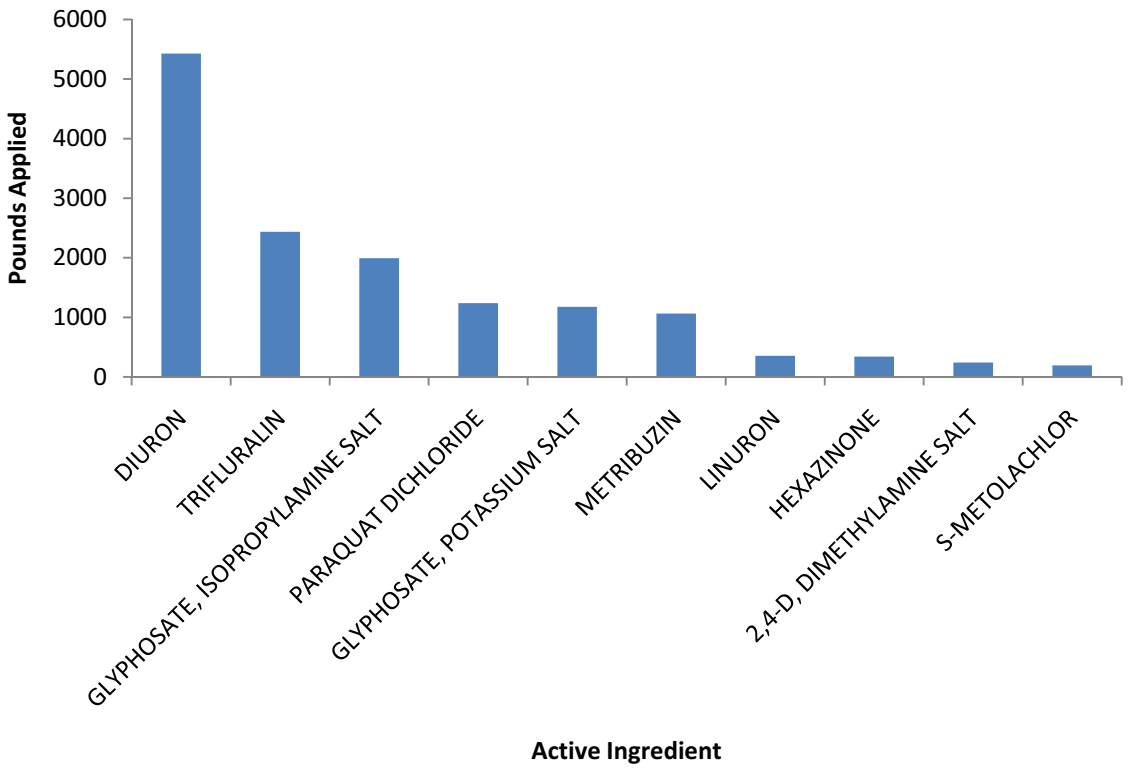
Ceriodaphnia toxicity at Grant Line Canal near Calpack is closely tied to chlorpyrifos exceedances. As discussed under the chlorpyrifos sourcing section, application of chlorpyrifos on alfafa have been determined to be the major cause of *Ceriodaphnia* toxicity and through outreach with the grower in the area and the elimination of chlorpyrifos use, exceedances have not occurred for chlorpyrifos or *Ceriodaphnia* since May 2006 (Table V-4).

Selenastrum capricornutum toxicity

Selenastrum toxicity has occurred during both storm and irrigation seasons at the Grant Line Canal near Calpack Rd sample site (Table V-4). The source of toxicity at this site may be herbicides or naturally occurring metals or other physical characteristics in the canal. The three samples that tested toxic to *Selenastrum* (not including the resample or the field duplicate) did not contain any herbicides at a concentration known to be toxic to algae (among those sampled by the Coalition). Copper and diuron were detected in these samples, but at levels not considered to have a significant effect in the sample water. The same concentrations (and greater) of copper and diuron were detected at the Grant Line Canal site during other events when toxicity was not experienced. The concentration of diuron detected in the samples that tested toxic (0.24 µg/L and 0.20 µg/L), were among the lowest detected concentrations in samples collected from the Grant Line Canal site between 2006 and 2007. Other herbicides were applied in the watershed (Figure V-2) and it is probable that the combination of herbicides

was responsible for the toxicity despite the fact that three of the five most used herbicides have exceptionally high K_{oc} values and low solubility's.

Figure V-2. Total pounds of pesticides relevant to *Selenastrum* toxicity applied prior to sampling events with toxicity in the Grant Line Canal near Calpack Rd site. Only the top ten active ingredients with the most pounds applied are shown.



Hyalella sediment toxicity

Hyalella toxicity has occurred at this site during the months of May, July, September (2005), April (2006) and March (2007) (Table V-3). No chemical analyses were performed on the sediment so the chemical causing toxicity is unknown. However, pyrethroid pesticides have been associated with sediment toxicity in other studies, and pyrethroids have been applied in this site subwatershed. Applications have been made aerially, and furrow and flood irrigation are common allowing the possibility that sediments containing pyrethroids or other constituents toxic to *Hyalella* are moved to the drain resulting in sediment toxicity.

Priority E Constituents

Cadmium

Since the time of this exceedance, the WQTL for cadmium has increased to 5 µg/L and the exceedances listed above are therefore no longer considered an exceedance. As a result, the Coalition will not develop a strategy to manage cadmium.

Nickel

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. Metallic nickel is insoluble in water but complexes with several other compounds in oxidation states from -1 to +4 and 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 also 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. The Coalition will address developing methods to source nickel when it becomes a priority.

Arsenic

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). California Department of Pesticide Regulation records indicate no use of sodium cacodylate across the Coalition region between 1998 and 2007 for agricultural use.

At this point the source of arsenic is unclear although native soils can contain elevated concentrations of arsenic. The Coalition will work with the Regional Board to determine if it is feasible to obtain the necessary data to establish background levels when arsenic becomes a priority.

DO

The Grant Line near Calpack drain is a non-moving water body that heats up in the summer and has no mechanism for mixing the water column. Additionally, there is a large amount of photosynthetic activity in the drain, all of which can contribute to low DO. When the water level in the drain reaches a set level, a pump is activated which pumps water over the levee into

Grant Line Canal. When the water is pumped into the canal, the water is oxygenated eliminating the low DO problem. In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. Three of the samples collected at Grant Line Canal contained measurable amounts of BOD and two of the three samples experienced an exceedance of the DO WQTL (Table XIII-6). One of the two samples with no measureable BOD experienced an exceedance, the other sample did not. These results do not eliminate BOD as a cause of low DO and it is not clear what the cause of low DO at this site is. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Table V-7. Grant Line Canal near Calpack. BOD, pH, and dissolved oxygen results for September 2006 – July 2007. ND = non detect.

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
Grant Line Canal near Calpack Rd	9/19/2006	6.67	2.8	ND
Grant Line Canal near Calpack Rd	2/11/2007	7.3	8.9	6
Grant Line Canal near Calpack Rd	2/28/2007	6.95	7.74	ND
Grant Line Canal near Calpack Rd	4/11/2007	6.89	2.76	8
Grant Line Canal near Calpack Rd	7/10/2007	6.9	6.2	6

Specific Conductivity/ Total Dissolved Solids (TDS)

Specific conductivity (EC) and Total Dissolved Solids (TDS) are measures of salt and are often found as exceedances together. EC and TDS exceedances are common in site subwatersheds in the Delta where shallow salty ground water commonly intrudes into the surface water drains. Also, irrigation water is salty do to the recirculation of the water from the Delta Mendota Canal back to the San Joaquin River. The Coalition recognizes that EC and TDS exceedances need to be to be managed on a regional basis and will work with the Regional Board to develop a management plan when EC/TDS become a priority.

E. coli

E. coli exceedances occurred 15 times since 2005 in both the storm and irrigation seasons (Table V-3). The Coalition performed a pilot study to understand the sources of *E. coli* in the site subwatershed. Molecular markers were used to distinguish human, bovine, and avian sources. Human, bovine, and avian molecular markers were found in the watershed indicating active inputs from all three species (Table V-8, V-9). Because this study was performed at a single time of the year with a limited set of potential hosts, a further study may be initiated to more fully understand bacterial contamination in the watershed. Until such time as the study is completed, the Coalition will not actively manage for *E. coli*. Once a better understanding of the *E. coli* dynamics is obtained, the Coalition will re-evaluate management options.

Table V-8. Grant Line Canal near Calpack Rd (544XGLCCR). Results of Bacteroides analysis. The Grant Line Canal subwatershed site was sampled only once. A + indicates the DNA was detected but at too low of a concentration to estimate a percentage.

Station Code	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
544XGLCCR	8/31/06	10:20	Grab	25	0	25

Table V-9. Grant Line Canal near Calpack Rd (544XGLCCR). Values of E. coli, fecal coliform, and total coliform in MPN/100mL, and the average C_T value for the All bacteria, human Bacteroides, bovine Bacteroides, and chicken Bacteroides. C_T values are not comparable across samples and are not absolute measures of the quantity of DNA in the sample.

Station Code	Sample Date	Sample Time	Sample Type	E. coli	Fecal Coliform	Total Coliform	Avg All Bac	Avg Human	Avg. Bovine	Avg Chicken
544XGLCCR	8/31/06	10:20	Grab	280	9400	22000	25.19	27.86	39.5	27.88

Color

Color is a non-conserved indicator of biological and physical inputs to the system and is not possible to manage unless the causes are known. Determining the causes of color is not a priority and the Coalition will not attempt to manage these constituents.

2008 Management Plan Monitoring

Since there have been no chlorpyrifos exceedances and no *Ceriodaphnia* toxicity since 2006 the Coalition will not be conducting Management Plan monitoring for these constituents during the irrigation season of 2008. The Coalition will conduct normal monitoring for *Selenastrum* in this subwatershed during the 2008 irrigation season since there is no suitable upstream location to sample and additional sampling would not aid in source identification for this particular site subwatershed.

VI. GRANT LINE CANAL @ CLIFTON COURT ROAD

Management Plan Constituents

Priority A

- Chlorpyrifos

Priority C

- Copper

Priority D

- *Hyalella azteca* sediment toxicity

Priority E

- Arsenic
- DDE
- Nickel
- Lead
- Dissolved Oxygen
- pH
- Specific Conductivity
- Color
- Total Dissolved Solids
- *E. coli*

Description of Grant Line Canal @ Clifton Court Road Site Subwatershed

Grant Line @ Clifton Court Road (756 irrigated acres) is located on the southwest section of Union Island. The site is west of the Grant line Canal @ Calpack Rd site immediately south of Clifton Court and drains fields east and south. The crops are primarily alfalfa, field crops, tomatoes and grain (Figure .

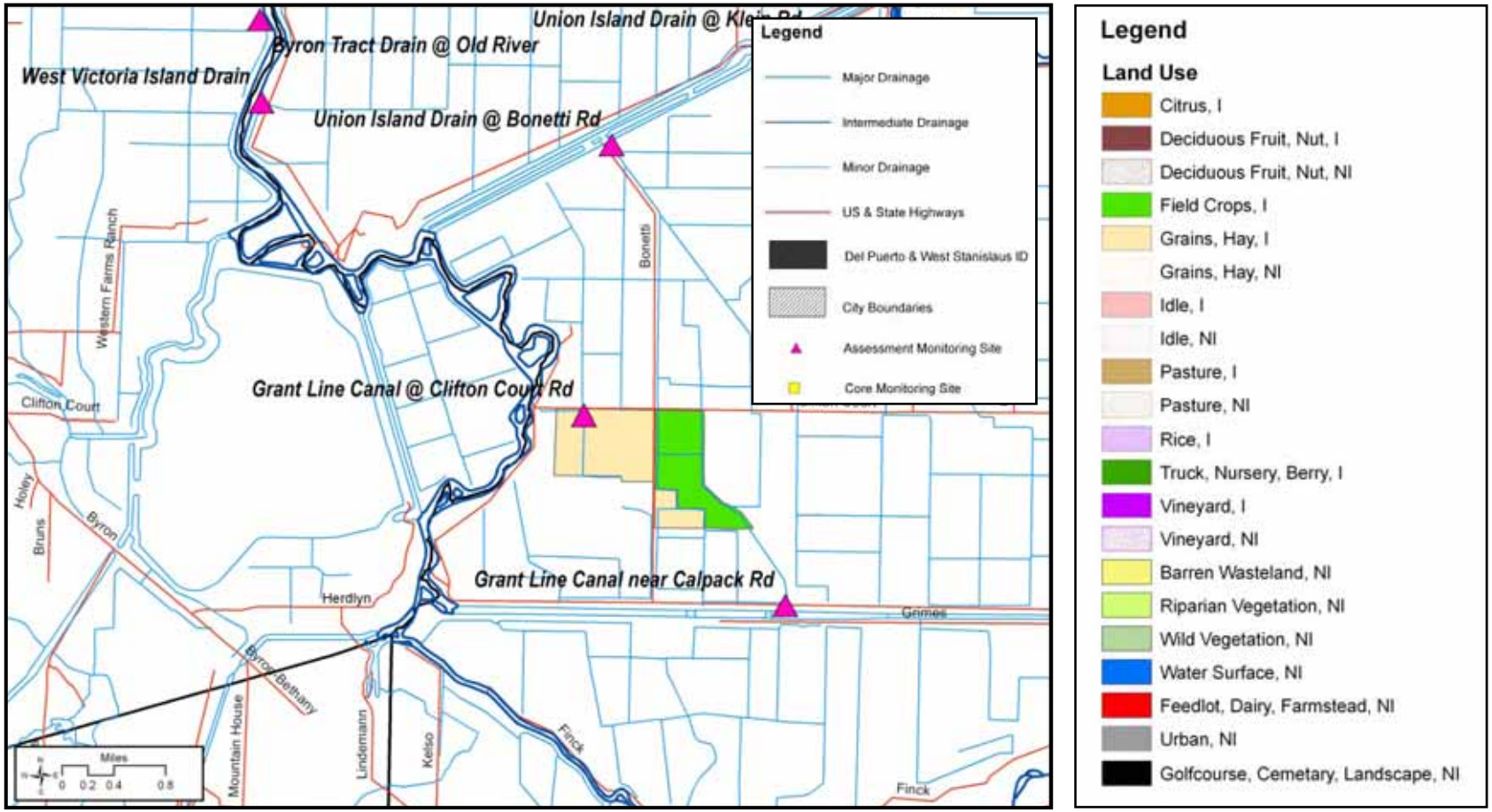
The Grant Line Canal (GLC) is located in the Bay-Delta tidal prism and receives water from east and west inputs. Source water of the GLC depends on delta tides, natural flows of large water bodies such as the San Joaquin River (SJR), and the operation of agriculture barriers.

In normal low flow conditions, water from the San Joaquin River enters Old River and makes its way to GLC via Salmon Slough and Doughty Cut. The GLC is also filled from Old River (just south of Coney Island) when delta tides are coming in and the SJR flow is pushed upstream.
Hence, GLC waters are a mix of both SJR water and Delta Mendota/California Aqueduct export water. It should also be noted that the Sacramento River water is pulled across the Delta to the export pumps, and thus the Old River receives input from the Sacramento River source water where it intersects with the western end of GLC. Under normal operating conditions, no GLC water enters Old River to the Central Delta because the flow moves west in the direction of the Aqueduct exports (due to high export demand). Therefore, all of the SJR water which entered

Old River and GLC typically ends up at the pumps regardless of the tides. Only during high flows (flood) does any SJR water enter Paradise cut and contribute to GLC. Paradise is a by-pass for such flows, not naturally connected to the SJR.

When incoming tides fill the South Delta channels, agriculture barriers function to hold water in the Delta to provide water depth for local diversions. Under these conditions, additional Sacramento River water enters the GLC via the Middle River because the GLC barrier low enough (and notched) to allow trapped water to flow out of the GLC in order to lessen the stagnant zones that export pumping and barriers create. Again, all of the mixed SJR water and Sacramento River water ends up in the export pumps and does not reach the Central Delta, the Bay or the ocean. The temporary GLC barrier is located near the Tracy Blvd bridge so that the channel is divided in two. This affects how much water is in any particular stretch of the channel, but not the sources and eventual destination. Old River from Indian Slough almost always experiences a net flow south to the export pumps. There is some flow fluctuation due to tides in this stretch, but the direction of flow does not change except in very high SJR flows which are only present during high flood risk events. Therefore, the waters of the GLC will almost always drain to the Delta Mendota Canal or the California Aqueduct.

Figure VI-1. Site subwatershed map of land use for Grant Line Canal @ Clifton Court Rd sample site. The highlighted points mark current sampling sites.



Subwatershed Monitoring History

Monitoring was initiated at the Grant Line Canal @ Clifton Court Rd monitoring site during the storm season of 2005 (Table VI-1). Samples were collected from this site for field parameters and the analysis of chemistry and toxicity. One sampling event occurs over a one-month period and consists of normal monitoring as well as resampling and management plan monitoring where appropriate. Specific information on the analysis conducted across each of the monitoring seasons is provided below (Table VI-2). Exceedances of field and physical parameters, *E. coli*, pesticides, metals and sediment toxicity have been detected at this site. A summary and discussion of these exceedances is provided in the next section (Table VI-3, VI-4).

The Grant Line Canal is not considered impaired in the current Basin Plan, however the Old River section that runs from the San Joaquin River to the Delta Mendota Canal, parallel to the Canal, is 303d listed and is impaired as a result of low dissolved oxygen. The export waters of the Delta, including the Delta Mendota Canal and the California Aqueduct which receive water from Grant Line Canal, are listed for numerous constituents including chlorpyrifos, DDT, diazinon, electrical conductivity, exotic species, group A pesticides, mercury and unknown toxicity.

Grant Line Canal @ Clifton Court Rd will be an Assessment Monitoring location under the new MRPP and the first monitoring rotation will occur in 2031. Until that time, the Coalition will continue to conduct Management Plan monitoring at this site. Management Plan monitoring is described in better detail later in this document.

Table VI-1. Grant Line Canal @ Clifton Court Rd sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Events Sampled	None	2	5	2	5	2	6

Table VI-2. Grant Line Canal @ Clifton Court Rd. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Field and Physical Parameters						
pH	1	5	3	5	3	9
Electrical Conductivity	2	5	3	5	3	9
Dissolved Oxygen	2	5	3	4	3	9
Total Dissolved Solids	2	5	2	5	2	6
Turbidity	2	5	2	5	2	6
E. coli	2	5	2	5	2	7
Color	2	5	2	5	2	6

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Total Organic Carbon	2	5	2	5	2	6
Biological Oxygen Demand				1	2	2
Carbamates						
Aldicarb				5	2	6
Carbaryl				5	2	6
Carbofuran				5	2	6
Methiocarb				5	2	6
Methomyl				5	2	6
Oxamyl				5	2	6
Organochlorines						
DDD				5	2	6
DDE				5	2	6
DDT				5	2	6
Dicofol				5	2	6
Dieldrin				5	2	6
Endrin				5	2	6
Methoxychlor				5	2	6
Organophosphates						
Azinphos methyl				5	2	6
Chlorpyrifos	2	5	2	5	2	6
Diazinon	2	5	2	5	2	6
Dimethoate				5	2	6
Disulfoton				5	2	6
Malathion				5	2	6
Methamidophos				5	2	6
Methidathion				5	2	6
Parathion, Methyl				5	2	6
Phorate				5	2	6
Phosmet				5	2	6
Pyrethroids						
Bifenthrin		1	2	5	2	6
Cypermethrin	2	5	2	5	2	6
Cyhalothrin, lambda	2	5	2	5	2	6
Permethrin	2	5	2	5	2	6
Cyfluthrin		1	2	5	2	6
Esfenvalerate/ Fenvalerate	2	5	2	5	2	6
Triazines						
Atrazine				5	2	6
Cyanazine				5	2	6
Diuron				5	2	6
Glyphosate				5	2	6
Linuron				5	2	6
Molinate				5	2	6
Paraquat dichloride				5	2	6
Simazine				5	2	6
Thiobencarb				5	2	6
Metals						

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Arsenic				5	2	6
Boron				5	2	6
Cadmium				5	2	6
Copper				5	2	8
Lead				5	2	6
Nickel				5	2	6
Selenium				5	2	2
Zinc				5	2	6
Nutrients						
Nitrate as NO3				5	2	6
Nitrite as Nitrogen				5	2	6
Ammonia				5	2	6
Hardness				5	2	8
Total Phosphorus				5	2	6
Orthophosphate				5	2	6
TKN				5	2	6
Toxicity						
Ceriodaphnia dubia	2	5	2	5	2	7
Pimephales promelas	2	5	2	5	2	7
Selenastrum capricornutum	2	5	2	5	2	7
Hyalella azteca		3	1	1	2	1

Exceedance History

During Coalition monitoring, exceedances of WQTL for field and physical parameters, *E. coli*, metals, pesticides, and sediment toxicity have occurred at this site. During the irrigation season of 2007, exceedances detected at the site included dissolved oxygen (6), pH (2), specific conductance (6), color (8), dissolved solids (5), *E. coli* (5), arsenic (4), nickel (6), DDE (1), DDT (1), cadmium (7), copper (2), lead (3), carbofuran (1), and chlorpyrifos (3) (Table VI-3, VI-4). There was no water column or sediment toxicity detected during monitoring in 2007. Samples collected over the entire three years of monitoring at the Grant Line Canal @ Clifton Court Rd sample site resulted in 17 exceedances of dissolved oxygen, six of pH, 11 of specific conductance, 22 of color, 10 of dissolved solids, 16 of *E. coli*, six of arsenic, 11 of nickel, two of DDE, one of DDT, one of ammonia, 12 of cadmium, five of copper, eight of lead, one of carbofuran, four of chlorpyrifos, and one of dimethoate (Table VI-3, VI-4). Two sediment samples tested toxic to *Hyalella azteca*, however there was no toxicity in the water column. All exceedances are listed in Table VI-3 and Table VI-4 by season and date and are based on water quality trigger limits (WQTL) listed in the introduction of the SJCDWQC Management Plan. The priority level (A-E) assigned to each constituent is listed in the bottom row of Table VI-3 and Table VI-4 for those analytes with two or more exceedances over the last three years.

Table VI-3. Field, bacteria, inorganic and legacy pesticide exceedances experienced in samples collected from Grant Line Canal @ Clifton Court Rd.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	pH, none	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Arsenic[1], µg/L	Nickel[1], µg/L	DDE(p,p')[1], µg/L	DDT(p,p')[1], µg/L
Grant Line Canal @ Clifton Court Rd	Irrigation	17/May/2005			801	250	550					
Grant Line Canal @ Clifton Court Rd	Irrigation	21/Jun/2005	5.4			300						
Grant Line Canal @ Clifton Court Rd	Irrigation	19/Jul/2005	6.4			750		1600				
Grant Line Canal @ Clifton Court Rd	Irrigation	16/Aug/2005	4.7			2000		1600				
Grant Line Canal @ Clifton Court Rd	Irrigation	20/Sep/2005	3.8			1000						
Grant Line Canal @ Clifton Court Rd	Irrigation	16/May/2006		6.48		180		2400		15		
Grant Line Canal @ Clifton Court Rd	Irrigation	20/Jun/2006	6.36			1100	530	550	12	70 (50.4)		
Grant Line Canal @ Clifton Court Rd	Irrigation	18/Jul/2006	3.6			300		1600		48		
Grant Line Canal @ Clifton Court Rd	Irrigation	15/Aug/2006	2.5	6.42		500		920		18		
Grant Line Canal @ Clifton Court Rd	Irrigation	19/Sep/2006	2.1	5.99	814	2800	600	360	35	150	0.014	
Grant Line Canal @ Clifton Court Rd	Irrigation	11/Apr/2007	3.56			100	480					
Grant Line Canal @ Clifton Court Rd	Irrigation	22/May/2007	5.77			320			20	36		
Grant Line Canal @ Clifton Court Rd	Irrigation	12/Jun/2007	4.09			120		2400		13		
Grant Line Canal @ Clifton Court Rd	Irrigation	20/Jun/2007	4		1011							
Grant Line Canal @ Clifton Court Rd	Irrigation	10/Jul/2007	0.14			200		2400	11	20		
Grant Line Canal @ Clifton Court Rd	Irrigation	07/Aug/2007			997	250	590	2400	14	15		
Grant Line Canal @ Clifton Court Rd	Irrigation	09/Aug/2007			810							
Grant Line Canal @ Clifton Court Rd	Irrigation	04/Sep/2007			838	170	550	1700	14	17		
Grant Line Canal @ Clifton Court Rd	Storm	16/Feb/2005	5.3		1743	100	1200	240				
Grant Line Canal @ Clifton Court Rd	Storm	21/Mar/2005	3.8		1715	100	1100	240				
Grant Line Canal @ Clifton Court Rd	Storm	27/Feb/2006				250		500				
Grant Line Canal @ Clifton Court Rd	Storm	15/Mar/2006				300		500				
Grant Line Canal @ Clifton Court Rd	Storm	27/Apr/2006	1.1	6.11	1214							
Grant Line Canal @ Clifton Court Rd	Storm	11/Feb/2007			1204	120	740	240				
Grant Line Canal @ Clifton Court Rd	Storm	28/Feb/2007		6.37	1099	750	700			25	0.008	0.01
Grant Line Canal @ Clifton Court Rd	Storm	07/Mar/2007	4.21	6.3								
Constituent Priority			**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	

[1]Montitoring for this analyte was not initiated until May of 2006.

Table VI-4. Nutrients, metals, pesticides and toxicity exceedances experienced in samples collected from the Grant Line Canal @ Clifton Court Rd monitoring site.

Station Name	Season	Sample Date	Ammonia as N[1], mg/L	Cadmium, µg/L	Copper[1, 2], µg/L	Lead[1, 2], µg/L	Carbofuran[1], µg/L	Chlorpyrifos, µg/L	Dimethoate[1], µg/L	Hyalella azteca, Survival (%)
Grant Line Canal @ Clifton Court Rd	Irrigation	20/Sep/2005								8.8
Grant Line Canal @ Clifton Court Rd	Irrigation	16/May/2006		0.08		2.2				
Grant Line Canal @ Clifton Court Rd	Irrigation	20/Jun/2006		0.4	52 (9)	15 (3.02)				
Grant Line Canal @ Clifton Court Rd	Irrigation	18/Jul/2006	1.8	0.3	31 (10.9)	7.2 (4.01)			11	
Grant Line Canal @ Clifton Court Rd	Irrigation	15/Aug/2006		0.07		2.6				
Grant Line Canal @ Clifton Court Rd	Irrigation	19/Sep/2006		0.9	100 (27.9)	35 (16.25)				
Grant Line Canal @ Clifton Court Rd	Irrigation	11/Apr/2007					0.09			
Grant Line Canal @ Clifton Court Rd	Irrigation	22/May/2007		0.2	24 (19)	6.1				
Grant Line Canal @ Clifton Court Rd	Irrigation	12/Jun/2007		0.08						
Grant Line Canal @ Clifton Court Rd	Irrigation	10/Jul/2007		0.1	17 (14.7)	3.2				
Grant Line Canal @ Clifton Court Rd	Irrigation	07/Aug/2007		0.1		2.5				
Grant Line Canal @ Clifton Court Rd	Irrigation	04/Sep/2007		0.06				0.13		
Grant Line Canal @ Clifton Court Rd	Storm	21/Mar/2005						0.02		
Grant Line Canal @ Clifton Court Rd	Storm	27/Apr/2006								91.25
Grant Line Canal @ Clifton Court Rd	Storm	11/Feb/2007		0.06				0.08		
Grant Line Canal @ Clifton Court Rd	Storm	28/Feb/2007		0.08				0.018		
Constituent Priority				**E**	**C**	**E**		**A**		**D**

[1]Montitoring for this analyte was not initiated until May of 2006.
[2]Water quality trigger for each sample is based on hardness and is shown in parenthesis.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at the Grant Line Canal @ Clifton Court Rd monitoring site for the constituent copper in June and September. Copper exceedances occurred in May and July during normal monitoring (NM) events. The amount of copper detected in MPM samples was not above the WQTL (based on hardness) (Table VI-5).

Table VI-5. Grant Line Canal @ Clifton Court Rd. Normal monitoring (NM) and Management Plan monitoring (MPM) results for copper from the 2007 irrigation season. Exceedance values are in bold.

Monitoring Type	NM	NM	NM	MPM	NM	NM	NM	MPM
Date	4/10/07	5/22/07	6/12/07	6/20/07	7/10/07	8/07/07	9/04/07	9/25/07
Copper (ug/L)	5.5	**24**	10	8.5	**17**	10	8.5	3.7

Load Calculations

Loads were calculated for chlorpyrifos and copper detections based on the following formula (Table VI-6):

Load = Discharge (cfs) X 28.317L/ft^3 X Concentration (milligram/L X 1000 or µg/L).

The load values presented for constituents 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 a normalization of the concentrations by flow for various constituents at the time the samples were collected.

Table VI-6. Loads of chlorpyrifos and copper calculated from concentration and discharge measured for each detection at the Grant Line Canal monitoring site.

Analyte Name	Sample Date	Discharge cfs	Result µg/L	Instantaneous Loading Rate
Chlorpyrifos	21-Mar-05	0	0.02	0
Chlorpyrifos	11-Feb-07	0	0.08	0
Chlorpyrifos	28-Feb-07	0	0.018	0
Chlorpyrifos	23-Jan-08	0	0.14	0
Copper	16-May-06	1.47	9	374.63
Copper	20-Jun-06	3.58	52	5271.49
Copper	18-Jul-06	0	31	0
Copper	15-Aug-06	0	11	0
Copper	19-Sep-06	0	100	0
Copper	11-Feb-07	0	4.7	0
Copper	28-Feb-07	0	6.7	0
Copper	22-May-07	0	24	0

Analyte Name	Sample Date	Discharge cfs	Result µg/L	Instantaneous Loading Rate
Copper	22-May-07	0	26	0
Copper	12-Jun-07	0	10	0
Copper	20-Jun-07	0	8.5	0
Copper	07-Aug-07	0	10	0
Copper	25-Sep-07	0	3.7	0
Copper	23-Jan-08	0	7.3	0

Source Identification

Priority A Constituents

Chlorpyrifos

The WQTL for chlorpyrifos (0.015 µg/L) has been exceeded at this site during the months of March (2005), February (2007) and September (2007) (Table VI-4). Numerous applications of chlorpyrifos were made prior to sampling in March 2005, but applications were made substantially before the September and February 2007 exceedances (Table VI-7, Figure VI-2). None of the exceedances resulted in toxicity to *Ceriodaphnia*. It is likely that all applications were made aerially to alfalfa or asparagus and it is possible that drift could be responsible for the March 2005 exceedance. The remaining exceedances are most likely the result of furrow or flood irrigation.

Table VI-7. Number of chlorpyrifos applications, pounds applied and acres treated for each month and year of application in the Grant Line Canal @ Clifton Court Rd site subwatershed.

Month	Number of Chlorpyrifos Applications	Pounds Product Applied	Acres Treated
March 2005	12	233.52	549.2
July 2005	9	348.46	746
August 2005	4	218.78	275.68
September 2005	2	99.15	198
March 2006	3	142.80	286.5
April 2006	5	50.32	202
August 2006	9	319.80	594.9
September 2006	1	51.58	103
October 2006	6	297.51	318
July 2007	6	283.24	282
2005 Total	27	899.90	1768.88
2006 Total	24	862.01	1504.4
2007 Total	6	283.24	282
TOTAL	**57**	**2045.16**	**3555.28**

Figure VI-2. Pounds of chlorpyrifos added to TRS within the Grant Line Canal @ Clifton Court Rd site subwatershed by month for 2005-2007.

Asterisk (*) denotes months in which chlorpyrifos exceedances were detected at the site.

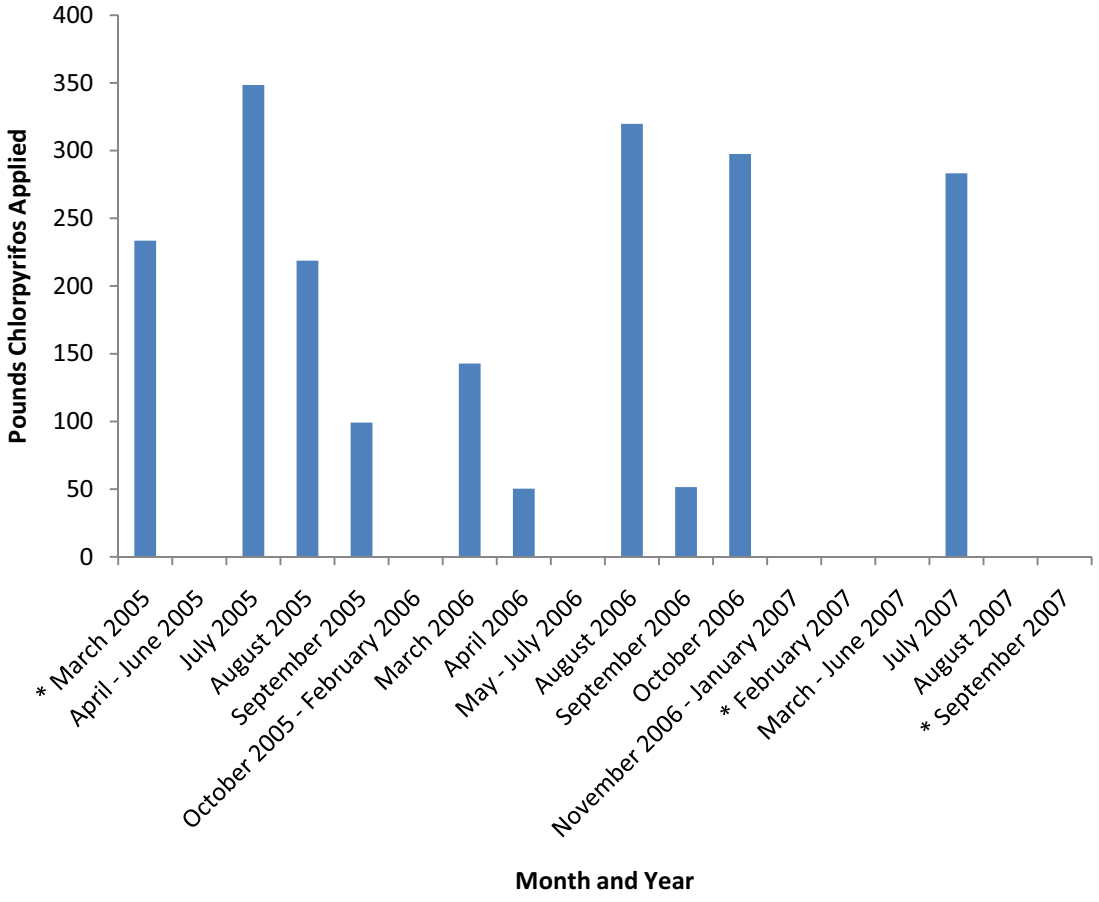


Table VI-8. All TRS that had more than one application associated with the exceedance of chlorpyrifos in March of 2005. Table shows the number of applications associated with the exceedance for a given TRS. There are no recorded applications during the months prior to exceedances detected in 2007.

TRS	Date of Associated Exceedance
	3/21/2005
1S4E14	3
1S4E16	2
1S4E21	4
1S4E22	2

Priority C Constituents

Copper

The WQTL for copper is variable based on hardness has been exceeded at this site during the months of June, July, September (2006), and May and July (2007) (Table VI-4). None of the exceedances was associated with toxicity to *Selenastrum*. Copper is applied during March (Table VI-9, Figure VI-3) but appears to be mobilized during the summer probably as a result of furrow or flood irrigation. Copper applications are limited to two sections (Table VI-10).

Table VI-9. Number of copper applications, pounds applied and acres treated for each month and year of application in the Grant Line Canal @ Clifton Court Rd site subwatershed. Copper applications occurred only during the month of March in 2006 and 2007.

Month	Number of Copper Applications	Pounds Product Applied	Acres Treated
March 2006	5	675.29	438.5
March 2007	4	537.25	437
TOTAL	**9**	**1212.54**	**875.5**

Figure VI-3. Grant Line Canal @ Clifton Ct. Pounds of copper added to TRS within the Grant Line Canal @ Clifton Court Rd site subwatershed by month for 2006-2007. Asterisk (*) denotes months in which chlorpyrifos exceedances were detected at the site.

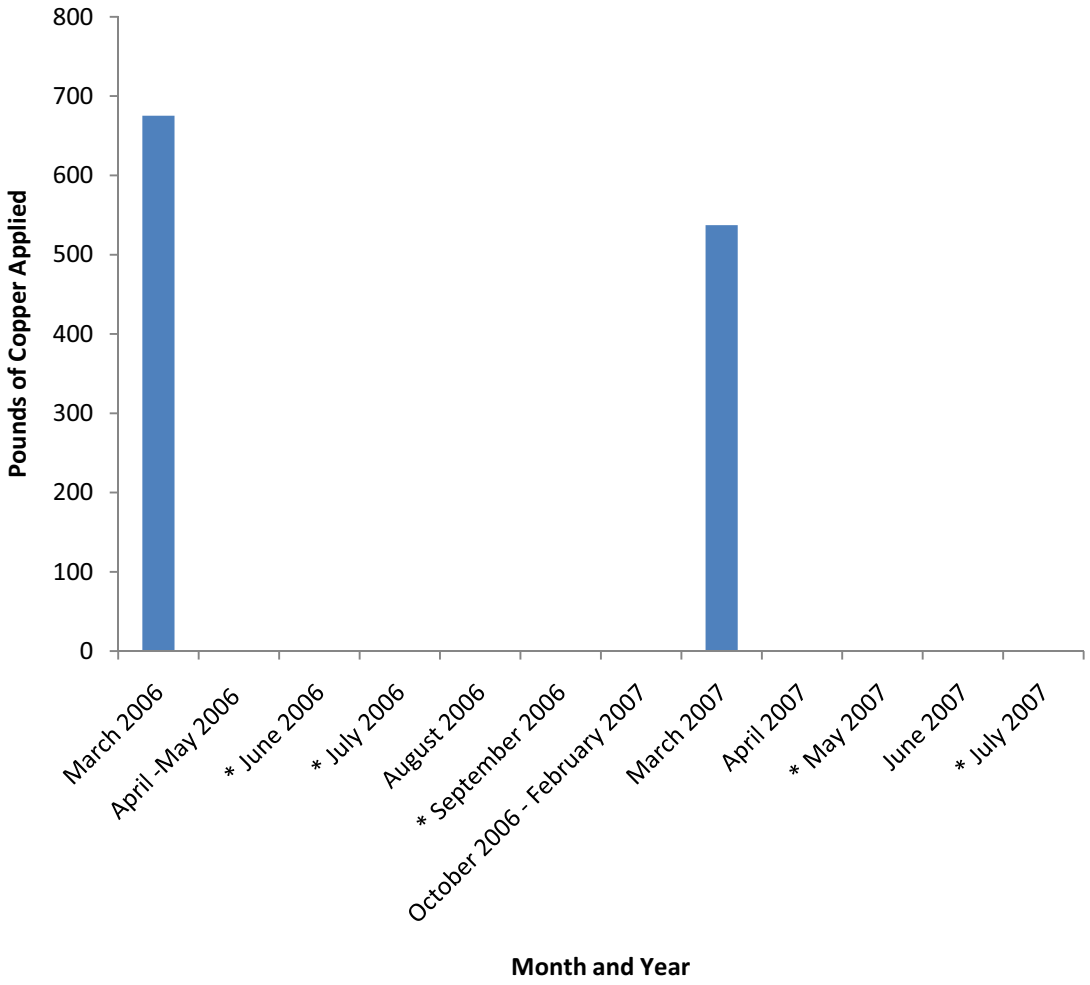


Table VI-10. Grant Line Canal @ Clifton Ct. All TRS that had more than one application associated with an exceedance for copper in 2006 and 2007. Table shows which exceedance the application was associated with and number of applications associated with an exceedance for a given TRS. Exceedance dates not included in this table do not have copper applications associated with them.

TRS	Exceedance Date	
	5/22/2007	6/20/2006
1S4E22	2	2
1S4E23	2	3

Priority D Constituents

Hyalella azteca toxicity

Sediment toxicity to *Hyalella azteca* is the only priority D constituent listed under the Grant Line Canal @ Clifton Court Rd Management Plan. Sediment toxicity occurred in samples collected during the months of September (2005) and April (2006) (Table VI-4). No chemical analyses were performed on the sediment so the chemical causing toxicity is unknown. However, pyrethroid pesticides have been associated with sediment toxicity in other studies, and pyrethroids have been applied in this site subwatershed. Applications have been made aerially, and furrow and flood irrigation are common allowing the possibility that sediments containing pyrethroids or other constituents toxic to *Hyalella* are moved to the drain resulting in sediment toxicity.

Priority E Constituents

Cadmium

Since the time of this exceedance, the WQTL for cadmium has increased to 5 µg/L and the exceedances listed above are therefore no longer considered an exceedance. As a result, the Coalition will not develop a strategy to manage cadmium.

Nickel

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. Metallic nickel is insoluble in water but complexes with several other compounds in oxidation states from -1 to +4 and 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 also 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. The Coalition will address developing methods to source nickel when it becomes a priority.

Arsenic

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). California Department of Pesticide Regulation records indicate no use of sodium cacodylate across the Coalition region between 1998 and 2007 for agricultural use.

At this point the source of arsenic is unclear although native soils can contain elevated concentrations of arsenic. The Coalition will work with the Regional Board to determine if it is feasible to obtain the necessary data to establish background levels when arsenic becomes a priority.

DO

Grant Line Canal is a water body that moves only when a pump is activated. The drain heats up in the summer and there is no mechanism for mixing the water column. Additionally, there is a large amount of photosynthetic activity in the drain, all of which can contribute to low DO. When the water level in the drain reaches a set level, a pump is activated which pumps water over the levee into Grant Line Canal. When the water is pumped into the canal, the water is oxygenated eliminating the low DO problem. In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. Three of the samples collected at Grant Line Canal contained measurable amounts of BOD and two samples experienced an exceedance of the DO WQTL (Table XIII-6). The third sample with measureable BOD did not experience an exceedance. One of the two samples with no measureable BOD experienced an exceedance, the other sample did not. These results do not eliminate BOD as a cause of low DO and it is unknown what the cause of low DO at this site is. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Table VI-11. Grant Line Canal @ Clifton Court Rd. BOD, pH, and dissolved oxygen results for September 2007 – July 2007. ND = non-detect.

StationName	SampleDate	pH	Oxygen, Dissolved	BOD, mg/L
Grant Line Canal @ Clifton Court Rd	9/19/2006	5.99	2.1	29
Grant Line Canal @ Clifton Court Rd	2/11/2007	6.58	7.47	ND
Grant Line Canal @ Clifton Court Rd	2/28/2007	6.37	10.88	17
Grant Line Canal @ Clifton Court Rd	4/11/2007	6.76	3.56	ND
Grant Line Canal @ Clifton Court Rd	7/10/2007	6.8	0.14	30

Specific Conductivity/ Total Dissolved Solids (TDS)

Specific conductivity (EC) and Total Dissolved Solids (TDS) are measures of salt and are often found as exceedances together. EC and TDS exceedances are common in site subwatersheds in the Delta where shallow salty ground water commonly intrudes into the surface water drains. Also, irrigation water is salty due to the recirculation of the water from the Delta Mendota Canal back to the San Joaquin River. The Coalition recognizes that EC and TDS exceedances need to be to be managed on a regional basis and will work with the Regional Board to develop a management plan when EC/TDS become a priority.

E. coli

Grant Line Canal @ Clifton Court Rd was not sampled for the 2006 *E. coli* study.

E. coli exceedances occurred 15 times since 2005 in both the storm and irrigation seasons. No manure is known to be applied in the watershed, and there are no urban inputs. The source of the *E. coli* is unknown at this time. The Coalition will address additional sourcing

Color/pH

Color and pH are non-conserved indicators of biological and physical inputs to the system and are not possible to manage unless the causes are known. Determining the causes of color or changes in pH is not a priority and the Coalition will not attempt to manage these constituents.

DDE

DDE is a breakdown product of DDT and indicates that DDT was applied several decades prior to sampling. DDE is found primarily bound to sediments and was likely included in the water sample due to bottom sediments that were mobilized by storm flows or the samplers themselves. The Coalition will not manage for DDE.

2008 Management Plan Monitoring

Additional Management Plan monitoring was conducted during the 2007 irrigation season for copper in June and September. No upstream monitoring is possible in this site subwatershed. The Coalition will continue to conduct normal monitoring in this site subwatershed for copper during the 2008 irrigation. Additional monitoring will not aid in sourcing copper exceedances at this time.

VII. KELLOGG CREEK

Management Plan Constituents

Priority C

- Copper

Priority D

- *Ceriodaphnia dubia* water column toxicity
- *Hyalella azteca* sediment toxicity

Priority E

- DDE
- DDT
- DO
- pH
- Specific Conductivity
- Color
- Total Dissolved Solids
- *E. coli*

Description of Kellogg Creek Site Subwatershed

Kellogg Creek @ Highway 4 (3,343 irrigated acres) is located just southeast of Discovery Bay, the site drains field crops immediately upstream (Figure VII-1). The headwaters of Kellogg Creek originate on Mt. Diablo and from there the creek flows north and east towards the city of Brentwood and then east towards Discovery Bay. Kellogg Creek runs through Discovery Bay and drains into Indian Slough in the western Delta. From the monitoring location, the watershed contains a combination of urban and agricultural land, with the agricultural land being primarily irrigated pasture, field crops, and deciduous orchards. Highway 4 runs adjacent to the monitoring site which could be influenced by storm water runoff from the roadway and businesses along Highway 4. To isolate the source of toxicity from agriculture, an additional monitoring location was established upstream in September 2005 at Kellogg Creek along Hoffman Lane.

Kellogg Creek along Hoffman Lane (2,116 irrigated acres) is upstream from Kellogg Creek @ Hwy 4 which was sampled in 2004 and 2005. Kellogg Creek @ Hwy 4 is no longer sampled because of large urban inputs. Deciduous orchards are the predominant crop grown in the Kellogg Creek along Hoffman Lane site subwatershed along with some nursery, berry, and some field crops (Figure VII-2).

Figure VII-1. Site subwatershed map of land use for past monitoring site at Kellogg Creek @ Hwy 4.

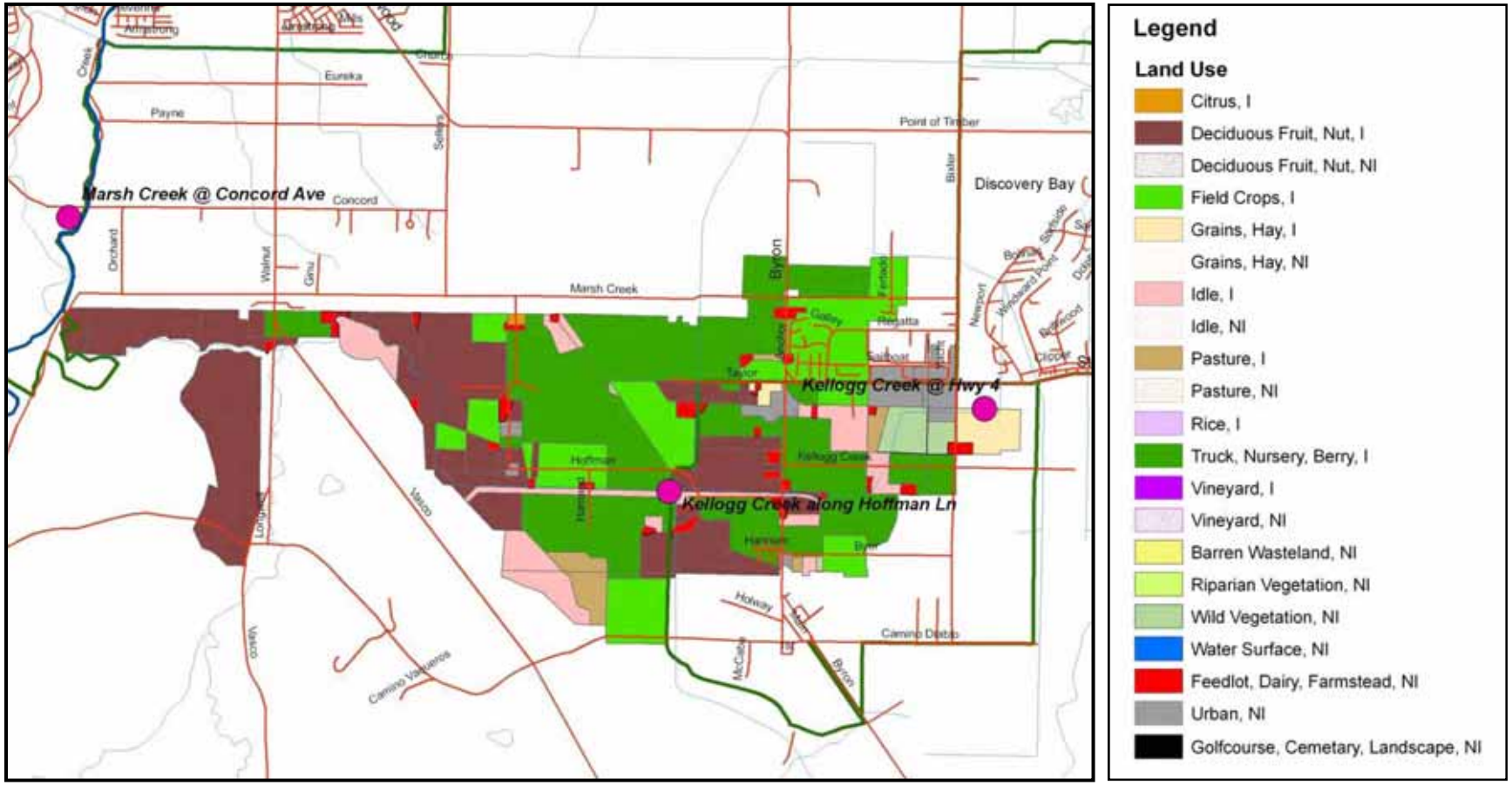
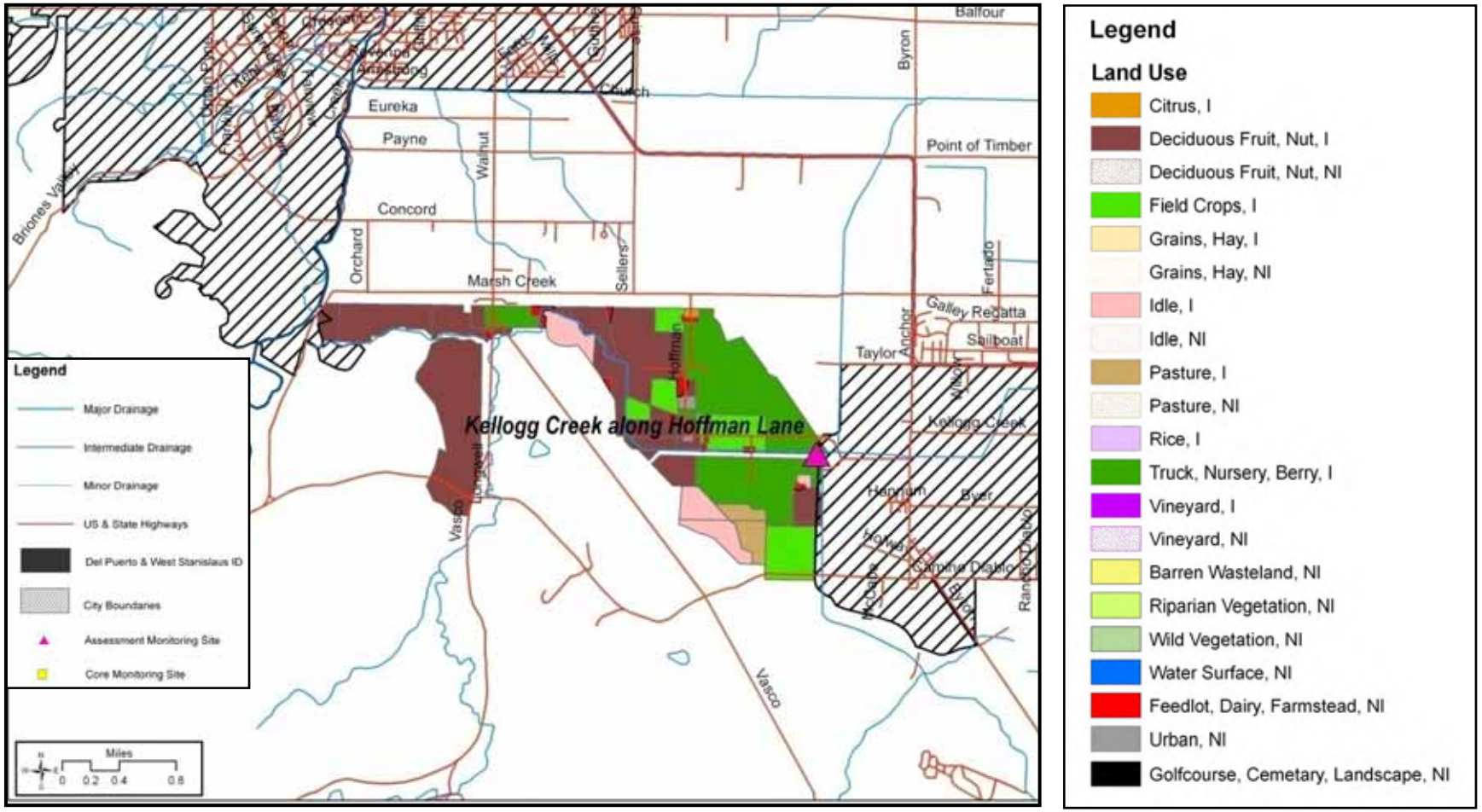


Figure VII-2. Site subwatershed map of land use for sample site at Kellogg Creek along Hoffman Lane.



Subwatershed Monitoring History

Coalition ambient water monitoring at the Kellogg Creek @ Hwy 4 sampling site was initiated in the storm season of 2004/2005 and was carried out for three seasons, ending with the storm season of 2005/2006 (Table VII-1). Monitoring at the Kellogg Creek along Hoffman Lane site was initiated in the irrigation season of 2005 and the site has been monitored since that time (Table VII-2). The constituents monitored by year and season are included in Table VII-3 for the Hwy 4 site and Table VII-4 for the Hoffman Lane site. During sampling at these two sites, exceedances of field and physical parameters, *E. coli*, metals, nutrients, pesticides, and sediment and water column toxicity have occurred. Details on these exceedances are provided in Table VII-5 and discussed in the next section.

The Kellogg Creek is not considered impaired in the Basin Plan.

Kellogg Creek along Hoffman Lane will be an Assessment Monitoring location under the new MRPP. Assessment Monitoring at this site will not begin until after 2031.

Table VII-1. Kellogg Creek @ Highway 4 sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	None	2	5	2	None	None	None

Table VII-2. Kellogg Creek along Hoffmann Lane sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	None	None	1	2	5	2	6

Table VII-3. Kellogg Creek @ Highway 4. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2005		2006
	Storm	Irrigation	Storm
Field and Physical Parameters			
pH	2	7	3
Electrical Conductivity	3	8	3
Dissolved Oxygen	3	8	3
Total Dissolved Solids	2	5	2
Turbidity	2	5	2
E. coli	2	5	2
Color	2	5	2

Constituent	2005		2006
	Storm	Irrigation	Storm
Total Organic Carbon	2	5	2
Organophosphates			
Chlorpyrifos	2	5	2
Diazinon	2	5	2
Pyrethroids			
Bifenthrin		1	2
Cypermethrin	2	5	2
Cyhalothrin, lambda	2	5	2
Permethrin	2	5	2
Cyfluthrin		1	2
Esfenvalerate/ Fenvalerate	2	5	2
Toxicity			
Ceriodaphnia dubia	3	5	2
Pimephales promelas	2	7	2
Selenastrum capricornutum	2	8	2
Hyalella azteca		5	1

Table VII-4. Kellogg Creek along Hoffmann Lane. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2005	2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation
Field and Physical Parameters					
pH	1	4	5	3	9
Electrical Conductivity	1	4	5	3	9
Dissolved Oxygen	1	4	5	3	9
Total Dissolved Solids	1	2	5	2	6
Turbidity	1	2	5	2	6
E. coli	1	2	6	2	7
Color	1	2	5	2	6
Total Organic Carbon	1	2	5	2	6
Biological Oxygen Demand			1	2	2
Carbamates					
Aldicarb			5	2	6
Carbaryl			5	2	6
Carbofuran			5	2	6
Methiocarb			5	2	6
Methomyl			5	2	6
Oxamyl			5	2	6
Organochlorines					
DDD			5	2	6
DDE			5	2	6
DDT			5	2	6
Dicofol			5	2	6
Dieldrin			5	2	6
Endrin			5	2	6
Methoxychlor			5	2	6

Constituent	2005	2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation
Organophosphates					
Azinphos methyl			5	2	6
Chlorpyrifos	1	2	5	2	6
Diazinon	1	2	5	2	6
Dimethoate			5	2	6
Disulfoton			5	2	6
Malathion			5	2	6
Methamidophos			5	2	6
Methidathion			5	2	6
Parathion, Methyl			5	2	6
Phorate			5	2	6
Phosmet			5	2	6
Pyrethroids					
Bifenthrin	1	2	5	2	6
Cypermethrin	1	2	5	2	6
Cyhalothrin, lambda	1	2	5	2	6
Permethrin	1	2	5	2	6
Cyfluthrin	1	2	5	2	6
Esfenvalerate/ Fenvalerate	1	2	5	2	6
Triazines					
Atrazine			5	2	6
Cyanazine			5	2	6
Diuron			5	2	6
Glyphosate			5	2	6
Linuron			5	2	6
Molinate			5	2	6
Paraquat dichloride			5	2	6
Simazine			5	2	6
Thiobencarb			5	2	6
Metals					
Arsenic			5	2	6
Boron			5	2	6
Cadmium			5	2	6
Copper			5	2	6
Lead			5	2	6
Nickel			5	2	6
Selenium			5	2	2
Zinc			5	2	6
Nutrients					
Nitrate as NO3			5	2	6
Nitrite as Nitrogen			5	2	6
Ammonia			5	2	6
Hardness			5	2	6
Total Phosphorus			5	2	6
Orthophosphate			5	2	6
TKN			5	2	6
Toxicity					

Constituent	2005	2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation
Ceriodaphnia dubia	1	3	5	2	8
Pimephales promelas	1	2	5	2	9
Selenastrum capricornutum	1	2	5	2	7
Hyalella azteca		1			2

Exceedance History

Over the course of Coalition monitoring, exceedances of water quality trigger limits for field and physical parameters, *E. coli,* nutrients, metals, pesticides, and water column and sediment toxicity have occurred at this site (Table VII-5, VII-6). During the irrigation season of 2007, exceedances detected at the site included dissolved oxygen (2), pH (2) color (7), dissolved solids (1), *E. coli* (1), lead (1), DDE (2), DDT (1), nitrate (1) and copper (2). Sediment samples collected during the storm monitoring event tested toxic to *Hyalella azteca* in both the original and the follow-up sample, and water column toxicity to *Ceriodaphnia dubia* was detected once. For all years of monitoring between 2004 and 2007, eight DO exceedances, four pH exceedances, 12 electrical conductivity exceedances (EC), eight exceedances of total dissolved solids, 24 color, one nitrate and nine *E. coli* exceedances occurred. One exceedances of the chlorpyrifos WQTL, one of permethrin, three of DDE and two of DDT have been detected. The analysis of metals was initiated in 2006 for irrigation season sampling and three exceedances of the copper limit and one of lead have been detected. The site has also experienced water column toxicity to *Pimephales promelas* twice, to *Selenastrum capricornutum* once and to *Ceriodaphnia dubia* four times. Sediment sampling has resulted in toxicity to *Hyalella azteca* in three monitoring events including toxicity in one resample.

All exceedances are listed in Table VII-5 and Table VII-6 by site, season and date and are based on water quality trigger limits (WQTL) listed in the overall introduction of the SJCDWQC Management Plan. The priority level (A-E) assigned to each constituent is listed in the bottom row of Table VII-5 and Table VII-6 for those analytes with two or more exceedances within the last three years.

Table VII-5. Field, bacteria, inorganic and legacy pesticide exceedances experienced in samples collected from the previous and current Kellogg Creek monitoring sites between February 2005 and September 2007.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	pH, none	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Lead, µg/L	DDE(p,p')[1], µg/L	DDT(p,p')[1], µg/L	Nitrate as N, mg/L
Kellogg Creek @ Hwy 4	Irrigation	17/May/2005	5.8			200						
Kellogg Creek @ Hwy 4	Irrigation	21/Jun/2005				2000		300				
Kellogg Creek @ Hwy 4	Irrigation	19/Jul/2005		8.66	1485	60	890					
Kellogg Creek @ Hwy 4	Irrigation	16/Aug/2005	6.6		1447	50	950					
Kellogg Creek @ Hwy 4	Irrigation	23/Aug/2005			885							
Kellogg Creek @ Hwy 4	Irrigation	20/Sep/2005				150		900				
Kellogg Creek @ Hwy 4	Storm	16/Feb/2005				1000		1600				
Kellogg Creek @ Hwy 4	Storm	23/Feb/2005			990							
Kellogg Creek @ Hwy 4	Storm	21/Mar/2005			1136	30	680					
Kellogg Creek @ Hwy 4	Storm	27/Feb/2006			1512	250	890	1600				
Kellogg Creek @ Hwy 4	Storm	15/Mar/2006			1097	120	670	1600				
Kellogg Creek @ Hwy 4	Storm	27/Apr/2006	6		1112							
Kellogg Creek along Hoffman Ln	Irrigation	20/Sep/2005		8.72		20		1600				
Kellogg Creek along Hoffman Ln	Irrigation	16/May/2006				36						
Kellogg Creek along Hoffman Ln	Irrigation	20/Jun/2006				32						
Kellogg Creek along Hoffman Ln	Irrigation	18/Jul/2006	6.8			45		250		0.036	0.02	
Kellogg Creek along Hoffman Ln	Irrigation	15/Aug/2006	6.4			20						
Kellogg Creek along Hoffman Ln	Irrigation	19/Sep/2006	3.4			18						
Kellogg Creek along Hoffman Ln	Irrigation	11/Apr/2007				28						
Kellogg Creek along Hoffman Ln	Irrigation	22/May/2007				24						
Kellogg Creek along Hoffman Ln	Irrigation	12/Jun/2007				28						
Kellogg Creek along Hoffman Ln	Irrigation	10/Jul/2007				70				0.022	0.018	
Kellogg Creek along Hoffman Ln	Irrigation	07/Aug/2007		8.52		20						
Kellogg Creek along Hoffman Ln	Irrigation	25/Sep/2007	6.87	8.75								
Kellogg Creek along Hoffman Ln	Storm	27/Feb/2006			1761	200	990					
Kellogg Creek along Hoffman Ln	Storm	15/Mar/2006			1207	150	770	900				
Kellogg Creek along Hoffman Ln	Storm	27/Apr/2006			1030							
Kellogg Creek along Hoffman Ln	Storm	11/Feb/2007				60	720					13
Kellogg Creek along Hoffman Ln	Storm	28/Feb/2007				130		920	2.8	0.018		
Kellogg Creek along Hoffman Ln	Storm	07/Mar/2007	3.03									
Constituent Priority			**E**	**E**	**E**	**E**	**E**	**E**		**E**	**E**	

[1]Montitoring for this analyte was not initiated until May of 2006.

[2]Water quality trigger for each sample is based on hardness and is shown in parenthesis.

Table VII-6. Metals, pesticides and toxicity (high priority) exceedances experienced in samples collected from the previous and current Kellogg Creek monitoring sites between February 2005 and September 2007.

Station Name	Season	Sample Date	Copper [1,2], µg/L	Chlorpyrifos, µg/L	Permethrin, total, µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Pimephales promelas, Survival (%)	Selenastrum capricornutum, Total Cell Count
Kellogg Creek @ Hwy 4	Irrigation	17/May/2005			0.036				
Kellogg Creek @ Hwy 4	Irrigation	21/Jun/2005						20	
Kellogg Creek @ Hwy 4	Irrigation	19/Jul/2005					0		
Kellogg Creek @ Hwy 4	Irrigation	16/Aug/2005							92000
Kellogg Creek @ Hwy 4	Irrigation	20/Sep/2005					57.5	85	
Kellogg Creek @ Hwy 4	Storm	16/Feb/2005		0.18		0			
Kellogg Creek along Hoffman Ln	Irrigation	11/Apr/2007				45			
Kellogg Creek along Hoffman Ln	Irrigation	10/Jul/2007	7 (6.9)						
Kellogg Creek along Hoffman Ln	Irrigation	09/Aug/2007					0		
Kellogg Creek along Hoffman Ln	Irrigation	31/Aug/2007					0		
Kellogg Creek along Hoffman Ln	Storm	15/Mar/2006				10			
Kellogg Creek along Hoffman Ln	Storm	28/Feb/2007	17 (15.4)						
Constituent Priority			**C**			**D**	**D**		

[1]Montitoring for this analyte was not initiated until May of 2006.
[2]Water quality trigger for each sample is based on hardness and is shown in parenthesis.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at the Kellogg Creek along Hoffman Ln monitoring site for *Pimephales* toxicity (Table VII-7). All samples collected during the 2007 irrigation season, including Management Plan monitoring, had 100% survival to *Pimephales*.

Table VII-7. 2007 Management Plan monitoring for Kellogg Creek along Hoffman Lane.

Sample Site	Sample Month	*Pimephales promelas*
Kellogg Creek along Hoffman Ln	June	**x**
Kellogg Creek along Hoffman Ln	September	**x**

Load Calculations

Loads were calculated for all copper detections based on the following formula (Table VII-8):

Load = Discharge (cfs) X 28.317L/ft^3 X Concentration (milligram/L X 1000 or µg/L).

The load values presented for constituents 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 a normalization of the concentrations by flow for various constituents at the time the samples were collected.

Table VII-8. Loads of copper calculated from concentration and discharge measured for each detection at the Kellogg Creek along Hoffman Ln monitoring site.

Analyte	Exceedance Date	Discharge (cfs)	Concentration (µg/L)	Load (µg/sec)
Kellogg Creek along Hoffman Ln	8/15/2006	16.22	2.1	964.53
Kellogg Creek along Hoffman Ln	9/19/2006	0	4.5	0
Kellogg Creek along Hoffman Ln	2/11/2007	0.04	4	4.53
Kellogg Creek along Hoffman Ln	2/28/2007	0	17	0

Source Identification

Priority C Constituents

Copper

The WQTL for copper was exceeded at this site during the months of February and July 2007 (Table VII-6). Neither of the exceedances was associated with toxicity to *Selenastrum*. Copper was applied during the winter and spring (Tables VII-9, Figure VII-3) and appears to be

mobilized during winter storm water discharges and in the summer probably as a result of furrow or flood irrigation. Copper applications were limited to one section prior to the February exceedance and five sections prior to the July exceedance (Table VII-10).

Table VII-9. Number of copper applications, pounds applied and acres treated for each month and year of application in the Kellogg Creek along Hoffman Ln site subwatershed between 2005 and 2007.

Month	Number of Copper Applications	Pounds Product Applied	Acres Treated
February 2005	4	150.55	51
March2005	3	347.03	139
April 2005	9	436.45	335.6
May 2005	5	392.35	213
February 2006	1	92.25	25
March 2006	9	444.92	286
April 2006	9	935.68	296
May 2006	1	46.48	30
June 2006	4	124.00	126
July 2006	1	20.90	17
January 2007	1	142.20	25
March 2007	3	371.14	87
April 2007	11	549.71	364
2005 Total	21	1326.38	738.6
2006 Total	25	1664.24	780
2007 Total	15	1063.05	476
TOTAL	**61**	**4053.67**	**1994.6**

Figure VII-3. Pounds of copper added to TRS within the Kellogg Creek along Hoffman Ln site subwatershed by month for 2005-2007. Asterisk (*) denotes months in which copper exceedances were detected at the site.

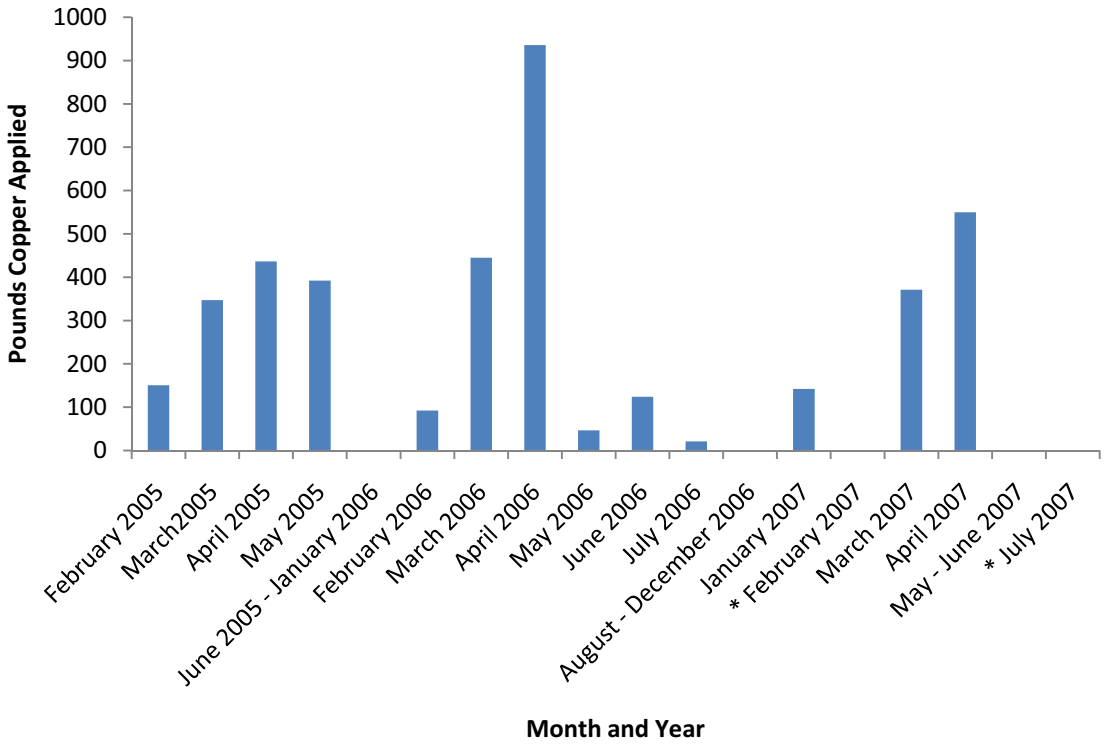


Table VII-10. All TRS that had one or more applications associated with exceedances of copper. Table shows the number of applications associated with the exceedance for a given TRS.

TRS	Date of Associated Exceedance	
	2/28/2007	7/10/2007
1N2E36		3
1N3E31	1	
1N3E32		1
1N3E33		2
1S3E4		2
1S3E5		1

Priority D Constituents

Ceriodaphnia dubia toxicity

Toxicity to *Ceriodaphnia* occurred in February 2005, March 2006, and April 2007 (Table VII-6). The February 2005 exceedance was associated with an exceedance of the chlorpyrifos WQTL

and the concentration of chlorpyrifos accounted for the toxicity in the sample. The TIE results for the remaining two toxic samples were inconclusive.

Pimephales promelas toxicity

Toxicity to *Pimephales* occurred in June and September 2005 (Table VII-6). Neither exceedance was associated with an exceedance of any constituent. A TIE was performed on the first sample and the results indicated the toxicity was caused by a particulate associated metabolically activated pesticide. Several organophosphate chemicals were applied in the watershed prior to sampling including dimethoate. No TIE was performed on the second sample. It is likely that toxicity was associated with sediment-bound constituents moving from the fields to Kellogg Creek.

Hyalella azteca toxicity

Sediment toxicity occurred in samples collected during the months of July and September 2005 and August 2007 (Table VII-6). No chemical analyses were performed on the sediment so the chemical causing toxicity is unknown. However, pyrethroid pesticides have been associated with sediment toxicity in other studies, and pyrethroids have been applied in this site subwatershed. Applications have been made aerially, and furrow and flood irrigation are common allowing the possibility that sediments containing pyrethroids or other constituents toxic to *Hyalella* were moved to the drain resulting in sediment toxicity.

Priority E Constituents

DO

Eight DO exceedances have occurred in Kellogg Creek since May 2005, primarily in the irrigation season. A single DO exceedance occurred in March 2007. In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. None of the samples collected at Kellogg Creek contained measurable amounts of BOD although one of the samples experienced an exceedance of the DO WQTL. These results do not eliminate BOD as a cause of low DO and it is not clear what the cause of low DO at this site is. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Table VII-11. Kellogg Creek along Hoffman Ln. BOD, pH, and dissolved oxygen results for September 2006 – July 2007. ND = non-detect.

StationName	SampleDate	pH	Oxygen, Dissolved	BOD, mg/L
Kellogg Creek along Hoffman Ln	9/19/2006	7.93	3.4	ND
Kellogg Creek along Hoffman Ln	2/11/2007	7.83	8.26	ND
Kellogg Creek along Hoffman Ln	2/28/2007	7.81	10.35	ND
Kellogg Creek along Hoffman Ln	4/11/2007	7.92	8.33	ND
Kellogg Creek along Hoffman Ln	7/10/2007	8.03	8	ND

Eight DO exceedances have occurred in Kellogg Creek since May 2005, primarily in the irrigation season. A single DO exceedance occurred in March 2007. The creek is a water body that carries water periodically when irrigation water is delivered or drained from fields. The water in the creek often becomes stagnant and heats up in the summer losing its capacity to carry oxygen.

Specific Conductivity/ Total Dissolved Solids (TDS)

Specific conductivity (EC) and Total Dissolved Solids (TDS) are measures of salt and are often found as exceedances together. EC and TDS exceedances are common in site subwatersheds such as Kellogg Creek that are under tidal influence and it is assumed that the EC/TDS exceedances are a result of the tidal prism moving water back into the creek. There is so little agricultural land that it is unlikely that fertilizer applications would result in exceedances in five different months.

E. coli

E. coli exceedances occurred nine times since 2005 in both the storm and irrigation seasons (Table VII-5). Watershed maps indicate several small confined animal operations, and cattle grazing is common on the slopes of Mt. Diablo (Figure VII-2). It is unknown if manure is applied in the watershed, but there are numerous urban storm drains that empty to Kellogg Creek, and any or all of these sources could be contributing coliform bacteria to Kellogg Creek. The Coalition performed a pilot study to understand the sources of E. coli in the site subwatershed. Molecular markers were used to distinguish human, bovine, and avian sources. Human and avian molecular markers were found in the watershed indicating active inputs from all three species (Table VII-12, VII-13). Because this study was performed at a single time of the year with a limited set of potential hosts, a further study may be initiated to more fully understand bacterial contamination in the watershed. Until such time as the study is completed, the Coalition will not actively manage for *E. coli*. Once a better understanding of the *E. coli* dynamics is obtained, the Coalition will re-evaluate management options.

Table VII-12. Results of Bacteroides analysis. The Kellogg Creek @ Hwy 4 site was sampled three times daily for three consecutive days, and its upstream site Kellogg Creek along Hoffman Ln site was sampled only once. A + indicates the DNA was detected but at too low of a concentration to estimate a percentage.

Station Code	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
544XKCHWF	8/16/2006	10:20	Grab	100	0	+
544XKCHWF	8/16/2006	15:30	Grab	100	0	+
544XKCHWF	8/16/2006	20:40	Grab	+	0	+
544XKCHWF	8/17/2006	9:40	Grab	+	0	12.5
544XKCHWF	8/17/2006	13:40	Grab	100	0	+
544XKCHWF	8/17/2006	18:30	Grab	50	0	3.125
544XKCHWF	8/18/2006	8:30	Grab	+	0	+

Station Code	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
544XKCHWF	8/18/2006	13:20	Grab	100	0	+
544XKCHWF	8/18/2006	18:40	Grab	100	0	+
544XKCAHL	8/31/2006	9:20	Grab	0	0	0

Table VII-13. Kellogg Creek (544XKCHWF) values of E. coli, fecal coliform, and total coliform in MPN/100mL., and the average C_T value for the All bacteria, human Bacteroides, bovine Bacteroides, and chicken Bacteroides. C_T values are not comparable across samples and are not absolute measures of the quantity of DNA in the sample.

Station Code	Sample Date	Sample Time	Sample Type	E. coli	Fecal Coliform	Total Coliform	Avg All Bac	Avg Human	Avg. Bovine	Avg Chicken
544XKCHWF	8/16/06	10:20	Grab				24.21	24.55	39.66	26.63
544XKCHWF	8/16/06	15:30	Grab				25.84	25.09	39.22	24.24
544XKCHWF	8/16/06	20:40	Grab				24.26	23.44	39.27	26.34
544XKCHWF	8/17/06	9:40	Grab				26.61	25.57		29.6
544XKCHWF	8/17/06	13:40	Grab				26.09	25.17	39.5	27.5
544XKCHWF	8/17/06	18:30	Grab				27.76	27.93	39.95	31.89
544XKCHWF	8/18/06	8:30	Grab				25.48	24.14	39.35	26.18
544XKCHWF	8/18/06	13:20	Grab				25.34	25.6	39.48	27.85
544XKCHWF	8/18/06	18:40	Grab				27.13	25.83	39.22	26.9
544XKCAHL	8/31/06	9:20	Grab	14	170	790	29.26	31.44		31.3

Color/pH

Color and pH are non-conserved indicators of biological and physical inputs to the system and are not possible to manage unless the causes are known. Determining the causes of color or changes in pH is not a priority and the Coalition will not attempt to manage these constituents.

DDT/DDE

DDE is a breakdown product of DDT and indicates that DDT was applied several decades prior to sampling. DDE is found primarily bound to sediments and was likely included in the water sample due to bottom sediments that were mobilized by storm flows or the samplers themselves. If DDT is being applied currently, it is applied illegally and is not the responsibility of the coalition. The Coalition will not manage for DDT or DDE.

2008 Management Plan Monitoring

Additional Management Plan monitoring will be conducted at Kellogg Creek along Hoffman Ln in April 2008 for *Ceriodaphnia* toxicity and in July for copper. Since *Pimephales* toxicity has not

occurred since 2005 the Coalition will not conduct Management Plan monitoring during the 2008 irrigation season.

Table VII-14. Kellogg Creek along Hoffman Lane 2008 Management Plan sampling. A = additional sampling. X = indicates the site, month, and analyte sampled.

Sample Site	Month	Type	Copper	Ceriodaphnia dubia
Kellogg Creek along Hoffman Ln	April	A		**x**
Kellogg Creek along Hoffman Ln	July	A	**x**	

VIII. LITTLEJOHNS CREEK @ JACK TONE RD

Management Plan Constituents

Priority A

- Chlorpyrifos

Priority C

- Cadmium
- Copper

Priority D

- *Selenastrum capricornutum* water column toxicity

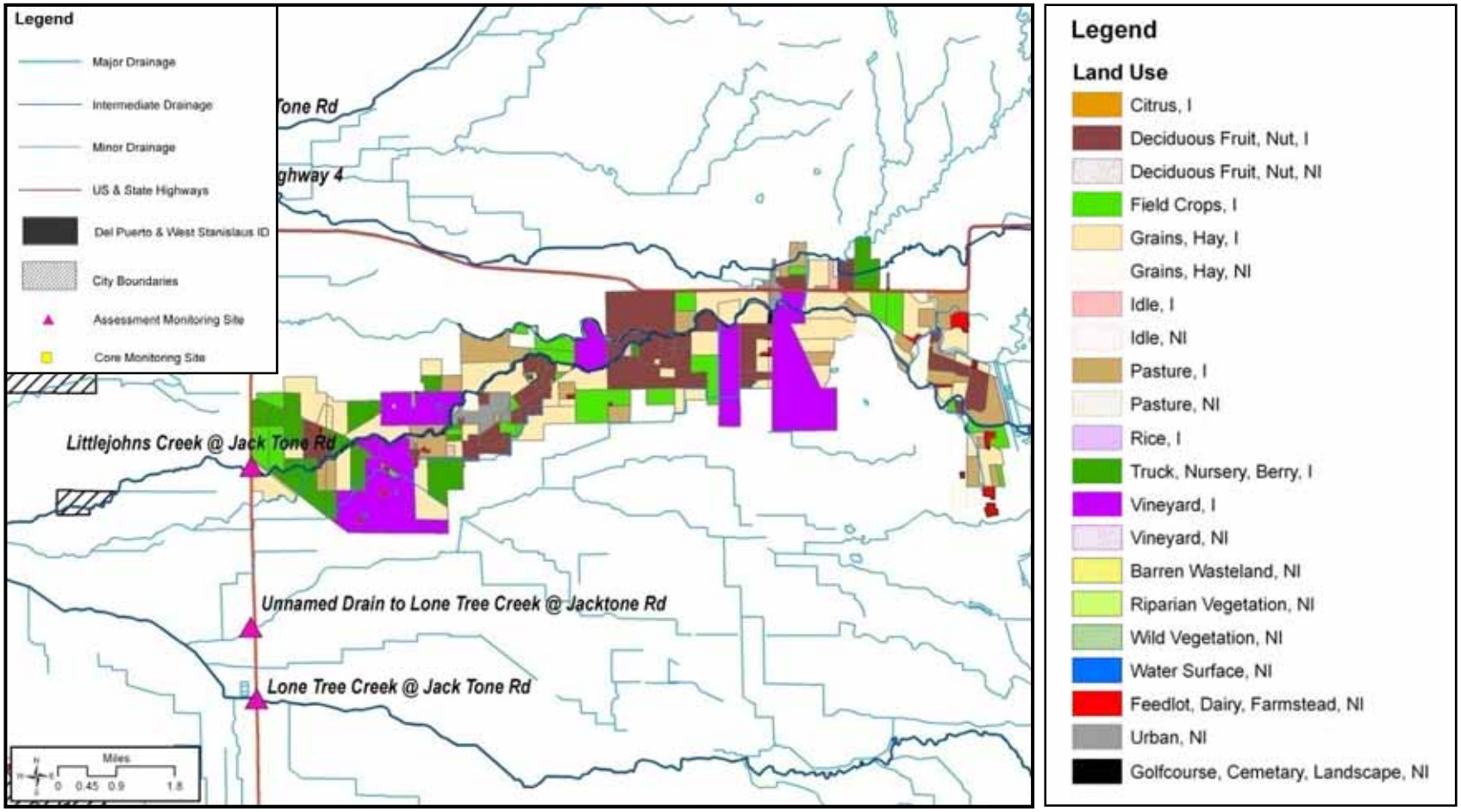
Priority E

- Dissolved Solids
- pH
- Color
- *E. coli*

Description of Littlejohns Creek @ Jack Tone Road Site Subwatershed

Littlejohns Creek @ Jack Tone Road (12,356 irrigated acres) originates at the western edge of Woodward Reservoir, flowing east through the Farmington Flood Control basin and eventually confluences with Lone Tree Creek to form French Camp Slough. The Creek originally flowed intermittently, but summer releases from water storage (from at least five dams) and irrigation return flows have resulted in year round flow. Within the Woodward Reservoir subwatershed there are at least 38 mine shafts, both underground and open pit, related to at least five underground mines that were active through 1955. The crops grown in the site subwatershed represent all of the major types of agriculture present in the Coalition region including field crops, orchards, grains, and vineyards as well as irrigated pasture (Figure VIII-1).

Figure VIII-1. Site subwatershed map of land use for the sampling site at Littlejohns Creek @ Jack Tone Rd. The highlighted point marks the current sampling site.



Subwatershed Monitoring History

Littlejohns Creek has been monitored since the 2004 irrigation season (Tables VIII-1, VIII-2). Exceedances of WQTLs for field and physical parameters, *E. coli*, metals, pesticides and toxicity have occurred. Littlejohns Creek is not considered impaired in the current Central Valley Basin Plan.

Littlejohns Creek @ Jack Tone Rd will be an Assessment Monitoring location under the new MRPP. Assessment Monitoring will not occur until 2013-2014. However, in addition to Assessment Monitoring, the Coalition will continue to conduct upstream management plan monitoring at the Littlejohns Creek @ 26 Mile Rd and Littlejohns Creek @ Escalon Bellota sample sites. Management Plan monitoring is described in better detail later in this document.

Table VIII-1. Littlejohns Creek @ Jack Tone Rd sampling events per season and year. An irrigation season sampling event encompasses normal monitoring and associated resampling, management plan monitoring, and sediment sampling. A storm event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Events Sampled	2	2	5	2	5	2	6

Table VIII-2. Littlejohns Creek @ Jack Tone Road. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Field and Physical Parameters							
pH	2	4	5	3	5	3	10
Electrical Conductivity	2	4	5	3	5	3	10
Dissolved Oxygen	2	4	5	2	5	3	10
Total Dissolved Solids	2	2	5	2	5	2	9
Turbidity	2	2	5	2	5	2	8
E. coli	2	2	5	2	6	2	7
Color	2	2	5	2	5	2	8
Total Organic Carbon	2	2	5	2	7	2	6
Biological Oxygen Demand					1	2	2
Carbamates							
Aldicarb					5	2	6
Carbaryl					5	2	6
Carbofuran					5	2	6
Methiocarb					5	2	6
Methomyl					5	2	6
Oxamyl					5	2	6
Organochlorines							
DDD					**5**	**2**	**6**
DDE					5	2	6
DDT					5	2	6

Constituent	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Dicofol					5	2	6
Dieldrin					5	2	6
Endrin					5	2	6
Methoxychlor					5	2	6
Organophosphates							
Azinphos methyl					5	2	6
Chlorpyrifos	2	2	5	2	5	2	7
Diazinon	2	2	5	2	5	2	6
Dimethoate					5	2	6
Disulfoton					5	2	6
Malathion					5	2	6
Methamidophos					5	2	6
Methidathion					5	2	6
Parathion, Methyl					5	2	6
Phorate					5	2	6
Phosmet					5	2	6
Pyrethroids							
Bifenthrin			1	2	5	2	6
Cypermethrin	2	2	5	2	5	2	6
Cyhalothrin, lambda	2	2	5	2	5	2	6
Permethrin	2	2	5	2	5	2	6
Cyfluthrin			1	2	5	2	6
Esfenvalerate/ Fenvalerate	2	2	5	2	5	2	6
Triazines							
Atrazine					5	2	6
Cyanazine					5	2	6
Diuron					5	2	6
Glyphosate					5	2	6
Linuron					5	2	6
Molinate					5	2	6
Paraquat dichloride					5	2	6
Simazine					5	2	6
Thiobencarb					5	2	6
Metals							
Arsenic					6	2	6
Boron					6	2	6
Cadmium					6	2	6
Copper					6	2	6
Lead					6	2	6
Nickel					6	2	6
Selenium					6	2	2
Zinc					6	2	6
Nutrients							
Nitrate as NO3					6	2	6
Nitrite as Nitrogen					6	2	6
Ammonia					6	2	6
Hardness					7	2	6

Constituent	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Total Phosphorus					6	2	6
Orthophosphate					6	2	6
TKN					6	2	6
Toxicity							
Ceriodaphnia dubia	2	2	5	2	6	2	7
Pimephales promelas	2	3	5	2	5	2	7
Selenastrum capricornutum	3	3	5	2	5	2	9
Hyalella azteca	2		5	1	1	2	2

Exceedance History

Exceedances of water quality trigger limits for field and physical parameters, *E. coli,* metals, pesticides, and water column and sediment toxicity have occurred at this site (Table VIII-3). During the irrigation season of 2007, exceedances detected at the site included dissolved oxygen (4), color (5), *E. coli* (1), cadmium (2), copper (2), lead (1), chlorpyrifos (2), and diazinon (1). Sediment samples collected during the storm monitoring event tested toxic to *Hyalella azteca* in both the original and the follow-up sample, and water column toxicity to *Selenastrum capricornutum* was detected once. For all years of monitoring between 2004 and 2007, 10 DO exceedances, one pH exceedance, 21 color, six *E. coli* exceedances, four chlorpyrifos exceedances, and one exceedance of the diazinon WQTL have occurred. The analysis of metals was initiated in 2006 for irrigation season sampling and three exceedances of the copper WQTL, two of cadmium and one of lead have occurred. Samples taken from Littlejohns Creek have also resulted in toxicity to *Pimephales* once and three times to *Selenastrum*. Sediment sampling has resulted in toxicity to *Hyalella* in one monitoring event including the original sample and the resample.

All exceedances are listed in Table VIII-3 by season and date and are based on water quality trigger limits (WQTL) listed in the overall introduction of the SJCDWQC Management Plan. The priority level (A-E) assigned to each constituent is listed in the bottom row of Table VIII-3 for those analytes with two or more exceedances within the last three years.

Table VIII-3. All exceedances experienced in samples collected from the Littlejohns Creek @ Jack Tone Rd Coalition monitoring site between August 2004 and September 2007.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	pH, none	Color, color units	E. coli, MPN/100 mL	Cadmium, µg/L	Copper [1,2], µg/L	Lead, µg/L	Chlorpyrifos, µg/L	Diazinon, µg/L	Hyalella azteca, Survival (%)	Pimephales promelas, Survival (%)	Selenastrum capricornutum, Total Cell Count
Littlejohns Creek @ Jack Tone Rd	Irrigation	24/Aug/2004			200									910500
Littlejohns Creek @ Jack Tone Rd	Irrigation	23/Sep/2004	6.7		50									
Littlejohns Creek @ Jack Tone Rd	Irrigation	17/May/2005			100	900								
Littlejohns Creek @ Jack Tone Rd	Irrigation	21/Jun/2005			60									
Littlejohns Creek @ Jack Tone Rd	Irrigation	19/Jul/2005	6.6		60					0.017				
Littlejohns Creek @ Jack Tone Rd	Irrigation	16/Aug/2005			40									
Littlejohns Creek @ Jack Tone Rd	Irrigation	20/Sep/2005	5.4		50	900								
Littlejohns Creek @ Jack Tone Rd	Irrigation	16/May/2006			34			4.4 (3.9)						
Littlejohns Creek @ Jack Tone Rd	Irrigation	20/Jun/2006	6.7		55									
Littlejohns Creek @ Jack Tone Rd	Irrigation	18/Jul/2006	3.1		26					0.027				
Littlejohns Creek @ Jack Tone Rd	Irrigation	15/Aug/2006			20									
Littlejohns Creek @ Jack Tone Rd	Irrigation	19/Sep/2006	5.4		25									
Littlejohns Creek @ Jack Tone Rd	Irrigation	10/Apr/2007			16									
Littlejohns Creek @ Jack Tone Rd	Irrigation	22/May/2007			25									
Littlejohns Creek @ Jack Tone Rd	Irrigation	12/Jun/2007			16			3.6 (3.3)						
Littlejohns Creek @ Jack Tone Rd	Irrigation	10/Jul/2007	6.85											628270
Littlejohns Creek @ Jack Tone Rd	Irrigation	17/Jul/2007	6.6											
Littlejohns Creek @ Jack Tone Rd	Irrigation	30/Jul/2007								0.018				
Littlejohns Creek @ Jack Tone Rd	Irrigation	07/Aug/2007					0.08							
Littlejohns Creek @ Jack Tone Rd	Irrigation	28/Aug/2007	5.85											
Littlejohns Creek @ Jack Tone Rd	Irrigation	04/Sep/2007	5.72											
Littlejohns Creek @ Jack Tone Rd	Storm	16/Feb/2005			100	1600							70	
Littlejohns Creek @ Jack Tone Rd	Storm	01/Mar/2005		6.37										
Littlejohns Creek @ Jack Tone Rd	Storm	21/Mar/2005			60	900								1280000
Littlejohns Creek @ Jack Tone Rd	Storm	27/Feb/2006			40									
Littlejohns Creek @ Jack Tone Rd	Storm	15/Mar/2006			450	1600								
Littlejohns Creek @ Jack Tone Rd	Storm	11/Feb/2007			60					0.029	0.11			
Littlejohns Creek @ Jack Tone Rd	Storm	28/Feb/2007			190	2400	0.06	11 (9)	2.2					
Littlejohns Creek @ Jack Tone Rd	Storm	06/Mar/2007										78.75		
Littlejohns Creek @ Jack Tone Rd	Storm	29/Mar/2007										83.75		
Constituent Priority			**E**	**E**	**E**	**E**	**C**	**C**		**A**		**D**		**D**

[1]Montitoring for this analyte was not initiated until May of 2006.
[2]Water quality trigger for each sample is based on hardness and is shown in parenthesis.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at the Littlejohns Creek @ Jack Tone Rd monitoring site for the constituent chlorpyrifos and for water column toxicity to *Selenastrum capricornutum*. Table VIII-4 provides monitoring results for these constituents from all sampling events during the 2007 irrigation season and indicates which constituents were being targeted in each management plan monitoring event.

Table VIII-4. Littlejohns Creek @ Jack Tone Rd. Normal monitoring (NM), Resampling (RS), and Management Plan monitoring (MPM) results for chlorpyrifos and toxicity to *Selenastrum capricornutum* from the 2007 irrigation season. Exceedance values are in bold.

Management Plan Constituent	NM	NM	NM	NM	RS	MPM	NM	MPM	NM
	4/10/07	5/22/07	6/12/07	7/10/07	7/17/07	7/30/07	8/07/07	8/28/07	9/04/07
Chlorpyrifos (ug/L)	<0.00259	<0.00259	<0.00259	0.013	NA	**0.018**	<0.003	NA	<0.003
Selenastrum cell count	1700000	1613000	940894	**628270**	758530	NA	706426	2904563	833429

NA – no Management Plan Monitoring occurred on this date for this constituent.

Load Calculations

Loads were calculated for the cadmium, chlorpyrifos and copper detections based on the following formula:

Load = Discharge (cfs) X 28.317L/ft^3 X Concentration (milligram/L X 1000 or µg/L).

The load values presented for constituents in this report represent instantaneous loads only (Table VIII-5). 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 a normalization of the concentrations by flow for various constituents at the time the samples were collected.

Table VIII-5. Loads of cadmium, chlorpyrifos and copper calculated from concentration and discharge measured for each detection at the Littlejohns Creek monitoring site.

Analyte	Exceedance Date	Discharge (cfs)	Concentration (µg/L)	Load (µg/sec)
Cadmium	2/11/2007	0	0.03	0
Chlorpyrifos	2/11/2007	0	0.029	0
Chlorpyrifos	1/23/2008	2.45	0.0039	0.270569
Copper	5/16/2006	23.5	4.4	2927.978
Copper	8/15/2006	12.79	2.1	760.5663
Copper	8/15/2006	12.79	2.5	905.4361
Copper	2/11/2007	0	6.8	0
Copper	9/4/2007	0	2.7	0
Copper	1/23/2008	2.45	3.8	263.6313

Source Identification

Priority A Constituents

Chlorpyrifos

Chlorpyrifos is the only priority A constituent to be managed within the Littlejohns Creek @ Jack Tone Rd site subwatershed. The WQTL for chlorpyrifos (0.015 µg/L) was exceeded at this site during the months of February 2007 and July, 2005, 2006, and 2007 (Table VIII-3). The February exceedance is most likely associated with a dormant spray, and the concentration in the sample suggests that it is a result of runoff from orchards rather than spray drift. There was no reported use of chlorpyrifos between October 2006 and March 2007. There were numerous applications in the months of June and July 2005, 2006, and 2007 (Table VIII-6, Figure VIII-2). Applications occurred in nine sections in 2005 and 2006 and four sections in 2007 (Table VIII-7). Concentrations in the 2005 and 2007 irrigation season exceedances were low and could be the result of spray drift. The concentration associated with the 2006 exceedance was higher and probably the result of irrigation return flows.

Table VIII-6. Number of chlorpyrifos applications, pounds applied and acres treated for each month and year of application in the Littlejohns Creek @ Jack Tone Rd site subwatershed between 2004 and 2007.

Month	Number of Chlorpyrifos Applications	Pounds Product Applied	Acres Treated
March 2004	17	705.65	846.7
April 2004	4	262.53	220
May 2004	19	1394.96	745.5
June 2004	3	168.88	133
July 2004	16	1732.72	888
August 2004	13	1034.19	578.2
March 2005	7	223.41	260
April 2005	2	95.68	98.2
May 2005	20	1464.51	752.3
June 2005	9	621.57	314.5
July 2005	22	1669.09	1253.1
August 2005	9	285.53	462.2
September 2005	4	123.42	142
March 2006	2	68.61	65
April 2006	2	38.52	50
May 2006	28	2279.51	1288.3
June 2006	13	744.21	381.5
July 2006	18	1374.56	971.5
August 2006	16	830.84	926.5
September 2006	1	40.06	80
March 2007	13	721.37	738
April 2007	5	358.47	243
May 2007	12	730.71	453
June 2007	2	156.80	78

Month	Number of Chlorpyrifos Applications	Pounds Product Applied	Acres Treated
July 2007	5	240.45	328
August 2007	4	195.57	207
2004 Total	72	5298.94	3411.4
2005 Total	73	4483.20	3282.3
2006 Total	80	5376.31	3762.8
2007 Total	41	2403.37	2047
TOTAL	266	17561.81	12503.5

Figure VIII-2. Pounds of chlorpyrifos added to TRS within the Littlejohns Creek @ Jack Tone Rd site subwatershed by month for 2004-2007.

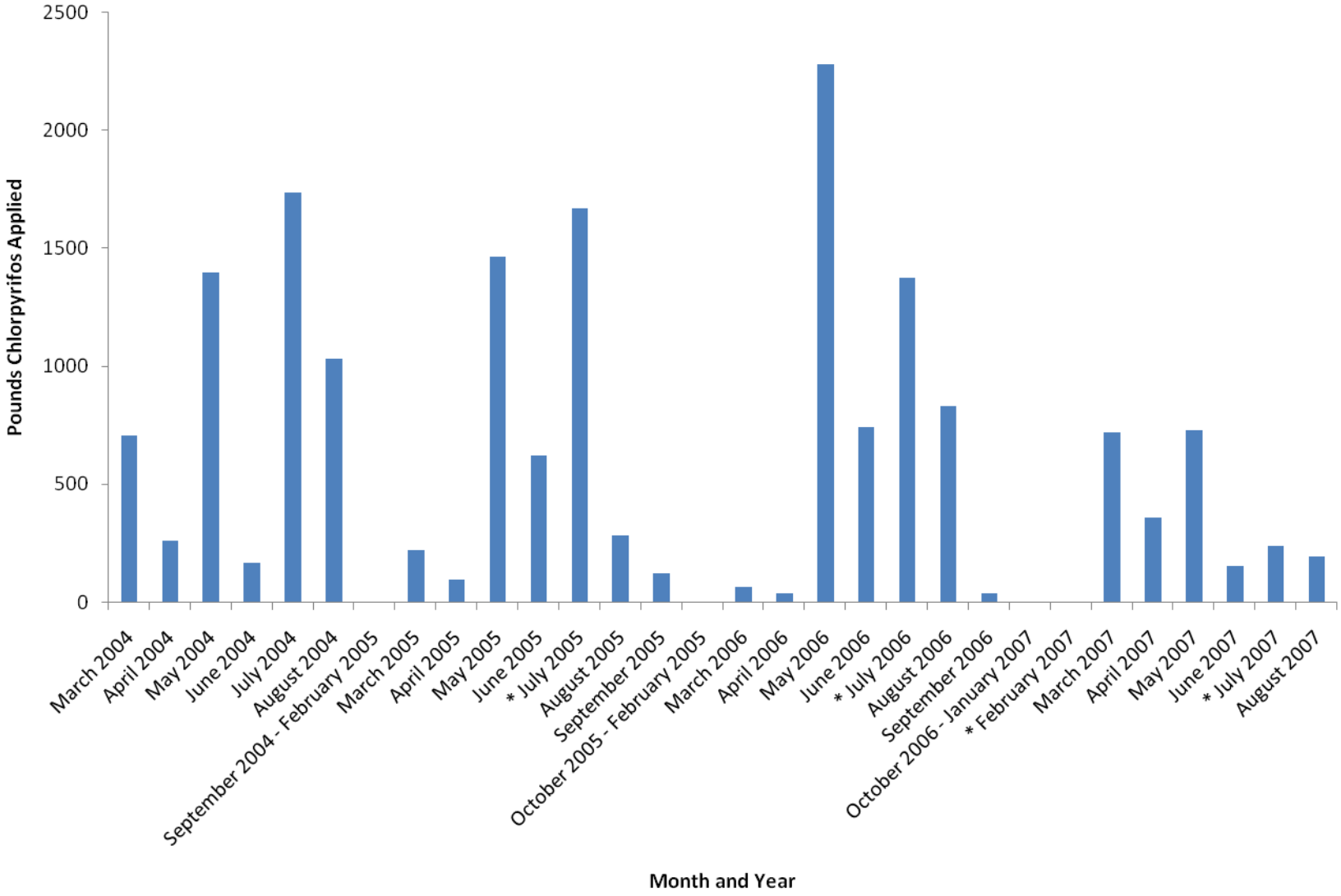


Table VIII-7. Littlejohns Creek @ Jack Tone Rd. All TRS that had more than one application associated with exceedances of chlorpyrifos (for chlorpyrifos, associated applications are within one month of the exceedance date). Table shows the number of applications associated with the exceedance for a given TRS.

TRS	Date of Associated Exceedance		
	7/19/2005	7/18/2006	7/30/2007
1N8E13	1		1
1N8E29	1	1	1
1N8E34	3	1	
1N8E35		2	
1N9E17	1	1	
1N9E18	2	2	2
1N9E19	2	1	1
1N9E35	1	1	
1N9E36	1	2	
1S8E6	1	1	

Priority C Constituents

Copper

Three exceedances of the copper WQTL occurred in the Littlejohns Creek site subwatershed across all summer months in May 2006 and February and June 2007. None of the exceedances was associated with toxicity to *Selenastrum*. Copper is applied in almost every month of the year in this watershed but peak applications are in March-June (Table VIII-8, Figure VIII-3). Copper appears to be mobilized during winter storm water discharges and through irrigation return flows. Copper is heavily used in the watershed with numerous applications being made across numerous sections (Table VIII-9).

Cadmium

Since the time of this exceedance, the WQTL for cadmium has increased to 5 µg/L and the exceedances listed above are therefore no longer considered an exceedance. As a result, the Coalition will not develop a strategy to manage cadmium.

Table VIII-8. Number of copper applications, pounds applied and acres treated for each month and year of application in the Littlejohns Creek @ Jack Tone Rd site subwatershed between 2004 and 2007.

Month	Number of Copper Applications	Pounds Product Applied	Acres Treated
January 2004	2	324.66	85
February 2004	5	219.06	142
March 2004	25	4208.24	1076.1
April 2004	33	9724.98	2036.5
May 2004	3	1007.93	84

Month	Number of Copper Applications	Pounds Product Applied	Acres Treated
September 2004	9	501.34	377.5
October 2004	5	274.76	139
November 2004	3	406.24	90
December 2004	3	1450.50	125
February 2005	1	33.20	8
March 2005	25	4345.09	814.8
April 2005	60	17219.84	3082.7
May 2005	43	11504.40	2181.45
June 2005	13	911.33	461.3
October 2005	3	229.64	187
December 2005	5	600.71	116
January 2006	2	567.95	85
February 2006	1	33.20	8
March 2006	7	376.72	162
April 2006	48	10962.59	1866.05
May 2006	35	10203.60	1762.2
June 2006	8	1686.29	562
July 2006	6	609.84	396
August 2006	3	151.99	106
September 2006	7	392.23	257.5
October 2006	7	465.08	299
January 2007	1	581.04	180
February 2007	1	1.61	3
March 2007	15	2852.65	522
April 2007	64	14310.42	2431
May 2007	10	3285.92	522
June 2007	1	61.60	40
2004 Total	88	18117.72	4155.1
2005 Total	150	34844.22	6851.25
2006 Total	124	25449.48	5503.75
2007 Total	92	21093.25	3698
TOTAL	**454**	**99504.66**	**20208.1**

Figure VIII-3. Pounds of copper added to TRS within the Littlejohns Creek @ Jack Tone Rd site subwatershed by month for 2004-2007. Asterisk (*) denotes months in which copper exceedances were detected at the site.

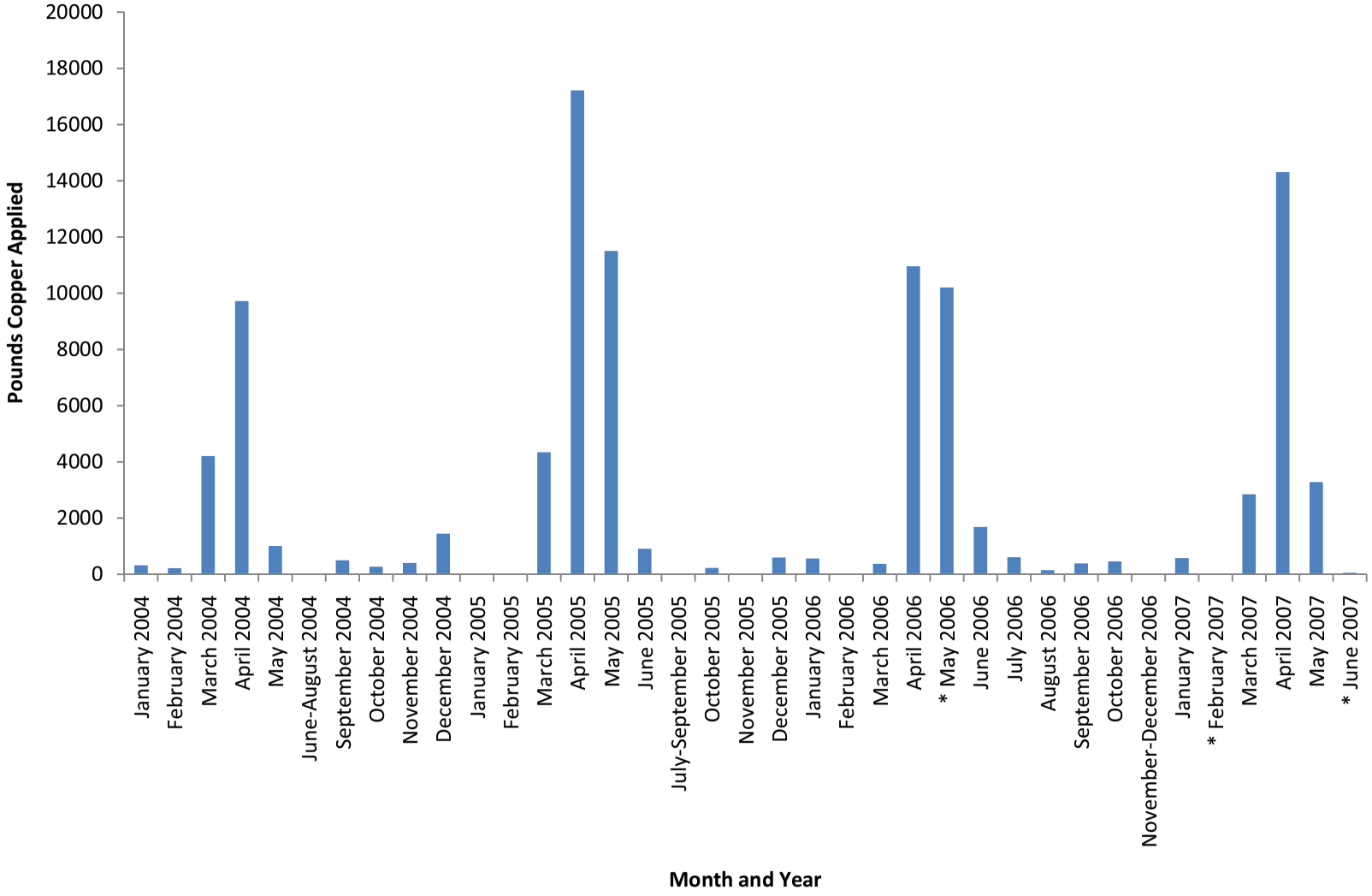


Table VIII-9. All TRS that had more than one application associated with exceedances of copper (for copper, associated applications are within three months of the exceedance date). Table indicates the number of applications associated with the exceedance for a given TRS.

TRS	Date of Associated Exceedance		
	2/28/2007	5/16/2006	6/12/2007
1N8E13		6	5
1N8E16		2	4
1N8E19		2	1
1N8E21		2	1
1N8E24		5	2
1N8E25		2	6
1N8E26		3	1
1N8E29		3	2
1N8E30		2	
1N8E33	1		1
1N8E34		9	3
1N8E35		1	2
1N9E16	1	2	3
1N9E17		3	6
1N9E18		6	9
1N9E19		14	19
1N9E25			2
1N9E26			4
1N9E29		2	
1N9E30		8	8
1S8E6		7	7

Priority D Constituents

Hyalella azteca toxicity

Sediment toxicity occurred in samples collected during March 2007 (Table VIII-3). The first exceedance occurred during normal monitoring and the second exceedance occurred during the resample for persistence. Since the purpose of the resample is to determine if the original toxicity is persistent, the toxic resample must be considered as an extension of the first sample, not an independent sample. As a result, the Coalition does not consider the toxicity to necessitate a management plan and will not manage for sediment toxicity at this site at this time.

Selenastrum capricornutum toxicity

Selenastrum toxicity was experienced three times from 2004 to 2007; August 2004, March 2005, and June 2007 (Table VIII-3). There were no exceedances of copper or herbicides associated with any of the toxicity events. No TIEs were performed for any of the exceedances. It is clear that the cause of the toxicity is associated with a soluble constituent(s) and preventing storm water and irrigation return flows would be effective in reducing or eliminating *Selenastrum* toxicity. At the time when this site becomes a priority, the Coalition will carefully review the PURs to determine which high solubility constituents should be targeted for focused outreach and management.

Priority E Constituents

DO

Ten DO exceedances have occurred in Littlejohns Creek since September 2004, always in the irrigation season. Although there is almost always flow in the creek it can slow considerably and the water can become stagnant and heat losing its capacity to carry oxygen. In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. None of the samples collected at Littlejohns Creek contained measurable amounts of BOD despite an exceedance of DO in September 2006 (5.4 mg/L) and July 2007 (6.85 mg/L). All other samples were collected at times when there were no DO exceedances (Table VIII-10). These results do not eliminate BOD as a cause of low DO and the cause of low DO at this site is unknown. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Table VIII-10. Littlejohns Creek @ Jack Tone Rd. BOD, pH and dissolved oxygen results for September 2006 – July 2007. ND = non-detect.

StationName	SampleDate	pH	Oxygen, Dissolved	BOD, mg/L
Littlejohns Creek @ Jack Tone Rd	9/19/2006	6.91	5.4	ND
Littlejohns Creek @ Jack Tone Rd	2/11/2007	8.21	8.5	ND
Littlejohns Creek @ Jack Tone Rd	2/28/2007	7.38	10.72	ND
Littlejohns Creek @ Jack Tone Rd	4/10/2007	7.45	9.23	ND
Littlejohns Creek @ Jack Tone Rd	7/10/2007	7.39	6.85	ND

E. coli

E. coli exceedances occurred six times since 2005 in both the storm and irrigation seasons. It is unknown if manure is applied in the watershed, but there does not appear to be a large number of dairies upstream. The *E. coli*/Bacteroides study conducted by the Coalition did not find bovine bacteria in the water at three sites in the Littlejohns Creek watershed (Tables VIII-

11, VIII-12) and the source of the *E. coli* is unknown at this time. The Coalition will address additional sourcing when *E. coli* becomes a priority.

Table VIII-11. Results of Bacteroides analysis. The Littlejohns Creek subwatershed sites were sampled only once. A + indicates the DNA was detected but at too low of a concentration to estimate a percentage.

Station Code	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
531XLCAHR	8/31/2006	14:10	Grab	12.5	0	+
531XLCAER	8/31/2006	14:50	Grab	+	0	+
531XLCAJR	8/31/2006	15:30	Grab	25	0	50

Table VIII-12. Values of E. coli, fecal coliform, and total coliform in MPN/100mL., and the average C_T value for the All bacteria, human Bacteroides, bovine Bacteroides, and chicken Bacteroides. C_T values are not comparable across samples and are not absolute measures of the quantity of DNA in the sample.

Station Code	Sample Date	Sample Time	Sample Type	E. coli	Fecal Coliform	Total Coliform	Avg All Bac	Avg Human	Avg. Bovine	Avg Chicken
531XLCAHR	8/31/06	14:10	Grab	110	110	2300	23.04	26.09		21.91
531XLCAER	8/31/06	14:50	Grab	-1.8	-1.8	-1.8	25.93	26.45		26.29
531XLCAJR	8/31/06	15:30	Grab	22	460	2300	29.11	30.97		29.66

Color/pH

Color and pH are non-conserved indicators of biological and physical inputs to the system and are not possible to manage unless the causes are known. Determining the causes of color or changes in pH is not a priority and the Coalition will not attempt to manage these constituents.

2008 Management Plan Monitoring

During the 2008 irrigation season, upstream sampling will occur at Littlejohns Creek @ 26 Mile Rd to assess the contribution of metals coming from the Sierra Nevada foothills, upstream of agriculture (Figure VIII-5). In addition, Littlejohns Creek @ Escalon Bellota will be sampled as an upstream sourcing location to the Jack Tone Rd site (Figure VIII-4). Littlejohns Creek @ Escalon Bellota will be sampled for chlorpyrifos and *Selenastrum* in July and August. The site at Escalon Bellota will also be sampled for metals in May and June (Table VIII-13). Management Plan monitoring location names, station codes and target latitude/longitudes are listed in Table VIII-14.

Table VIII-13. Littlejohns Creek 2008 Management Plan sampling. U = upstream sampling. X = indicates the site, month, and analyte sampled.

Sample Site	Month	Type	Chlorpyrifos	Metals	*Selenastrum capricornutum*
Littlejohns Creek @ 26 Mile Rd	May	U		x	
Littlejohns Creek @ 26 Mile Rd	June	U		x	

Sample Site	Month	Type	Chlorpyrifos	Metals	*Selenastrum capricornutum*
Littlejohns Creek @ 26 Mile Rd	July	U		x	
Littlejohns Creek @ 26 Mile Rd	August	U		x	
Littlejohns Creek @ 26 Mile Rd	September	U		x	
Littlejohns Creek @ Escalon Bellota	May	U		x	
Littlejohns Creek @ Escalon Bellota	June	U		x	
Littlejohns Creek @ Escalon Bellota	July	U	x		x
Littlejohns Creek @ Escalon Bellota	August	U	x		x

Table VIII-14. Littlejohns Creek Management Plan monitoring locations.

Sample Site	Station Code	Latitude	Longitude
Littlejohns Creek @ Jack Tone Rd	531XLCAJR	37.8896	-121.146
Littlejohns Creek @ 26 Mile Rd	531LCATMR	37.8932	-120.878
Littlejohns Creek @ Escalon Bellota Rd	531XLCAER	37.9255	-120.999

Figure VIII-4. Littlejohns Creek @ Escalon Bellota Management Plan monitoring location land use map.

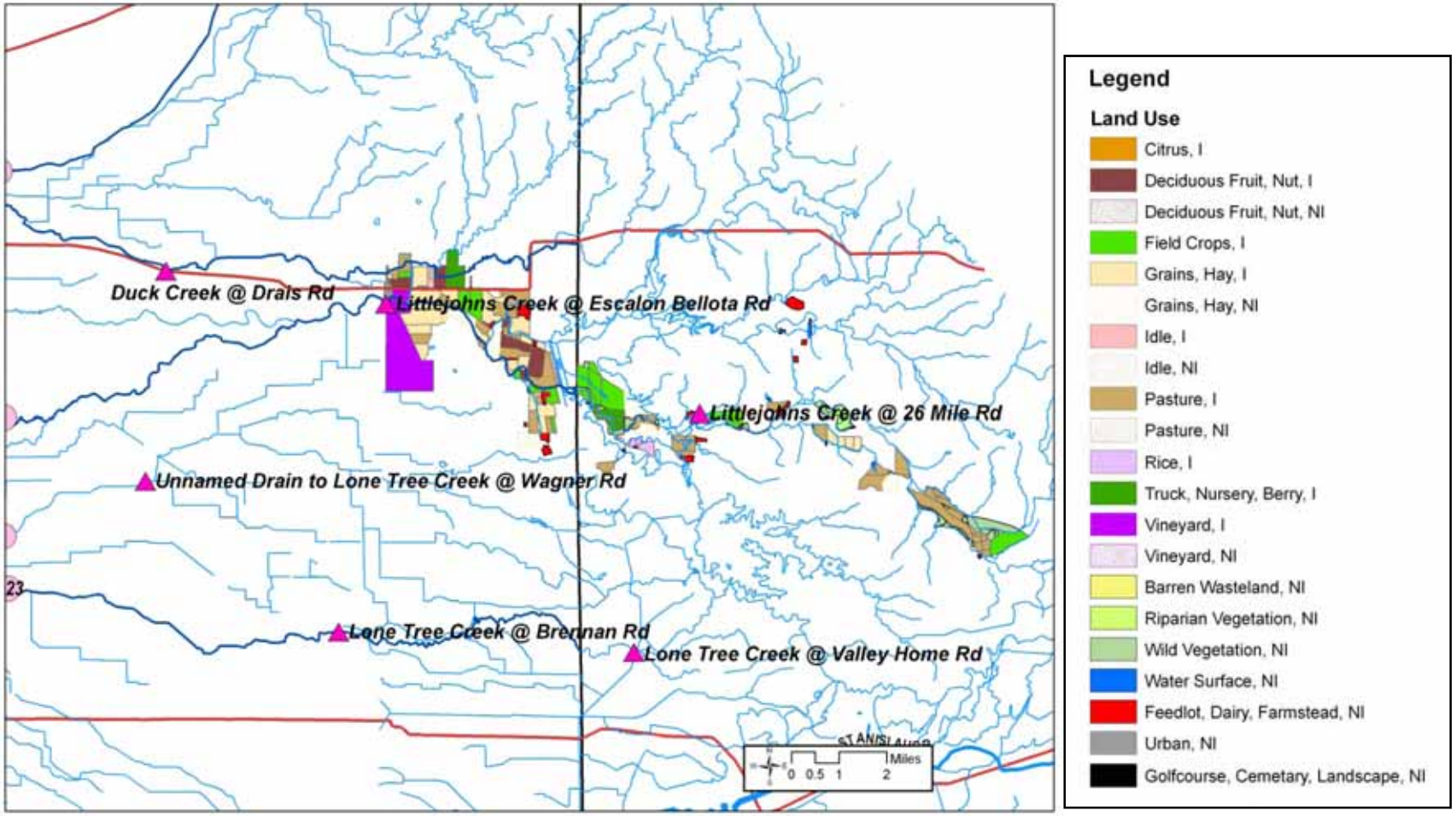
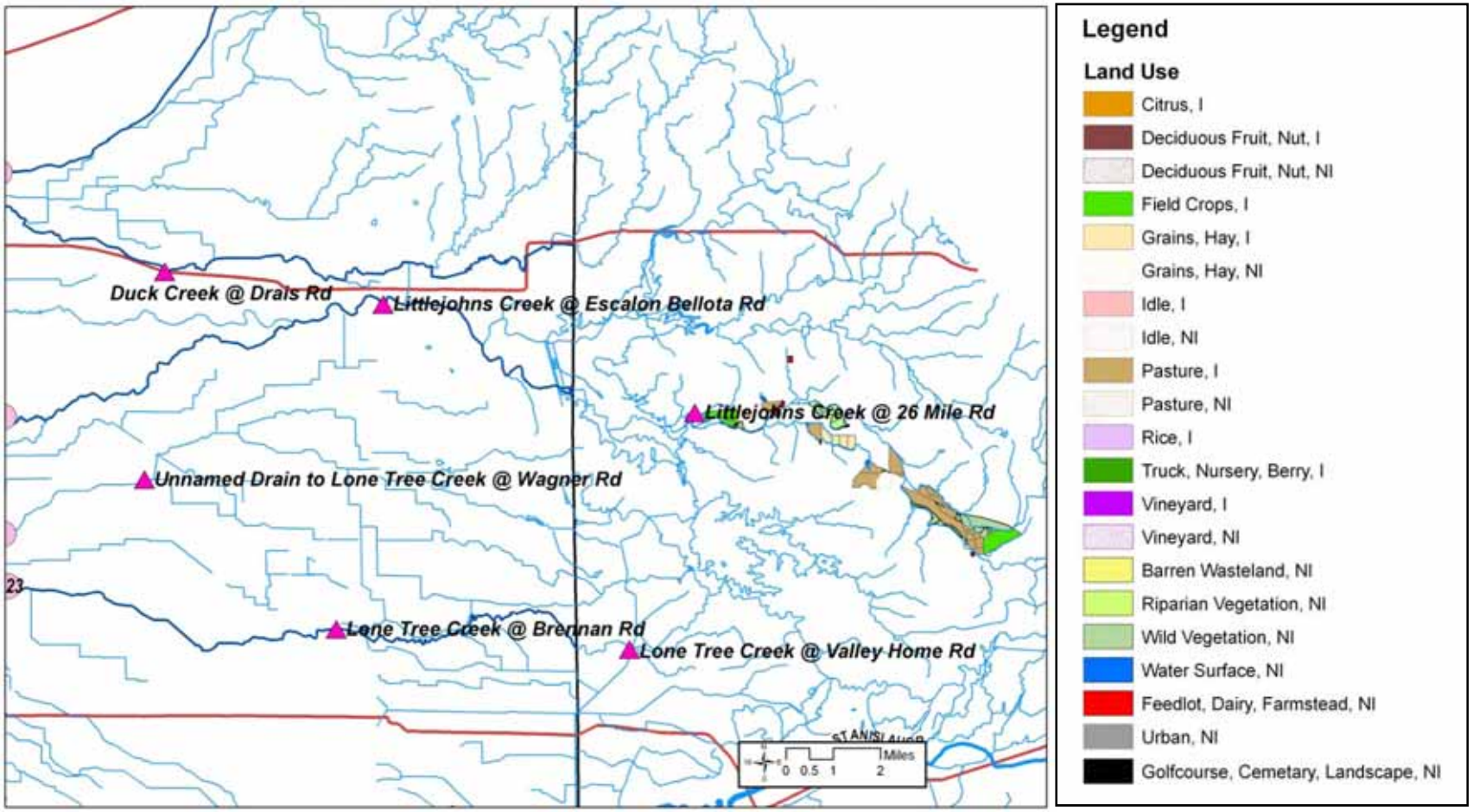


Figure VIII-5. Littlejohns Creek @ 26 Mile Rd Management Plan monitoring location land use map.



IX. MOKELUMNE RIVER @ BRUELLA RD

Management Plan Constituents

Priority C

- Copper

Priority D

- *Ceriodaphnia dubia* water column toxicity
- *Selenastrum capricornutum* water column toxicity

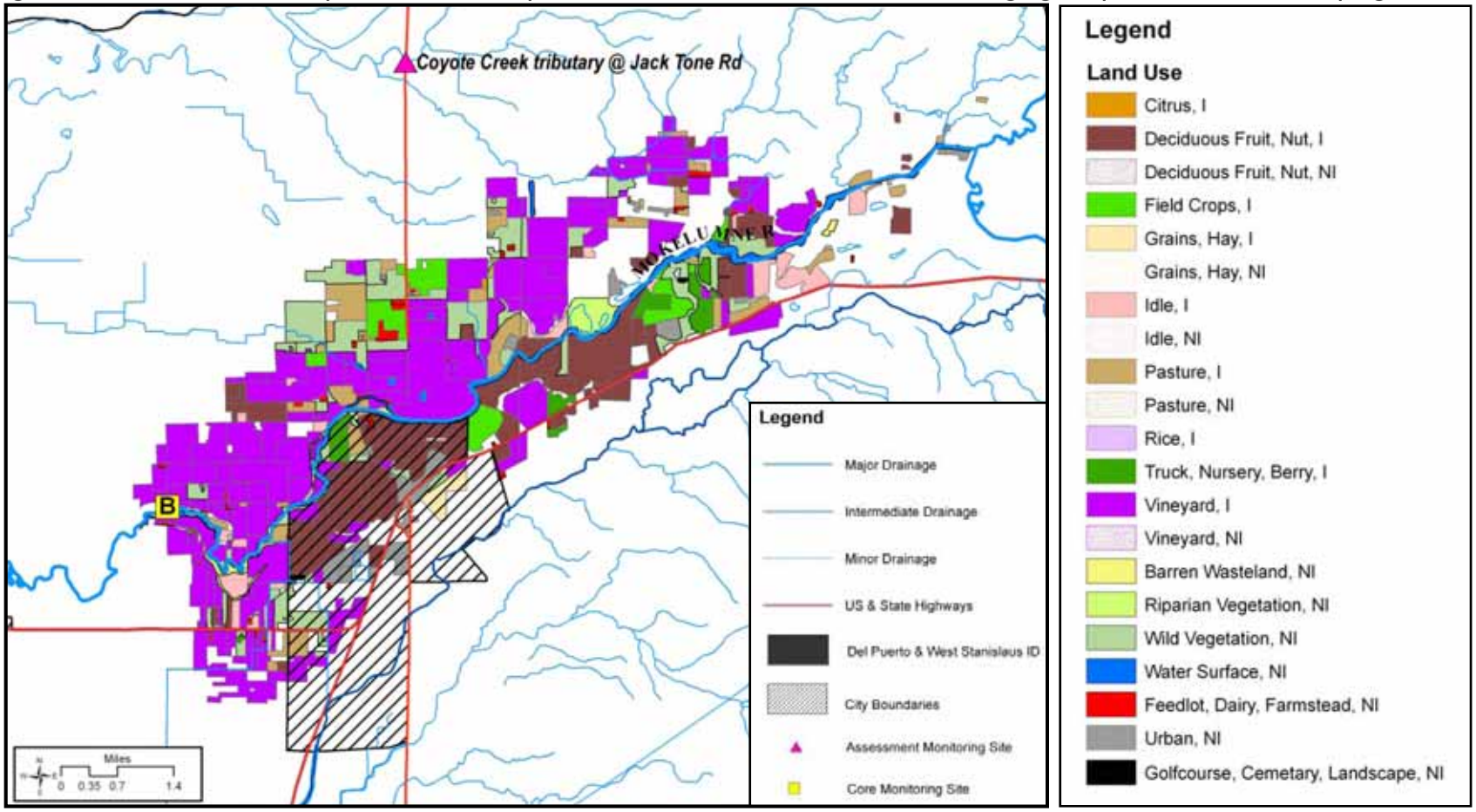
Priority E

- DO
- pH

Description of Mokelumne River @ Bruella Rd Site Subwatershed

Mokelumne River @ Bruella Road (8,671 irrigated acres) contains upstream agriculture of primarily vineyards although some orchards are immediately adjacent to the site. This site integrates the signal from a relatively large upstream area (Figure IX-1).

Figure IX-1. Site subwatershed map of land use for sample site at Mokelumne River @ Bruella Rd. The highlighted points mark current sampling sites.



Subwatershed Monitoring History

Mokelumne River @ Bruella Rd ambient water monitoring was initiated in the first season of Coalition monitoring in August of 2004 (Tables IX-1, IX-3). During one irrigation event in 2005 an upstream location (Mokelumne River @ Fish Hatchery) was selected to determine the contribution of sources upstream of the hatchery (Table IX-2, Table IX-4)

The lower section of the Mokelumne River is listed as impaired for copper and zinc in the current Central Valley Basin Plan 303d list. The listed source for both of these metals is resource extraction.

Mokelumne River @ Bruella Road will be a Core Monitoring location under the new MRPP.

Table IX-1. Mokelumne River @ Bruella Rd sampling events per season and year. An irrigation season sampling event encompasses normal monitoring and associated resampling, management plan monitoring, and sediment sampling. A storm event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	2	2	5	2	5	2	6

Table IX-2. Mokelumne River @ Fish Hatchery sampling events per season and year. An irrigation season sampling event encompasses normal monitoring and associated resampling, management plan monitoring, and sediment sampling. A storm event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	None	None	1	None	None	None	None

Table IX-3. Mokelumne River @ Bruella Rd. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Field and Physical Parameters							
pH	3	3	7	3	5	3	10
Electrical Conductivity	3	3	7	3	5	3	10
Dissolved Oxygen	3	3	7	2	5	3	10
Total Dissolved Solids	2	2	5	2	5	3	7
Turbidity	2	2	5	2	5	3	6
E. coli	2	2	5	2		2	
Color	2	2	5	2	5	2	6
Total Organic Carbon	2	2	5	2	5	2	6
Biological Oxygen Demand					1	3	2

Constituent	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Carbamates							
Aldicarb					5	2	6
Carbaryl					5	2	6
Carbofuran					5	2	6
Methiocarb					5	2	6
Methomyl					5	2	6
Oxamyl					5	2	6
Organochlorines							
DDD					5	2	6
DDE					5	2	6
DDT					5	2	6
Dicofol					5	2	6
Dieldrin					5	2	6
Endrin					5	2	6
Methoxychlor					5	2	6
Organophosphates							
Azinphos methyl					5	2	6
Chlorpyrifos	2	2	5	2	5	2	6
Diazinon	2	2	5	2	5	2	6
Dimethoate					5	2	6
Disulfoton					5	2	6
Malathion					5	2	6
Methamidophos					5	2	6
Methidathion					5	2	6
Parathion, Methyl					5	2	6
Phorate					5	2	6
Phosmet					5	2	6
Pyrethroids							
Bifenthrin			1	2	5	2	6
Cypermethrin	2	2	5	2	5	2	6
Cyhalothrin, lambda	2	2	5	2	5	2	6
Permethrin	2	2	5	2	5	2	6
Cyfluthrin			1	2	5	2	6
Esfenvalerate/ Fenvalerate	2	2	5	2	5	2	6
Triazines							
Atrazine					5	2	6
Cyanazine					5	2	6
Diuron					5	2	6
Glyphosate					5	2	6
Linuron					5	2	6
Molinate					5	2	6
Paraquat dichloride					5	2	6
Simazine					5	2	6
Thiobencarb					5	2	6
Metals							
Arsenic					5	2	6
Boron					5	2	6

Constituent	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Cadmium					5	2	6
Copper					5	2	6
Lead					5	2	6
Nickel					5	2	6
Selenium					5	2	2
Zinc					5	2	6
Nutrients							
Nitrate as NO3					5	2	6
Nitrite as Nitrogen					5	2	6
Ammonia					5	2	6
Hardness					5	2	6
Total Phosphorus					4	2	6
Orthophosphate					5	2	6
TKN					5	2	6
Toxicity							
Ceriodaphnia dubia	3	4	6	3	5	3	8
Pimephales promelas	2	2	5	2	5	3	6
Selenastrum capricornutum	2	3	5	2	5	3	8
Hyalella azteca	2		5		1	1	1

Table IX-4. Mokelumne River @ Fish Hatchery. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2005
	Irrigation
Field and Physical Parameters	
pH	1
Electrical Conductivity	1
Dissolved Oxygen	1
Total Dissolved Solids	1
Turbidity	1
E. coli	1
Color	1
Total Organic Carbon	1
Organophosphates	
Chlorpyrifos	1
Diazinon	1
Pyrethroids	
Bifenthrin	1
Cypermethrin	1
Cyhalothrin, lambda	1
Permethrin	1
Cyfluthrin	1
Esfenvalerate/ Fenvalerate	1
Toxicity	
Ceriodaphnia dubia	1
Pimephales promelas	1

Constituent	2005
	Irrigation
Selenastrum capricornutum	1

Exceedance History

During Coalition monitoring, exceedances of water quality trigger limits for field parameters, metals, pesticides and water column toxicity have occurred at this site. During the irrigation season of 2007, exceedances detected at the site included pH (1), copper (3) and *Selenastrum* toxicity (1). Samples collected over the entire four years of monitoring at the Mokelumne River @ Bruella Road sample site resulted in four exceedances of DO, three of pH, three of copper and one of DDT. Toxicity occurred five times to *Ceriodaphnia dubia* and three times to *Selenastrum capricornutum*. All exceedances are listed in Table IX-5 by season and date and are based on water quality trigger limits (WQTL) listed in the introduction of the SJCDWQC Management Plan. The priority level (A-E) assigned to each constituent is listed in the bottom row of Table IX-5 for those analytes with two or more exceedances over the last three years.

Table IX-5. All exceedances experienced in samples collected from the Mokelumne River Coalition monitoring sites between August 2004 and September 2007.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	pH, none	Copper[1,2], µg/L	DDT, µg/L	Ceriodaphnia dubia, Survival (%)	Selenastrum capricornutum, Total Cell Count
Mokelumne River @ Bruella Rd	Irrigation	24/Aug/2004						835000
Mokelumne River @ Bruella Rd	Irrigation	23/Sep/2004					5	
Mokelumne River @ Bruella Rd	Irrigation	17/May/2005						1580000
Mokelumne River @ Bruella Rd	Irrigation	21/Jun/2005	5.1				35	
Mokelumne River @ Bruella Rd	Irrigation	19/Jul/2005	6.6					
Mokelumne River @ Bruella Rd	Irrigation	16/May/2006	6.9	6.48				
Mokelumne River @ Bruella Rd	Irrigation	20/Jun/2006	6.7			0.0096[3]		
Mokelumne River @ Bruella Rd	Irrigation	15/Aug/2006		6.33				
Mokelumne River @ Bruella Rd	Irrigation	10/Apr/2007		8.52				
Mokelumne River @ Bruella Rd	Irrigation	12/Jun/2007			1.8 (1.7)			
Mokelumne River @ Bruella Rd	Irrigation	10/Jul/2007			4.7 (1.9)			507779
Mokelumne River @ Bruella Rd	Irrigation	07/Aug/2007			2.4 (1.9)			
Mokelumne River @ Bruella Rd	Storm	21/Mar/2005					35	1260000
Mokelumne River @ Bruella Rd	Storm	27/Feb/2006					5	
Mokelumne River @ Bruella Rd	Storm	10/Mar/2006					5	
Mokelumne River @ Fish Hatchery	Irrigation	20/Sep/2005	5.5					
Constituent Priority			**E**	**E**	**C**		**D**	**D**

[1]Montitoring for this analyte was not initiated until May of 2006.
[2]Water quality trigger for each sample is based on hardness and is shown in parenthesis.
[3]Exceedance detected in field blank only and is included in summary and tally of exceedances but not considered representative of water quality at the Mokelumne River @ Bruella Rd sample site.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at the Mokelumne River @ Bruella Rd. monitoring site for water column toxicity to *Ceriodaphnia dubia* and *Selenastrum capricornutum*. Table IX-6 provides monitoring results for these constituents from all sampling events during the 2007 irrigation season and indicates which constituents were being targeted in each management plan monitoring event.

Table IX-6. Mokelumne River @ Bruella Rd. Normal monitoring (NM), resampling (RS), and Management Plan monitoring (MPM) results for water column toxicity to *Ceriodaphnia dubia* and *Selenastrum capricornutum* from the 2007 irrigation season. Exceedance values are in bold.

Management Plan Constituent	**NM**	**NM**	**NM**	**MPM**	**NM**	**RS**	**NM**	**MPM**	**NM**	**MPM**
	4/10/07	5/22/07	6/12/07	6/20/07	7/10/07	7/17/07	8/07/07	8/28/07	9/04/07	9/25/07
Ceriodaphnia %survival	100%	95%	90%	100%	100%	NA	100%	NA	100%	100%
Selenastrum cell count	1690000	1392000	696656	NA	**507779**	439393	507779	611987	540334	NA

NA – Management Plan monitoring not conducted on this date for this analyte.

Load Calculations

No loads were able to be calculated for copper detections because flows are too high to take flow measurements safely.

Source Identification

Priority C Constituent

Copper

Three exceedances of the copper WQTL occurred in the Mokelumne River site subwatershed in June, July, and August 2007. The July exceedance was associated with toxicity to *Selenastrum*. Large amounts of copper are applied in almost every month of the year in this watershed but peak applications are in March-June (Table IX-7, Figure IX-2). Copper is heavily used in the watershed with applications being made across numerous sections (Table IX-8). Copper appears to move to the river by sediments mobilized during irrigation.

D Constituents

Ceriodaphnia dubia toxicity

Toxicity to *Ceriodaphnia* occurred in September 2004, March and June 2005, and February and March 2006. *Ceriodaphnia* toxicity was not associated with an exceedance of any pesticide for which the Coalition samples. TIEs were performed on all samples except the March 2006 resample. Results of all TIEs were inconclusive.

Selenastrum capricornutum toxicity

Selenastrum toxicity was experienced four times from 2004 to 2007; August 2004, March and May 2005, and July 2007. The July 2007 was associated with a copper exceedance, and the Coalition did not analyze for metals prior to 2006 so it is unknown if copper was present in the sample. No TIEs were performed for any of the exceedances. It is clear that the cause of the toxicity is associated with a soluble constituent(s) and preventing storm water and irrigation return flows would be effective in reducing or eliminating *Selenastrum* toxicity. At the time when this site becomes a priority, the Coalition will carefully review the PURs to determine which high solubility constituents should be targeted for focused outreach and management.

Table IX-7. Number of copper applications, pounds applied and acres treated for each month and year of application in the Mokelumne River @ Bruella Rd site subwatershed between 2004 and 2007.

Month	Number of Copper Applications	Pounds Product Applied	Acres Treated
January 2004	2	107.45	17.5
February 2004	6	1715.15	110
March 2004	22	3933.24	833.25

Month	Number of Copper Applications	Pounds Product Applied	Acres Treated
April 2004	37	4027.48	1216.15
May 2004	10	556.71	268.5
June 2004	9	330.93	227
July 2004	3	124.13	105
October 2004	2	193.41	105
November 2004	4	795.17	79
December 2004	8	1521.28	139.5
January 2005	1	24.56	5
February 2005	4	3125.23	233.5
March 2005	25	1877.12	701
April 2005	58	4507.58	1910.5
May 2005	21	4251.34	996
June 2005	7	690.71	305
July 2005	4	138.00	48.5
October 2005	1	147.36	20
December 2005	9	2080.57	177.5
February 2006	5	2405.73	140
March 2006	2	194.03	14
April 2006	41	5642.08	1405.65
May 2006	40	6141.98	1466.5
June 2006	2	49.20	19
July 2006	4	395.96	59.45
August 2006	3	246.12	82
November 2006	3	604.76	46
December 2006	8	1207.82	141
February 2007	1	53.80	10
March 2007	16	4175.58	558
April 2007	38	8429.84	2058
May 2007	13	1927.20	529
July 2007	1	90.00	40
2004 Total	103	13304.95	3100.9
2005 Total	130	16842.48	4397
2006 Total	108	16887.67	3373.6
2007 Total	69	14676.42	3195
TOTAL	**410**	**61711.51**	**14066.5**

Figure IX-2. Pounds of copper added to TRS within the Mokelumne River @ Bruella Rd site subwatershed by month for 2004-2007. Asterisk (*) denotes months in which chlorpyrifos exceedances were detected at the site.

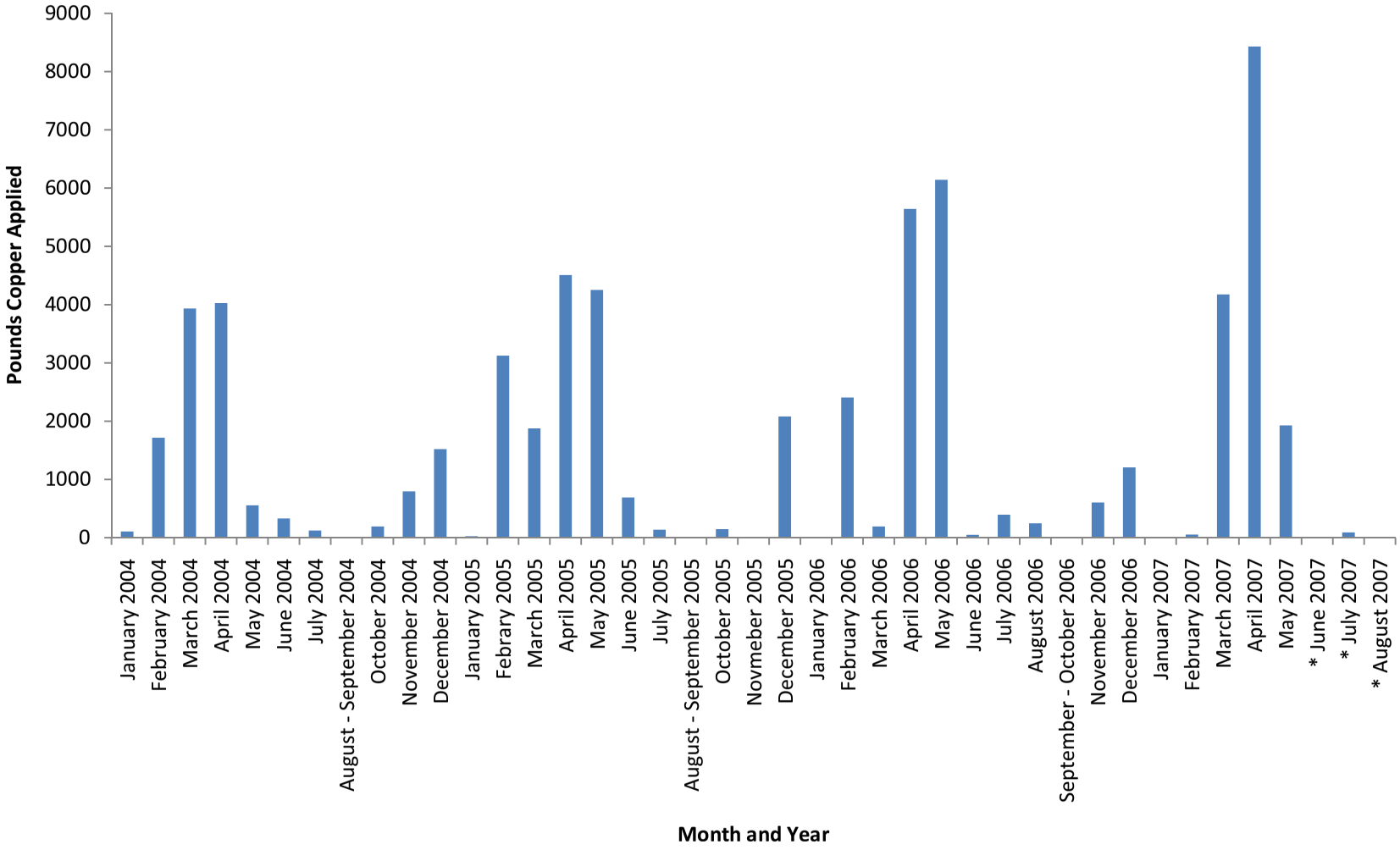


Table IX-8. All TRS that had more than one application associated with exceedances of copper. Table shows the number of applications associated with the exceedance for a given TRS.

TRS	Date of Associated Exceedance		
	6/12/2007	7/10/2007	8/7/2007
3N7E4	3		
3N7E5	2	1	
4N7E25	5	3	
4N7E27	2	1	
4N7E33	2	2	
4N7E34	4	2	2
4N8E11	7	6	1
4N8E15	3	1	
4N8E17	3	2	
4N8E18	2	2	
4N8E20	3	2	
4N8E21	4	3	
4N8E29	6	3	
4N8E30	6	2	
4N8E8	3	3	2
4N8E9	2	2	2

Priority E Constituents

pH

pH is a non-conserved indicator of biological and physical inputs to the system and is not possible to manage unless the causes are known. Determining the causes of changes in pH is not a priority and the Coalition will not attempt to manage this constituent.

2008 Management Plan Monitoring

Additional Management Plan monitoring will be conducted during the irrigation season of 2008 at Mokelumne River @ Bruella Rd In June, July and August for copper, in June and September for *Ceriodaphnia* toxicity, and in May, July and August for *Selenastrum* toxicity (Table IX-9).

Table IX-9. Mokelumne River @ Bruella Rd 2008 Management Plan sampling. A = additional sampling. X = indicates the site, month, and analyte sampled.

Sample Site	Month	Type	Copper	*Ceriodaphnia dubia*	*Selenastrum capricornutum*
Mokelumne River @ Bruella Rd	May	A			x
Mokelumne River @ Bruella Rd	June	A	x	x	
Mokelumne River @ Bruella Rd	July	A	x		x
Mokelumne River @ Bruella Rd	August	A	x		x
Mokelumne River @ Bruella Rd	September	A		x	

X. MORMON SLOUGH

Management Plan Constituents

Priority A

- Chlorpyrifos

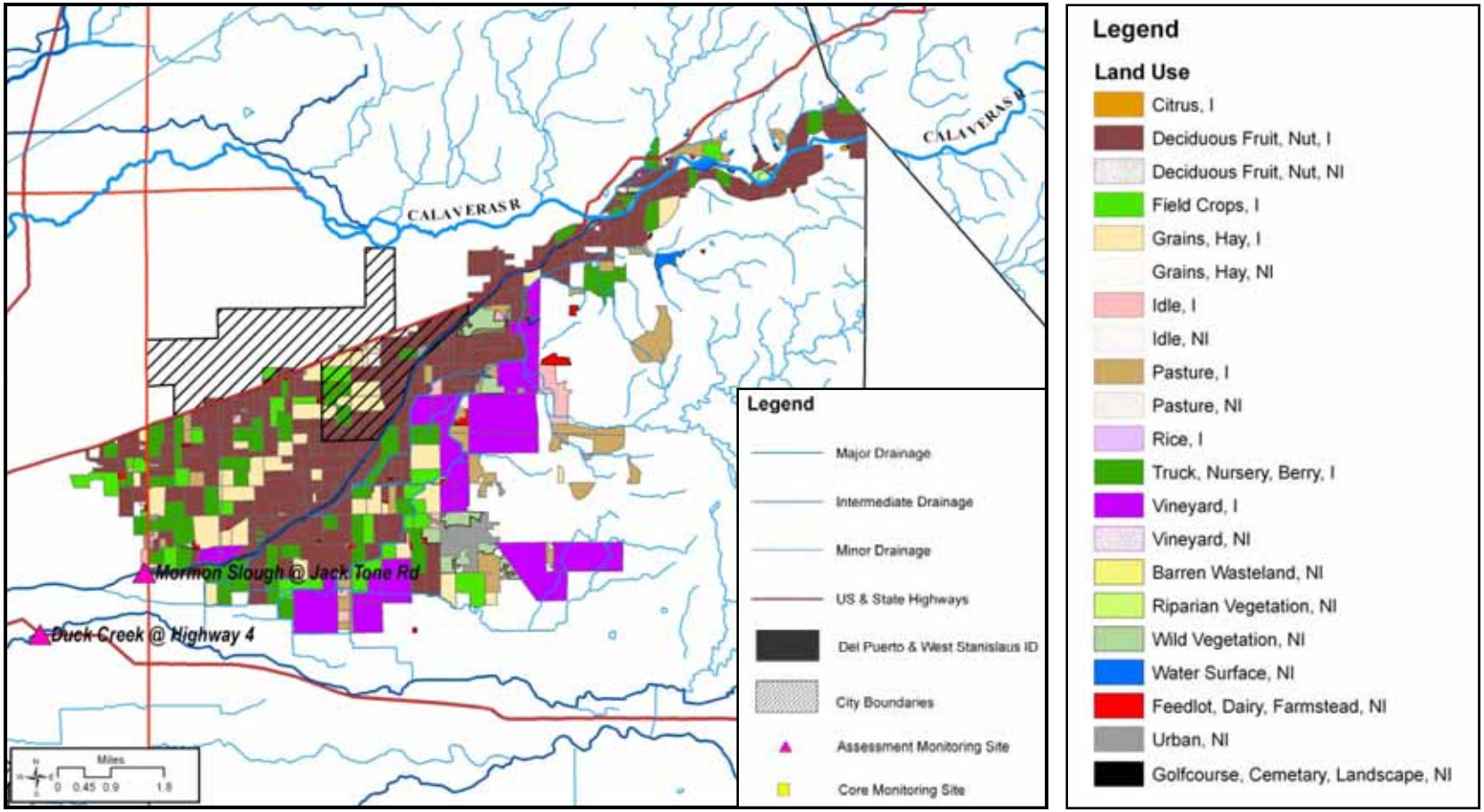
Priority E

- Dissolved Oxygen
- Color
- *E. coli*

Description of Mormon Slough @ Jack Tone Road Site Subwatershed

Mormon Slough @ Jack Tone Road (21,219 irrigated acres) is located to the north of and running parallel to the Duck Creek site subwatershed. Mormon Slough drains an area east of Stockton consisting of mostly agriculture and eventually flowing through Stockton and into the Delta. Vineyards and deciduous orchards make up over half of the irrigated agriculture in the site subwatershed with field crops, grains, truck farm/nursery/berry, and irrigated pasture contributing large acreages (Figure X-1).

Figure X-1. Site subwatershed map of land use for sample site at Mormon Slough @ Jack Tone Rd. The highlighted points mark current sampling sites



Subwatershed Monitoring History

Coalition ambient water monitoring at the Mormon Slough @ Jack Tone Rd sampling site was initiated in the irrigation season of 2006 and it has been monitored since that time (Tables X-1, X-2). Exceedances of field parameters, color, *E. coli*, pesticides, and sediment and water column toxicity have occurred. A section of the Mormon Slough, downstream of the Coalition monitoring site, is listed as impaired in the current Basin Plan for low dissolved oxygen and pathogens. The potential sources listed are urban runoff/storm sewers, and recreational and tourism activities.

Mormon Slough @ Jack Tone Rd will be an Assessment Monitoring location under the new MRPP. Assessment Monitoring at this site will begin in 2011. In the meantime, Management Plan Monitoring for chlorpyrifos will also occur at this site during months of May and September.

Table X-1. Mormon Slough @ Jack Tone Rd sampling events per season and year. An irrigation season sampling event encompasses normal monitoring and associated resampling, management plan monitoring, and sediment sampling. A storm event encompasses normal monitoring and any associated resampling.

Year	2004	2005		2006		2007	
Season	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	None	None	None	None	5	2	6

Table X-2. Mormon Slough @ Jack Tone Rd. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
Field and Physical Parameters			
pH	5	3	8
Electrical Conductivity	5	3	8
Dissolved Oxygen	5	3	8
Total Dissolved Solids	5	2	7
Turbidity	5	3	6
E. coli	5	2	6
Color	5	2	6
Total Organic Carbon	5	2	6
Biological Oxygen Demand	1	2	2
Carbamates			
Aldicarb	5	2	6
Carbaryl	5	2	6
Carbofuran	5	2	6
Methiocarb	5	2	6
Methomyl	5	2	6
Oxamyl	5	2	6
Organochlorines			

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
DDD	5	2	6
DDE	5	2	6
DDT	5	2	6
Dicofol	5	2	6
Dieldrin	5	2	6
Endrin	5	2	6
Methoxychlor	5	2	6
Organophosphates			
Azinphos methyl	5	2	6
Chlorpyrifos	5	2	6
Diazinon	5	2	6
Dimethoate	5	2	6
Disulfoton	5	2	6
Malathion	5	2	6
Methamidophos	5	2	6
Methidathion	5	2	6
Parathion, Methyl	5	2	6
Phorate	5	2	6
Phosmet	5	2	6
Pyrethroids			
Bifenthrin	5	2	6
Cypermethrin	5	2	6
Cyhalothrin, lambda	5	2	6
Permethrin	5	2	6
Cyfluthrin	5	2	6
Esfenvalerate/ Fenvalerate	5	2	6
Triazines			
Atrazine	5	2	6
Cyanazine	5	2	6
Diuron	5	2	6
Glyphosate	5	2	6
Linuron	5	2	6
Molinate	5	2	6
Paraquat dichloride	5	2	6
Simazine	5	2	6
Thiobencarb	5	2	6
Nutrients			
Nitrate as NO3			1
Nitrite as Nitrogen			1
Orthophosphate			1
Toxicity			
Ceriodaphnia dubia	5	2	7
Pimephales promelas	5	2	6
Selenastrum capricornutum	5	2	7
Hyalella azteca		2	1

Exceedance History

Monitoring at Mormon Slough began with the irrigation season of 2006. Exceedances of the WQTL include dissolved oxygen (6), color (7), *E. coli* (1), chlorpyrifos (2), toxicity to *Ceriodaphnia dubia (1), and Selenastrum capricornutum* (1). Sediment toxicity to *Hyalella azteca* occurred once (Table X-3).

Table X-3. All exceedances experienced in samples collected from the Mormon Slough @ Jack Tone Rd Coalition monitoring site between May 2006 and September 2007.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	Color, color units	E. coli, MPN/100 mL	Chlorpyrifos, µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Selenastrum capricornutum, Total Cell Count
Mormon Slough @ Jack Tone Rd	Irrigation	16/May/2006		25		0.035			
Mormon Slough @ Jack Tone Rd	Irrigation	20/Jun/2006	5.8	20					
Mormon Slough @ Jack Tone Rd	Irrigation	18/Jul/2006	6.6	19					
Mormon Slough @ Jack Tone Rd	Irrigation	15/Aug/2006		17					
Mormon Slough @ Jack Tone Rd	Irrigation	19/Sep/2006	6.9	20					
Mormon Slough @ Jack Tone Rd	Irrigation	12/Jun/2007	6.68						
Mormon Slough @ Jack Tone Rd	Irrigation	10/Jul/2007	6.27						543601
Mormon Slough @ Jack Tone Rd	Irrigation	17/Jul/2007	6						
Mormon Slough @ Jack Tone Rd	Irrigation	04/Sep/2007		20		0.21	0		
Mormon Slough @ Jack Tone Rd	Storm	28/Feb/2007		100	2400				
Mormon Slough @ Jack Tone Rd	Storm	06/Mar/2007						90	
Constituent Priority			**E**	**E**	**E**	**A**			

2007 Management Plan Monitoring Results

Management Plan monitoring was not conducted during the 2007 irrigation season since the second chlorpyrifos exceedance occurred in September 2007.

Load Calculations

Loads were calculated for chlorpyrifos detections based on the following formula (Table X-4):

Load = Discharge (cfs) X 28.317L/ft^3 X Concentration (milligram/L X 1000 or µg/L).

The load values presented for constituents 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 a normalization of the concentrations by flow for various constituents at the time the samples were collected. Due to a lack of flow in the creek during both monitoring events, the calculated load is shown as zero.

Table X-4. Loads of chlorpyrifos calculated from concentration and discharge measured for each detection at the Mormon Slough monitoring site.

Analyte	Exceedance Date	Discharge (cfs)	Concentration (µg/L)	Load (µg/sec)
Chlorpyrifos	7/10/2007	0	0.015	0
Chlorpyrifos	9/4/2007	0	0.21	0

Source Identification

Priority A Constituent

Chlorpyrifos

The WQTL for chlorpyrifos (0.015 µg/L) was exceeded in May 2006 and September 2007 (Table X-3), both in the irrigation season. The September 2007 exceedance was associated with complete mortality to *Ceriodaphnia*, and the TIE for the *Ceriodaphnia* indicated that a metabolically activated pesticide was the cause and the calculated TUs were accounted for by the concentration of chlorpyrifos in the sample. The high concentrations in the samples suggest that the exceedance is a result of runoff in irrigation return flows. There were a large number of applications of chlorpyrifos in May 2006 and July and August 2007 (Table X-5, Figure X-2). Applications occurred in ten sections prior to the 2006 exceedance and four sections prior to the 2007 exceedance (Table X-6).

Table X-5. Number of chlorpyrifos applications, pounds applied and acres treated for each month and year of application in the Mormon Slough @ Jack Tone Rd site subwatershed between 2006 and 2007.

Month	Number of Chlorpyrifos Applications	Pounds Product Applied	Acres Treated
February 2006	5	209.82	109.7
March 2006	6	410.78	220
April 2006	5	88.88	74
May 2006	60	2445.08	2430
June 2006	20	943.50	572
July 2006	43	3081.24	1841.5
August 2006	32	1303.83	907.5

Month	Number of Chlorpyrifos Applications	Pounds Product Applied	Acres Treated
September 2006	19	976.63	612.3
October 2006	5	493.21	267.2
November 2006	6	392.77	214.9
December 2006	1	0.52	1
January 2007	1	1.23	3
March 2007	11	314.83	364
April 2007	36	1077.41	1546
May 2007	12	777.10	484
June 2007	3	259.93	131
July 2007	27	1208.92	892
August 2007	9	272.04	137
2006 Total	202	10346.27	7250.1
2007 Total	99	3911.46	3557
TOTAL	**301**	**14257.73**	**10807.1**

Figure X-2. Pounds of chlorpyrifos added to TRS within the Mormon Slough @ Jack Tone Rd site subwatershed by month for 2006-2007. Asterisk (*) denotes months in which chlorpyrifos exceedances were detected at the site.

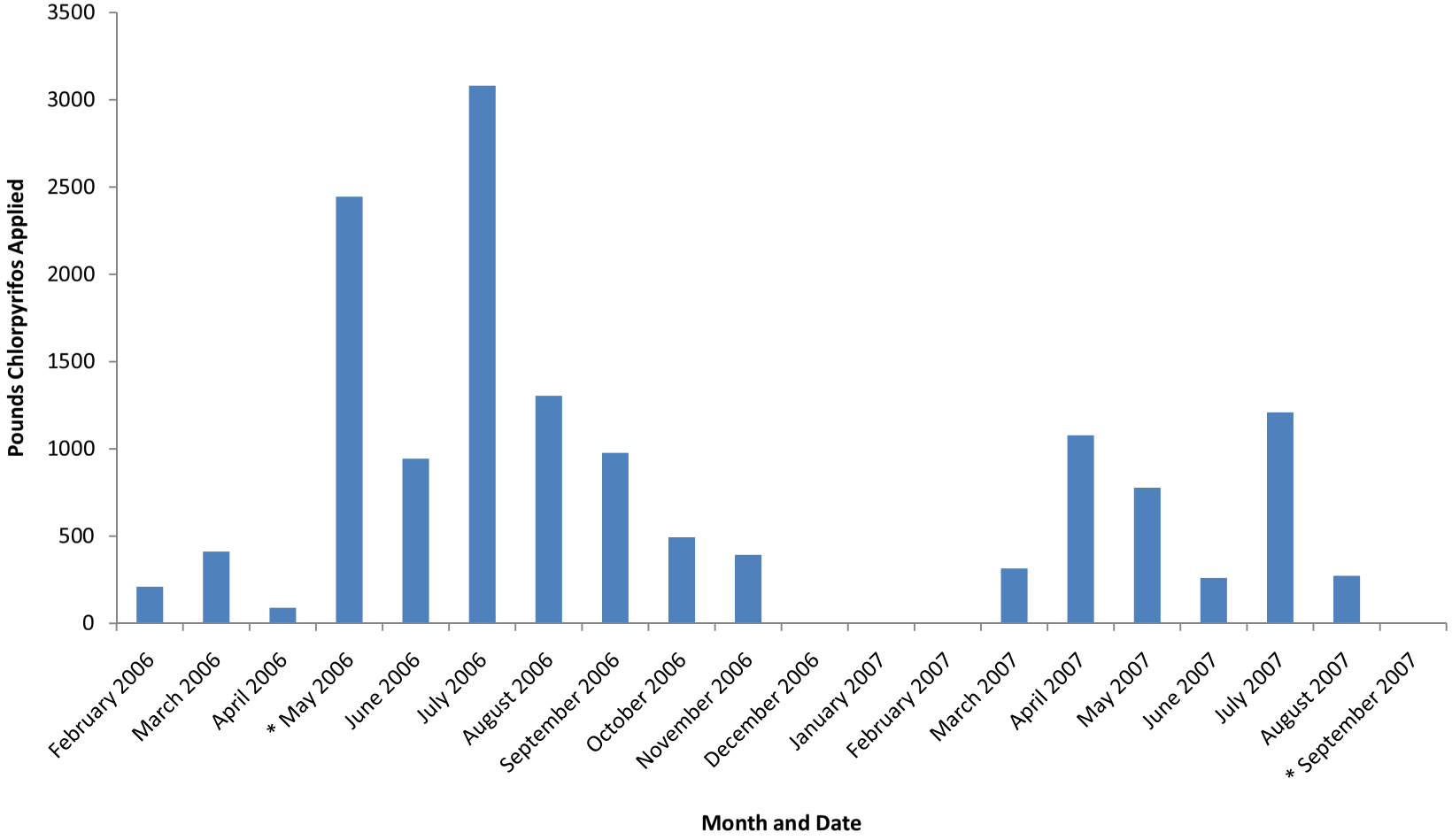


Table X-6. All TRS that had one or more applications associated with exceedances of chlorpyrifos. Table shows the number of applications associated with the exceedance for a given TRS.

TRS	5/16/2006	9/4/2007
1N8E11	2	
2N7E36	2	
2N8E1	3	
2N8E12	3	
2N8E14	3	1
2N8E16	2	1
2N8E19	1	1
2N8E28		2
2N8E29	2	
2N8E32	4	
2N9E8	5	

Priority E Constituents

DO

In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. None of the samples collected at Mormon Slough contained measurable amounts of BOD and two of the samples experienced an exceedance of the DO WQTL although the exceedances were relatively small (Table X-7). These results do not eliminate BOD as a cause of low DO and it is not clear what the cause of low DO at this site is. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Table X-7. Mormon Slough @ Jack Tone Rd. BOD, pH and dissolved oxygen results for September 2006 – July 2007. ND = non-detect.

Station Name	Sample Date	Sample Type Code	Oxygen, Dissolved	BOD, mg/L
Mormon Slough @ Jack Tone Rd	9/19/2006	Grab	6.9	ND
Mormon Slough @ Jack Tone Rd	2/11/2007	Grab	9.97	ND
Mormon Slough @ Jack Tone Rd	2/28/2007	Grab	11.43	ND
Mormon Slough @ Jack Tone Rd	4/10/2007	Grab	8.65	ND
Mormon Slough @ Jack Tone Rd	7/10/2007	Grab	6.27	ND

E. coli

E. coli exceedances occurred six times since 2005 in both the storm and irrigation seasons. It is unknown if manure is applied in the watershed, but there does not appear to be a large number of dairies upstream. Mormon Slough @ Jack Tone Rd site subwatershed was not

sampled for the 2006 *E. coli* study and the source of the *E. coli* is unknown at this time. The Coalition will address additional sourcing when *E. coli* becomes a priority.

Color

Color is a non-conserved indicator of biological and physical inputs to the system and is not possible to manage unless the causes are known. Determining the causes of color is not a priority and the Coalition will not attempt to manage these constituents.

2008 Management Plan Monitoring

Additional Management Plan monitoring will occur in May and September 2008 for chlorpyrifos (Table X-8).

Table X-8. Mormon Slough @ Jack Tone Rd 2008 Management Plan sampling. A = additional sampling. X = indicates the site, month, and analyte sampled.

Sample Site	Month	Type	Chlorpyrifos
Mormon Slough @ Jack Tone Rd	May	A	**x**
Mormon Slough @ Jack Tone Rd	September	A	**x**

XI. ROBERTS ISLAND DRAIN ALONG HOUSE ROAD

Monitoring Plan Constituents

Priority D

- *Hyalella azteca* water column toxicity

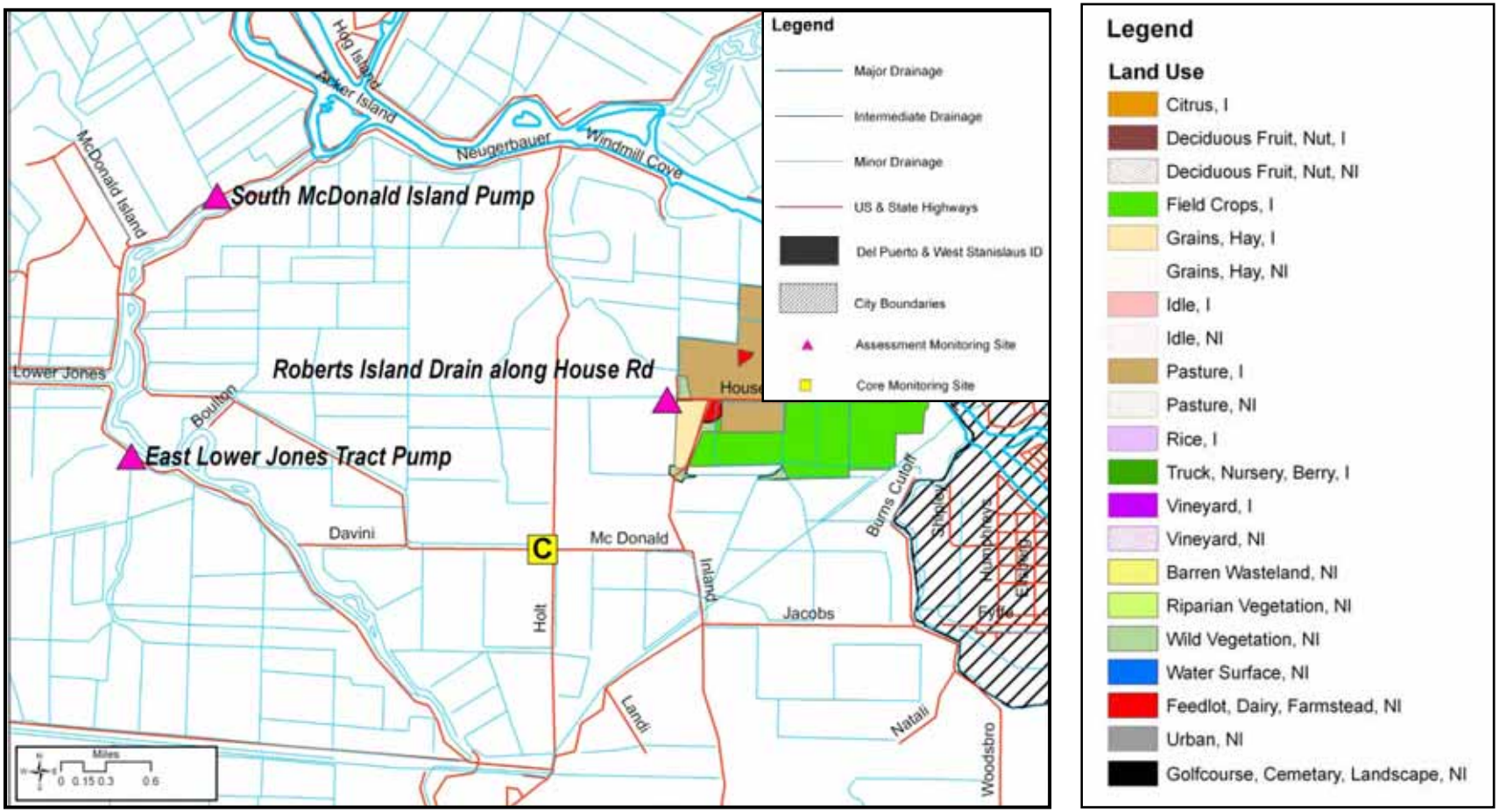
Priority E

- Dissolved Oxygen
- pH
- Specific Conductivity
- Color
- Total Dissolved Solids
- *E. coli*

Description of Roberts Island Drain along House Road Site Subwatershed

Roberts Island Drain along House Road (1,541 irrigated acres) site subwatershed is located on the northeastern edge of Roberts Island. From the sample site, the water in the drain flows north and is discharged only when pumped into the Delta channel. The primary agriculture in the site subwatershed is asparagus, followed by field crops and pasture (Figure XI-1).

Figure XI-1. Site subwatershed map of land use for sample site at Roberts Island Drain along House Rd. The highlighted points mark current sampling sites.



Subwatershed Monitoring History

Monitoring was initiated at the Roberts Island Drain along House Rd monitoring site during the irrigation season of 2006 and the site has been monitored since that time (Tables XI-1, XI-2). Samples were collected from this site for field parameters and the analysis of chemistry and toxicity. Exceedances of WQTLs for field and physical parameters, *E. coli*, pesticides and sediment toxicity have occurred at this site. A summary and discussion of these exceedances is provided in the next section (Table XI-3).

The Roberts Island Drain is not considered impaired in the current Basin Plan.

Roberts Island Drain along House Road will be an Assessment Monitoring location under the new MRPP and the first monitoring rotation will occur after 2031.

Table XI-1. Roberts Island Drain along House Rd number of sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Events Sampled	None	None	None	None	5	2	6

Table XI-2. Roberts Island Drain along House Rd. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
Field and Physical Parameters			
pH	5	4	8
Electrical Conductivity	5	4	8
Dissolved Oxygen	5	4	8
Total Dissolved Solids	5	2	6
Turbidity	5	2	6
E. coli	5	2	6
Color	5	2	6
Total Organic Carbon	5	2	6
Biological Oxygen Demand	1	2	2
Carbamates			
Aldicarb	5	2	6
Carbaryl	5	2	6
Carbofuran	5	2	6
Methiocarb	5	2	6
Methomyl	5	2	6
Oxamyl	5	2	6
Organochlorines			

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
DDD	5	2	6
DDE	5	2	6
DDT	5	2	6
Dicofol	5	2	6
Dieldrin	5	2	6
Endrin	5	2	6
Methoxychlor	5	2	6
Organophosphates			
Azinphos methyl	5	2	6
Chlorpyrifos	5	2	6
Diazinon	5	2	6
Dimethoate	5	2	6
Disulfoton	5	2	6
Malathion	5	2	6
Methamidophos	5	2	6
Methidathion	5	2	6
Parathion, Methyl	5	2	6
Phorate	5	2	6
Phosmet	5	2	6
Pyrethroids			
Bifenthrin	5	2	6
Cypermethrin	5	2	6
Cyhalothrin, lambda	5	2	7
Permethrin	5	2	6
Cyfluthrin	5	2	6
Esfenvalerate/ Fenvalerate	5	2	6
Triazines			
Atrazine	5	2	6
Cyanazine	5	2	6
Diuron	5	2	6
Glyphosate	5	2	6
Linuron	5	2	6
Molinate	5	2	6
Paraquat dichloride	5	2	6
Simazine	5	2	6
Thiobencarb	5	2	6
Nutrients			
Nitrate as NO3			1
Nitrite as Nitrogen			1
Orthophosphate			1
Toxicity			
Ceriodaphnia dubia	5	2	6
Pimephales promelas	5	2	6
Selenastrum capricornutum	5	2	6
Hyalella azteca	1	2	1

Exceedance History

During Coalition monitoring, exceedances of water quality trigger limits for field and physical parameters, *E. coli,* pesticides, and water column and sediment toxicity have occurred at this site. During the irrigation season of 2007, exceedances included nine dissolved oxygen (DO), nine electrical conductivity (EC), eight color, five dissolved solids, two *E. coli*, one cypermethrin and sediment toxicity to *Hyalella* detected in samples from the 2007 storm monitoring event. Samples collected over the entire three seasons of monitoring at the Roberts Island Drain along House Road sample site resulted in 14 exceedances of DO, three of pH, 11 of EC, 13 of color, nine of dissolved solids, six *E. coli*, one cypermethrin, and one DDE. Sediment toxicity to *Hyalella* occurred in the original sample and the resample of the 2007 storm monitoring event (Table XI-3).

Table XI-3. All exceedances experienced in samples collected from the Roberts Island along House Rd monitoring site.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	pH, none	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Cypermethrin, total, µg/L	DDE(p,p')[1], µg/L	Hyalella azteca, Survival (%)
Roberts Island Drain along House Rd	Irrigation	16/May/2006	6.1			200		410			
Roberts Island Drain along House Rd	Irrigation	20/Jun/2006	1.31	6.06	1060	170	1200	390		0.009	
Roberts Island Drain along House Rd	Irrigation	18/Jul/2006	3.2	6.38		220	460				
Roberts Island Drain along House Rd	Irrigation	15/Aug/2006	3.4	6.43		320	570	1100			
Roberts Island Drain along House Rd	Irrigation	19/Sep/2006	3.1		737	130	550	330			
Roberts Island Drain along House Rd	Irrigation	11/Apr/2007	4.74		1723	170	1100				
Roberts Island Drain along House Rd	Irrigation	22/May/2007				150					
Roberts Island Drain along House Rd	Irrigation	12/Jun/2007	4.7		793	220	500				
Roberts Island Drain along House Rd	Irrigation	10/Jul/2007	3.3		1148	380	740				
Roberts Island Drain along House Rd	Irrigation	07/Aug/2007	6.75			200		1000			
Roberts Island Drain along House Rd	Irrigation	09/Aug/2007	5.92		759						
Roberts Island Drain along House Rd	Irrigation	04/Sep/2007	4.71			80		460	0.077		
Roberts Island Drain along House Rd	Irrigation	25/Sep/2007	3.39		1527						
Roberts Island Drain along House Rd	Storm	11/Feb/2007	5.81		1212	200	780				
Roberts Island Drain along House Rd	Storm	28/Feb/2007			1966	150	1200				
Roberts Island Drain along House Rd	Storm	06/Mar/2007			1970						5
Roberts Island Drain along House Rd	Storm	29/Mar/2007	5.12		1872						17.5
Constituent Priority			**E**	**E**	**E**	**E**	**E**	**E**			**D**

[1]Montitoring for this analyte was not initiated until May of 2006.

2007 Management Plan Monitoring Result

In 2007, Management Plan monitoring was implemented at the Roberts Island Drain along House Rd monitoring site for the constituent lambda cyhalothrin. Table XI-4 provides monitoring results for this constituent from all sampling events during the 2007 irrigation season.

Table XI-4. Roberts Island Drain along House Rd. Normal monitoring (NM) and Management Plan monitoring (MPM) results for Cyhalothrin, Lambda from the 2007 irrigation season.

Monitoring Type	NM	NM	NM	NM	NM	NM	MPM
Date	4/10/07	5/22/07	6/12/07	7/10/07	8/07/07	9/04/07	9/25/07
Cyhalothrin, Lambda (ug/L)	<0.001	<0.001	<0.001	<0.001	<0.001	0.013	<0.001

Load Calculations

Load calculations are not relevant to the Management of priority constituents in this site subwatershed.

Source Identification

Priority D Constituents

Hyalella azteca toxicity

Sediment toxicity occurred in samples collected during March 2007. The first exceedance occurred during normal monitoring and the second exceedance occurred during the resample for persistence. Since the purpose of the resample is to determine if the original toxicity is persistent, the toxic resample must be considered as an extension of the first sample, not an independent sample. As a result, the Coalition does not consider the toxicity to necessitate a management plan and will not manage for sediment toxicity at this site at this time.

Priority E Constituents

DO

Table XI-5. Roberts Island Drain along House Rd. BOD, pH and dissolved oxygen results for September 2006 – July 2007. ND = non-detect.

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
Roberts Island Drain along House Rd	9/19/2006	6.51	3.1	ND
Roberts Island Drain along House Rd	2/11/2007	6.98	5.81	ND
Roberts Island Drain along House Rd	2/28/2007	6.9	7.46	ND
Roberts Island Drain along House Rd	4/11/2007	6.8	4.74	ND
Roberts Island Drain along House Rd	7/10/2007	6.85	3.3	ND

The Roberts Island drain is a water body that moves only when a pump is activated. The drain heats up in the summer and there is no mechanism for mixing the water column. Additionally, there is a large amount of photosynthetic activity in the drain, all of which can contribute to low DO. When the water level in the drain reaches a set level, a pump is activated which pumps water over the levee into Grant Line Canal. When the water is pumped into the canal, the water is oxygenated eliminating the low DO problem. In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. None of the samples collected at Mormon Slough contained measurable amounts of BOD although four of the samples experienced an exceedance of the DO WQTL (Table XI-5). These results probably

eliminate BOD as a cause of low DO and it is not clear what the cause of low DO at this site is. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Specific Conductivity/ Total Dissolved Solids (TDS)

Specific conductivity (EC) and Total Dissolved Solids (TDS) are measures of salt and are often found as exceedances together. EC and TDS exceedances are common in site subwatersheds in the Delta where shallow salty ground water commonly intrudes into the surface water drains. Also, irrigation water is salty due to the recirculation of the water from the Delta Mendota Canal back to the San Joaquin River. The Coalition recognizes that EC and TDS exceedances need to be to be managed on a regional basis and will work with the Regional Board to develop a management plan when EC/TDS become a priority.

E. coli

E. coli exceedances occurred in the irrigation seasons six times since 2006. It is unknown if manure is applied in the watershed, and there are no urban inputs. However, several residences are located in the immediate vicinity and are on septic. The source of the *E. coli* is unknown at this time. The Coalition will address additional sourcing when E. coli becomes a priority. Roberts Island Drain along House Rd site subwatershed was not sampled for the 2006 *E. coli* study.

Color/pH

Color and pH are non-conserved indicators of biological and physical inputs to the system and are not possible to manage unless the causes are known. Determining the causes of color or changes in pH is not a priority and the Coalition will not attempt to manage these constituents.

2008 Management Plan Monitoring

The Coalition will conduct normal monitoring at Roberts Island Drain along House Rd during 2008.

XII. ROBERTS ISLAND DRAIN @ HOLT ROAD

Management Plan Constituents

Priority D

- *Hyalella azteca* water column toxicity

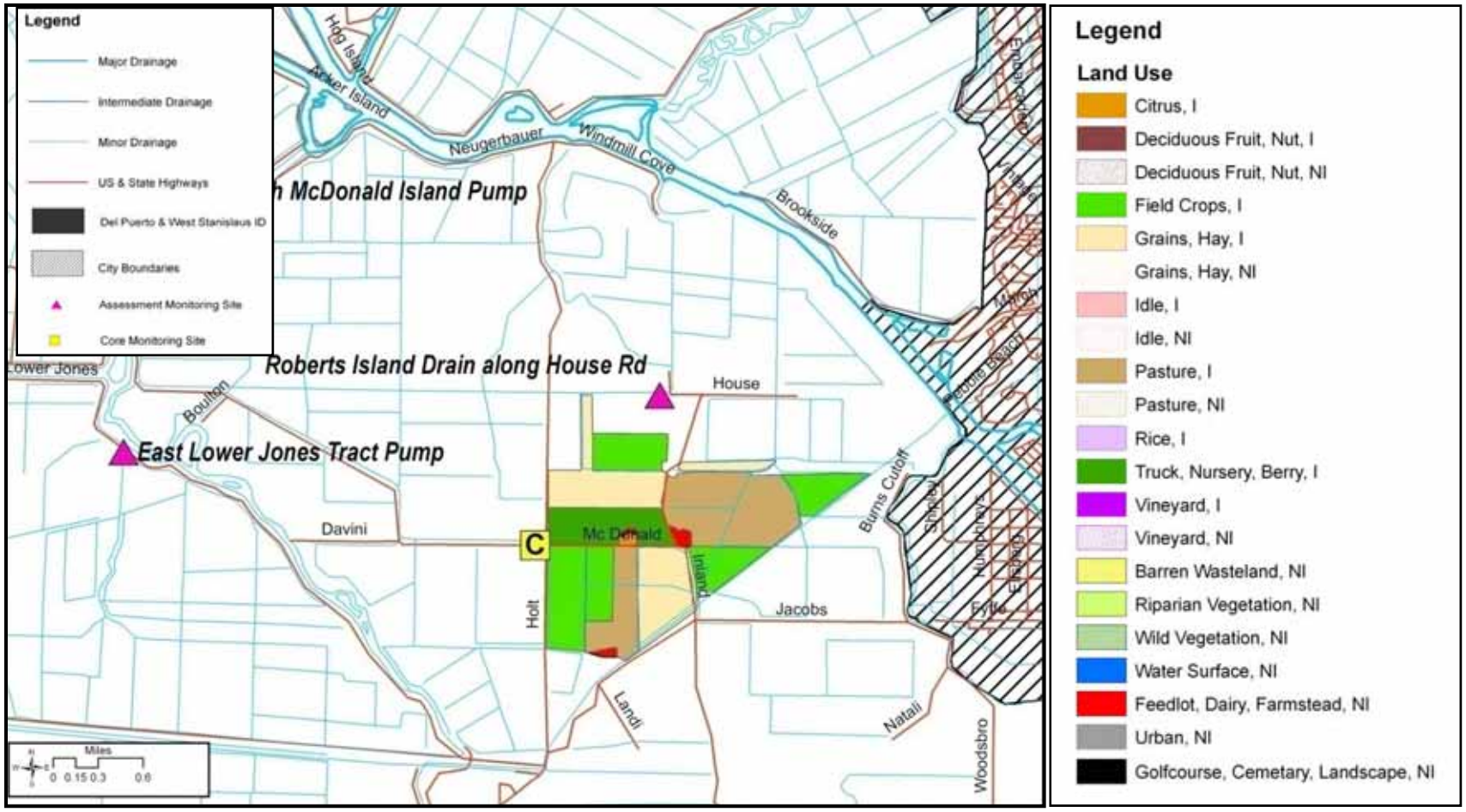
Priority E

- DDE
- Dissolved Oxygen
- Specific Conductivity
- Color
- Total Dissolved Solids
- *E. coli*

Description of Roberts Island @ Holt Road Site Subwatershed

Roberts Island Drain @ Holt Road (1,985 irrigated acres) site subwatershed is a portion of Roberts Island that is drained by the pump west of the sample site along McDonald Rd. It is located south of Roberts Island Drain along House Rd. The primary agriculture upstream of the sample site is asparagus, field crops, grains, hay (alfalfa) and pasture (Figure XII-1).

Figure XII-1. Site subwatershed map of land use for sample site at Roberts Island Drain at Holt Rd. The highlighted points mark current sampling sites.



Subwatershed Monitoring History

Monitoring was initiated at the Roberts Island Drain @ Holt Rd monitoring site during the irrigation season of 2006 and the site has been monitored sine then (Tables XII-1, XII-2). Samples were collected from this site for field parameters and the analysis of chemistry and toxicity. Exceedances of field and physical parameters, *E. coli*, pesticides and water column and sediment toxicity have been detected at this site. A summary and discussion of these exceedances is provided in the next section (Table XII-3).

The Roberts Island Drain is not considered impaired under the current Basin Plan.

Roberts Island Drain @ Holt Rd will be a Core Monitoring location under the new MRPP. Assessment Monitoring will occur again at this site in 2011.

Table XII-1. Roberts Island Drain @ Holt Rd. Number of sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Events Sampled	None	None	None	None	5	2	6

Table XII-2. Roberts Island Drain @ Holt Rd. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
Field and Physical Parameters			
pH	5	3	10
Electrical Conductivity	5	3	10
Dissolved Oxygen	5	3	10
Total Dissolved Solids	5	2	6
Turbidity	5	2	6
E. coli	5	2	6
Color	5	2	6
Total Organic Carbon	5	2	6
Biological Oxygen Demand	1	2	2
Carbamates			
Aldicarb	5	2	6
Carbaryl	5	2	6
Carbofuran	5	2	6
Methiocarb	5	2	6
Methomyl	5	2	6
Oxamyl	5	2	6
Organochlorines			
DDD	5	2	6

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
DDE	5	2	6
DDT	5	2	6
Dicofol	5	2	6
Dieldrin	5	2	6
Endrin	5	2	6
Methoxychlor	5	2	6
Organophosphates			
Azinphos methyl	5	2	6
Chlorpyrifos	5	2	6
Diazinon	5	2	6
Dimethoate	5	2	6
Disulfoton	5	2	6
Malathion	5	2	6
Methamidophos	5	2	6
Methidathion	5	2	6
Parathion, Methyl	5	2	6
Phorate	5	2	6
Phosmet	5	2	6
Pyrethroids			
Bifenthrin	5	2	6
Cypermethrin	5	2	6
Cyhalothrin, lambda	5	2	8
Permethrin	5	2	6
Cyfluthrin	5	2	6
Esfenvalerate/ Fenvalerate	5	2	6
Triazines			
Atrazine	5	2	6
Cyanazine	5	2	6
Diuron	5	2	6
Glyphosate	5	2	6
Linuron	5	2	6
Molinate	5	2	6
Paraquat dichloride	5	2	6
Simazine	5	2	6
Thiobencarb	5	2	6
Nutrients			
Nitrate as NO3			1
Nitrite as Nitrogen			1
Orthophosphate			1
Toxicity			
Ceriodaphnia dubia	5	2	7
Pimephales promelas	5	2	6
Selenastrum capricornutum	5	2	7
Hyalella azteca	2	1	1

Exceedance History

During Coalition monitoring, exceedances of water quality trigger limits for field and physical parameters, *E. coli,* pesticides, and water column and sediment toxicity have occurred at this site. During the irrigation season of 2007, exceedances detected at the site included 10 dissolved oxygen (DO), 12 electrical conductivity (EC), eight color, seven total dissolved solids, one *E. coli*, two DDE, one diuron, and water column toxicity one time each to *Ceriodaphnia* and *Selenastrum*. Samples collected over the entire three seasons of monitoring at the Roberts Island Drain @ Holt Rd sample site resulted in 15 exceedances of DO, 15 of EC, 13 of color, eight of dissolved solids, two *E. coli*, one chlorpyrifos, three DDE and one diuron. Toxicity occurred once to *Ceriodaphnia* and once to *Selenastrum*, and sediment toxicity to *Hyalella* occurred in the original sample and the resample of the 2006 irrigation monitoring event (Table XII-3).

Table XII-3. All exceedances experienced in samples collected from the Roberts Island Drain @ Holt Rd monitoring site.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Chlorpyrifos, µg/L	DDE(p,p')[1], µg/L	Diuron[1], µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Selenastrum capricornutum, Total Cell Count
Roberts Island Drain @ Holt Rd	Irrigation	16/May/2006	5.5	736	80								
Roberts Island Drain @ Holt Rd	Irrigation	20/Jun/2006	3.45	1811	140	1300	870		0.006				
Roberts Island Drain @ Holt Rd	Irrigation	18/Jul/2006	1.9		85								
Roberts Island Drain @ Holt Rd	Irrigation	15/Aug/2006	6.7		90							70	
Roberts Island Drain @ Holt Rd	Irrigation	19/Sep/2006	3.4	764	90			0.018				11.25	
Roberts Island Drain @ Holt Rd	Irrigation	11/Apr/2007	5.16	950	50	540							
Roberts Island Drain @ Holt Rd	Irrigation	22/May/2007	6.85	1851	74	1100							
Roberts Island Drain @ Holt Rd	Irrigation	12/Jun/2007	3.3	751	50								
Roberts Island Drain @ Holt Rd	Irrigation	10/Jul/2007	3.72	749	100	570	2400		0.021	4.8	0		289594
Roberts Island Drain @ Holt Rd	Irrigation	07/Aug/2007	2.32	920	75	560							
Roberts Island Drain @ Holt Rd	Irrigation	09/Aug/2007	0.64	1134									
Roberts Island Drain @ Holt Rd	Irrigation	28/Aug/2007	4.83	1436									
Roberts Island Drain @ Holt Rd	Irrigation	04/Sep/2007	1.99	966	90	620							
Roberts Island Drain @ Holt Rd	Irrigation	25/Sep/2007	2.25	1132									
Roberts Island Drain @ Holt Rd	Storm	11/Feb/2007		1231	50	770							
Roberts Island Drain @ Holt Rd	Storm	28/Feb/2007	6.14	1368	85	830			0.013				
Roberts Island Drain @ Holt Rd	Storm	06/Mar/2007		856									
Constituent Priority			**E**	**E**	**E**	**E**	**E**		**E**			**D**	

[1]Montitoring for this analyte was not initiated until May of 2006.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at the Roberts Island Drain @ Holt Rd. monitoring site for the constituent Cyhalothrin, Lambda. Table XII-4 provides monitoring results for this constituent from all sampling events during the 2007 irrigation season.

Table XII-4. Roberts Island Drain @ Holt Rd. Normal monitoring (NM) and Management Plan monitoring (MPM) results for Cyhalothrin, Lambda from the 2007 irrigation season.

Monitoring Type	NM	NM	NM	NM	NM	MPM	NM	MPM
Date	4/10/07	5/22/07	6/12/07	7/10/07	8/07/07	8/28/07	9/04/07	9/25/07
Cyhalothrin, Lambda (µg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Load Calculations

Load calculations are not relevant to the Management of priority constituents in this site subwatershed.

Source Identification

Priority D Constituents

Hyalella azteca toxicity

Sediment toxicity occurred in samples collected during March 2007. The first exceedance occurred during normal monitoring and the second exceedance occurred during the resample for persistence. Since the purpose of the resample is to determine if the original toxicity is persistent, the toxic resample must be considered as an extension of the first sample, not an independent sample. As a result, the Coalition does not consider the toxicity to necessitate a management plan and will not manage for sediment toxicity at this site at this time.

Priority E Constituents

DO

Table XII-5. Roberts Island Drain @ Holt Rd. BOD, pH and dissolved oxygen results for September 2006 - July 2007. ND = non-detect.

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
Roberts Island Drain @ Holt Rd	9/19/2006	6.67	3.4	9
Roberts Island Drain @ Holt Rd	2/11/2007	7.42	8.15	ND
Roberts Island Drain @ Holt Rd	2/28/2007	7.23	6.14	ND
Roberts Island Drain @ Holt Rd	4/11/2007	7.15	5.16	ND
Roberts Island Drain @ Holt Rd	7/10/2007	6.91	3.72	19

In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. Only two samples collected at Roberts Island contained measurable amounts of BOD and those two samples experienced an exceedance of the DO WQTL (Table XII-5). However, two additional samples also had exceedances of the DO WQTL but those samples contained no BOD. These results do not eliminate BOD as a cause of low DO and it is not clear what the cause of low DO at this site is. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Specific Conductivity/ Total Dissolved Solids (TDS)

Specific conductivity (EC) and Total Dissolved Solids (TDS) are measures of salt and are often found as exceedances together. EC and TDS exceedances are common in site subwatersheds in the Delta where shallow salty ground water commonly intrudes into the surface water drains. Also, irrigation water is salty due to the recirculation of the water from the Delta Mendota Canal back to the San Joaquin River. The Coalition recognizes that EC and TDS exceedances need to be to be managed on a regional basis and will work with the Regional Board to develop a management plan when EC/TDS become a priority.

E. coli

E. coli exceedances occurred in the irrigation seasons twice since 2006. It is unknown if manure is applied in the watershed, and there are no urban inputs. However, several residences are located in the immediate vicinity and are on septic. Roberts Island Drain at Holt Rd site subwatershed was not sampled for the 2006 *E. coli* study. The source of the *E. coli* is unknown at this time. The Coalition will address additional sourcing when *E. coli* becomes a priority.

Color

Color is a non-conserved indicator of biological and physical inputs to the system and is not possible to manage unless the causes are known. Determining the causes of color is not a priority and the Coalition will not attempt to manage these constituents.

DDE

DDE is a breakdown product of DDT and indicates that DDT was applied several decades prior to sampling. DDE is found primarily bound to sediments and was likely included in the water sample due to bottom sediments that were mobilized by storm flows or the samplers themselves. The Coalition will not manage for DDE.

2008 Management Plan Monitoring

There are no constituents within the Roberts Island Drain @ Holt Site Subwatershed Management Plan that will require Management Plan monitoring at this time.

XIII. SAND CREEK @ HWY 4 BYPASS

Management Plan Constituents

Priority A

- Chlorpyrifos

Priority C

- Dieldrin

Priority D

- *Ceriodaphnia dubia* water column toxicity
- *Hyalella azteca* sediment toxicity

Priority E

- DDE
- DDT
- Dissolved Oxygen
- Specific Conductivity
- Color
- Total Dissolved Solids
- *E. coli*

Description of Sand Creek @ Highway 4 Bypass Site Subwatershed

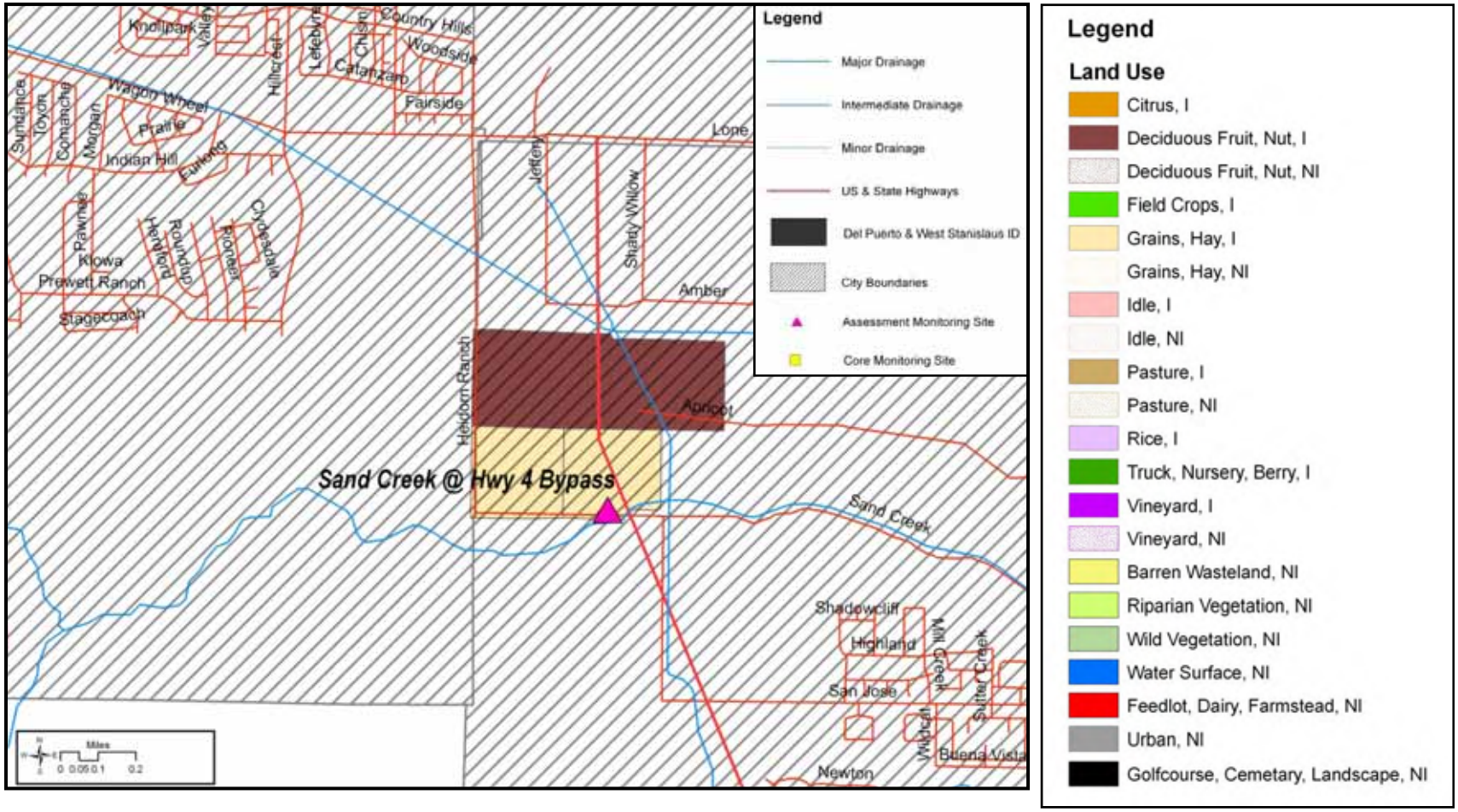
Sand Creek @ Hwy 4 Bypass (185 irrigated acres) is located northwest of Brentwood at the intersection of Hwy 4 Bypass and Sand Creek. Roddy Ranch Golf Club is located upstream of the sampling site off Empire Mile Rd. in Horse Valley, which is adjacent to one of the tributaries of Sand Creek. The land use map available from the Department of Water Resources indicates deciduous nuts and grains and hay, but recent visits to the site indicate the area is planted in field crops, primarily corn (Figure XIII-1). Areas to the east and west of Highway 4 bypass have had recent urban growth with new housing and shopping developments.

Sand Creek runs from its headwaters in Black Diamond Mines Regional Park to its confluence with Marsh Creek just north of Brentwood. The creek drains approximately 14.4 square miles with seasonal flow in its more natural upland reaches, and perennial flow supported by agricultural return flows in the lowland reaches. Several tributaries provide surface water flow to the creek, including an unnamed drainage to the west, and Horse Creek to the south. The Creek substrate is dominated by mostly deep sandy soils in its lower reaches.

Wastewater discharge to Sand Creek from oil/water separation processes associated with production have commonly occurred in the past, and could include volatile aromatic

compounds (such as benzene) as well as oil and grease. It is unknown to what extent residuals from these releases still exist in the creek.

Figure XIII-1. Site subwatershed map of land use above the Sand Creek @ Hwy 4 Bypass sample site. The highlighted point marks the current sampling site.



Subwatershed Monitoring History

Coalition ambient water monitoring at the Sand Creek @ Hwy 4 Bypass sampling site was initiated in the irrigation season of 2006 and has been monitored since that time (Tables XIII-1, XIII-2). During sampling at this site, exceedances of field and physical parameters, *E. coli*, pesticides, and sediment and water column toxicity have occurred. Details on these exceedances are provided in Table XIII-3 and discussed in the next section.

The Sand Creek is not considered impaired in the current Basin Plan, however Marsh Creek, which receives flow from Sand creek, is listed for mercury. The potential source is listed as resource extraction.

Table XIII-1. Sand Creek @ Hwy 4 Bypass sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

Year	2004	2005		2006		2007	
Season	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	None	None	None	None	5	2	6

Table XIII-2. Sand Creek @ Hwy 4 Bypass. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
Field and Physical Parameters			
pH	8	4	10
Electrical Conductivity	8	4	10
Dissolved Oxygen	8	4	10
Total Dissolved Solids	5	2	6
Turbidity	5	2	6
E. coli	5	2	6
Color	5	2	6
Total Organic Carbon	5	2	6
Biological Oxygen Demand	1	2	2
Carbamates			
Aldicarb	5	2	6
Carbaryl	5	2	6
Carbofuran	5	2	6
Methiocarb	5	2	6
Methomyl	5	2	6
Oxamyl	5	2	6
Organochlorines			
DDD	5	2	6
DDE	5	2	6

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
DDT	5	2	6
Dicofol	5	2	6
Dieldrin	5	2	8
Endrin	5	2	6
Methoxychlor	5	2	6
Organophosphates			
Azinphos methyl	5	2	6
Chlorpyrifos	5	2	7
Diazinon	5	2	6
Dimethoate	5	2	6
Disulfoton	5	2	6
Malathion	5	2	6
Methamidophos	5	2	6
Methidathion	5	2	6
Parathion, Methyl	5	2	6
Phorate	5	2	6
Phosmet	5	2	6
Pyrethroids			
Bifenthrin	5	2	6
Cypermethrin	5	2	6
Cyhalothrin, lambda	5	2	6
Permethrin	5	2	6
Cyfluthrin	5	2	6
Esfenvalerate/ Fenvalerate	5	2	6
Triazines			
Atrazine	5	2	6
Cyanazine	5	2	6
Diuron	5	2	6
Glyphosate	5	2	6
Linuron	5	2	6
Molinate	5	2	6
Paraquat dichloride	5	2	6
Simazine	5	2	6
Thiobencarb	5	2	6
Nutrients			
Nitrate as NO3			1
Nitrite as Nitrogen			1
Orthophosphate			1
Toxicity			
Ceriodaphnia dubia	8	3	8
Pimephales promelas	6	3	6
Selenastrum capricornutum	5	3	6
Hyalella azteca	2	2	2

Exceedance History

During ambient water monitoring at Sand Creek @ Hwy 4 Bypass, 13 DO, 20 specific conductivity (EC), 12 total dissolved solids (TDS), 10 *E. coli*, three DDE, two DDT, two chlorpyrifos, two dieldrin, and one exceedance each of diazinon, endrin, and methomyl have occurred. The analysis of metals was initiated in the 2006 irrigation season however no exceedances of metals have occurred. Sand Creek has also experienced water column toxicity to *Ceriodaphnia* three times and to *Pimephales* once. Sediment samples experienced toxicity to *Hyalella* five times (Table XIII-3).

Table XIII-3. All exceedances experienced in samples collected from the Sand Creek @ Hwy 4 Bypass Coalition monitoring site between May 2006 and September 2007.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Chlorpyrifos, µg/L	DDE(p,p')[1], µg/L	DDT(p,p')[1], µg/L	Diazinon, µg/L	Dieldrin[1], µg/L	Endrin[1], µg/L	Methomyl[1], µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Pimephales promelas, Survival (%)
Sand Creek @ Hwy 4 Bypass	Irrigation	16/May/2006	6.3		4400		330	0.089	0.1	0.054		0.076			15		60
Sand Creek @ Hwy 4 Bypass	Irrigation	25/May/2006	6.3	1718													
Sand Creek @ Hwy 4 Bypass	Irrigation	20/Jun/2006			1700	980	520	0.038	0.48	0.4		0.11	0.082	12	0		
Sand Creek @ Hwy 4 Bypass	Irrigation	28/Jun/2006	6.62	1455													
Sand Creek @ Hwy 4 Bypass	Irrigation	18/Jul/2006	5.3	1475	38	1200	980				0.45				0		
Sand Creek @ Hwy 4 Bypass	Irrigation	26/Jul/2006	5.7	1557													
Sand Creek @ Hwy 4 Bypass	Irrigation	15/Aug/2006	6.2	1544	40	1200	820									0	
Sand Creek @ Hwy 4 Bypass	Irrigation	19/Sep/2006	5.5	1386	40	1100	1300									0	
Sand Creek @ Hwy 4 Bypass	Irrigation	11/Apr/2007		1919	36	1400											
Sand Creek @ Hwy 4 Bypass	Irrigation	22/May/2007		1946	20	1400											
Sand Creek @ Hwy 4 Bypass	Irrigation	12/Jun/2007	6.35	1848	35	1300	460										
Sand Creek @ Hwy 4 Bypass	Irrigation	20/Jun/2007		1913													
Sand Creek @ Hwy 4 Bypass	Irrigation	10/Jul/2007		1554	40	1000	280		0.0066								
Sand Creek @ Hwy 4 Bypass	Irrigation	30/Jul/2007	5.02	1817													
Sand Creek @ Hwy 4 Bypass	Irrigation	07/Aug/2007	6.82	1762	30	1300											
Sand Creek @ Hwy 4 Bypass	Irrigation	09/Aug/2007	4.9	1723												0	
Sand Creek @ Hwy 4 Bypass	Irrigation	31/Aug/2007	5.77	1522												0	
Sand Creek @ Hwy 4 Bypass	Irrigation	04/Sep/2007	5.27	1608	40	1200	360										
Sand Creek @ Hwy 4 Bypass	Storm	11/Feb/2007		2851	200	2100	2400										
Sand Creek @ Hwy 4 Bypass	Storm	28/Feb/2007		3701	54	2700	2000										

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Chlorpyrifos, µg/L	DDE(p,p')[1], µg/L	DDT(p,p')[1], µg/L	Diazinon, µg/L	Dieldrin[1], µg/L	Endrin[1], µg/L	Methomyl[1], µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Pimephales promelas, Survival (%)
Sand Creek @ Hwy 4 Bypass	Storm	06/Mar/2007		2433												3.75	
Sand Creek @ Hwy 4 Bypass	Storm	29/Mar/2007		1816												2.5	
Constituent Priority			**E**	**E**	**E**	**E**	**E**	**A**	**E**	**E**		**C**			**C**	**D**	

[1]Monitoring for this analyte was not initiated until May of 2006.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at the Sand Creek @ Hwy 4 Bypass monitoring site for dieldrin and chlorpyrifos and for water column toxicity to *Ceriodaphnia dubia*. Table XIII-4 shows monitoring results for these constituents from all sampling events during the 2007 irrigation season and indicates which constituents were being targeted in each management plan monitoring event.

Table XIII-4. Sand Creek @ Hwy 4 Bypass Normal monitoring (NM) and Management Plan monitoring (MPM) results for dieldrin, chlorpyrifos, and toxicity to *Ceriodaphnia* from the 2007 irrigation season.

Management Plan Constituents	**NM**	**NM**	**NM**	**MPM (dieldrin, chlorpyrifos, *Ceriodaphnia*)**	**NM**	**MPM (*Ceriodaphnia*)**	**NM**	**NM**
	4/11/07	5/22/07	6/12/07	6/20/07	7/10/07	7/30/07	8/07/07	9/04/07
Dieldrin (ug/L)	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Chlorpyrifos (ug/L)	<0.00259	<0.00259	<0.00259	<0.00259	<0.003	NA	<0.003	<0.003
Ceriodaphnia % survival	50%	100%	100%	100%	100%	100%	100%	100%

Load Calculations

Loads were calculated for chlorpyrifos and dieldrin detections based on the following formula (Table XIII-5):

Load = Discharge (cfs) X 28.317L/ft^3 X Concentration (milligram/L X 1000 or µg/L).

The load values presented for constituents 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 a normalization of the concentrations by flow for various constituents at the time the samples were collected.

Table XIII-5. Loads of chlorpyrifos and dieldrin calculated from concentration and discharge measured for each detection at the Sand Creek monitoring site.

Analyte Name	Sample Date	Discharge cfs	Result	Instantaneous Loading Rate
Chlorpyrifos	5/16/2006	2.96	0.089	7.45983
Dieldrin	5/16/2006	2.96	0.076	6.370192

Source Identification

Priority A Constituent

Chlorpyrifos

The WQTL for chlorpyrifos (0.015 µg/L) was exceeded in May and June 2006 (Table XIII-3). Both exceedances were associated with significant mortality to *Ceriodaphnia.* TIEs for the *Ceriodaphnia* tests indicated that a metabolically activated pesticide was the cause and the calculated TUs were accounted for by the concentration of chlorpyrifos in the sample. The concentrations in the samples suggest that the exceedances were a result of mobilization of chlorpyrifos in irrigation return flows. There was no reported use of chlorpyrifos in the watershed, however discussions with a grower revealed that he applied chlorpyrifos to corn.

Priority C Constituents

Dieldrin

Dieldrin exceedances occurred in May and June 2006 at relatively high concentrations. No dieldrin use was reported in the watershed and the source of the dieldrin is unknown.

Priority D Constituents

Ceriodaphnia dubia toxicity

Ceriodaphnia toxicity was experienced in May and June 2006 and has been discussed above in association with the chlorpyrifos exceedances. A third toxicity occurred in July 2006 at the same time as a diazinon exceedance and the TIE indicated a metabolically activated pesticide was the cause. The diazinon in the sample accounted for the toxicity in the sample. Controlling the movement of organophosphate pesticides to the creek will prevent the toxicity to *Ceriodaphnia*.

Hyalella azteca toxicity

Hyalella toxicity has occurred at this site during the months of March (2007), August (2006, 2007) and September (2007) (Table XIII-3). The August-September 2006 and the August 2007 samples were normal monitoring-resamples and the Coalition considers each pair to be a single event. The third toxic sample was collected in March 2007. Sediment chemistry analyses are not performed and the exact toxic constituent and the source are unknown.

Priority E Constituents

DO

In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. None of the samples collected at Sand Creek contained measurable

amounts of BOD and only one sample experienced an exceedance of the DO WQTL (Table XIII-6). These results do not eliminate BOD as a cause of low DO and it is not clear what the cause of low DO at this site is. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Table XIII-6. Sand Creek @ Hwy 4 Bypass. BOD, pH and dissolved oxygen results for September 2006 – July 2007. ND = non-detect.

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
Sand Creek @ Hwy 4 Bypass	9/19/2006	7.3	5.5	ND
Sand Creek @ Hwy 4 Bypass	2/11/2007	7.86	8.77	ND
Sand Creek @ Hwy 4 Bypass	2/28/2007	7.89	12.38	ND
Sand Creek @ Hwy 4 Bypass	4/11/2007	7.78	7.07	ND
Sand Creek @ Hwy 4 Bypass	7/10/2007	8.02	7.7	ND

Specific Conductivity/ Total Dissolved Solids (TDS)

Specific conductivity (EC) and Total Dissolved Solids (TDS) are measures of salt and are often found as exceedances together. EC and TDS exceedances are common in site subwatersheds such as Sand Creek that are under tidal influence and it is assumed that the EC/TDS exceedances are a result of the tidal prism moving water back into the creek. There is so little agricultural land that it is unlikely that fertilizer applications would result in exceedances in five different months. The Coalition recognizes that EC and TDS exceedances need to be to be managed on a regional basis and will work with the Regional Board to develop a management plan when EC/TDS become a priority.

E. coli

E. coli exceedances occurred in the irrigation seasons ten times since 2006. It is unknown if manure is applied in the watershed, but there is a large urban input from storm drains. There is also a large amount of cattle grazing upstream. *E. coli* could originate with any or all of these sources. Sand Creek @ Hwy 4 Bypass site subwatershed was not sampled for the 2006 *E. coli* study. The source of the *E. coli* is unknown at this time. The Coalition will address additional sourcing when *E. coli* becomes a priority.

Color

Color is a non-conserved indicator of biological and physical inputs to the system and is not possible to manage unless the causes are known. Determining the causes of color is not a priority and the Coalition will not attempt to manage these constituents.

DDT/DDE

DDE is a breakdown product of DDT and indicates that DDT was applied several decades prior to sampling. DDE is found primarily bound to sediments and was likely included in the water

sample due to bottom sediments that were mobilized by storm flows or the samplers themselves. If DDT is currently being applied, it is being applied illegally and is not the responsibility of the coalition. The Coalition will not manage for DDT or DDE.

2008 Management Plan Monitoring

Additional Management Plan monitoring will be conducted at Sand Creek @ Hwy 4 Bypass in May and June for chlorpyrifos and dieldrin and May, June and July for *Ceriodaphnia* toxicity.

Table XIII-7. Sand Creek @ Hwy 4 Bypass 2008 Management Plan sampling. A = additional sampling. X = indicates the site, month, and analyte sampled.

Sample Site	Month	Type	Chlorpyrifos	Dieldrin	Ceriodaphnia dubia
Sand Creek @ Hwy 4 Bypass	May	A	x	x	x
Sand Creek @ Hwy 4 Bypass	June	A	x	x	x
Sand Creek @ Hwy 4 Bypass	July	A			x

XIV. TERMINOUS TRACT DRAIN

Management Plan Constituents

Priority D

- *Hyalella azteca* sediment toxicity
- *Pimephales promelas* water column toxicity
- *Selenastrum capricornutum* water column toxicity

Priority E

- Arsenic
- Dissolved Oxygen
- Specific Conductivity
- Color
- Total Dissolved Solids
- *E. coli*

Description of Terminous Tract Drain Site Subwatershed

Terminous Tract drain @ Hwy 12 (9,889 irrigated acres) site subwatershed drains all of the acreage north of State Highway 12 and most of the acreage south of the Highway on Terminous Tract. This sampling site is located near the confluence of White Slough/Potato Slough and the Mokelumne River. The primary agricultural crops are field crops, turf, grains and hay (Figure XIV-1).

Terminous Tract @ field drain off Glascock Rd (1,471 irrigated acres) – This site drains another small watershed on the Terminous Tract. Located north of the Terminous Tract off Highway 12 site, the primary agricultural crops are field crops, grains and hay. Monitoring at this site was ceased after the storm season of 2005/2006 (Figure XIV-2).

Terminous Tract on Hwy 12 @ west of Guard Rd (1,324 irrigated acres) – located east of the Terminous Tract off Highway 12 site, the site subwatershed drains a small area. Field crops and truck and nursery crops are the primary agricultural activities, and the subwatershed contains a relatively large percentage of its land in pasture. Monitoring at this site was ceased after the storm season of 2005/2006 (Figure XIV-2).

Figure XIV-1. Site subwatershed map of land use for sample site at Terminous Tract Drain @ Hwy 12. The highlighted points mark current sampling sites.

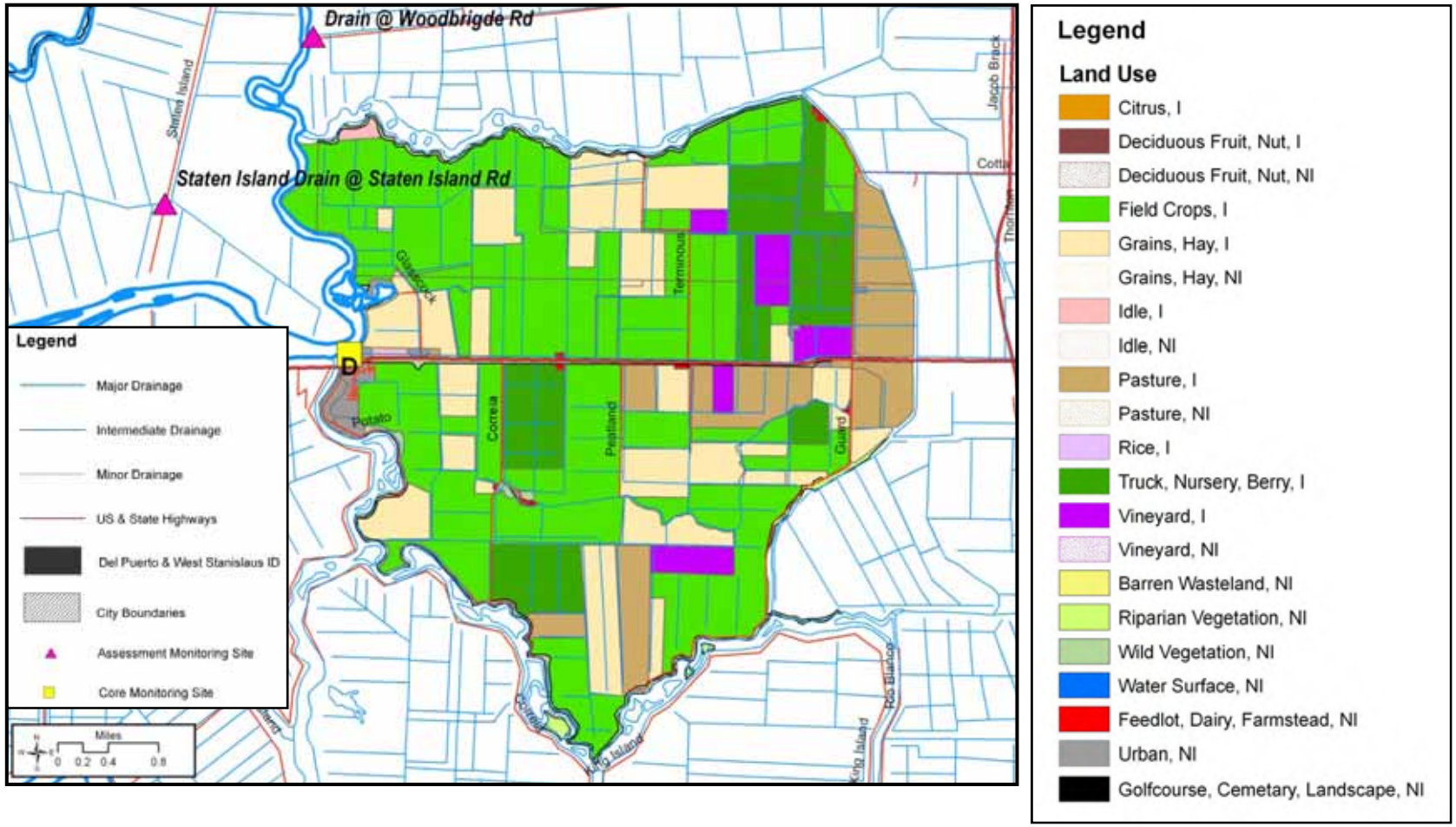


Figure XIV-2. Site subwatershed map s of land use for past monitoring sites at Delta Drain - Terminous Tract off Glascock Rd and Delta Drain – Terminous Tract off Guard Rd. The red highlighted points mark both current and past sampling sites.

Subwatershed Monitoring History

Coalition ambient water monitoring at the Terminous Tract @ Hwy 12 sampling site was initiated in the storm season of 2005 and has been monitored since that time. Sampling at the two other sites in the Terminous Tract Drain site subwatershed were also initiated at this sampling, but were only sampled for three seasons ending with the storm season of 2006 (Tables XIV-1, XIV-2, XIV-3, XIV-4, XIV-5, XIV-6). The sites at Glasscock and Guard Roads were monitored in an effort to determine if exceedances could be partitioned to specific subwatersheds. After several monitoring events it was determined that it was not possible to partition the loads and the Glasscock Road and Guard Road sites were no longer sampled. Monitoring for metals began during the irrigation season of 2006. During sampling at this site, exceedances of field and physical parameters, *E. coli*, metals, pesticides, and sediment and water column toxicity have occurred. Details on these exceedances are provided in Table XIV-7 and discussed in the next section.

The Terminous Tract is not considered impaired in the current Basin Plan, however the Sacramento/San Joaquin River Delta is listed for a number of constituents including chlorpyrifos, DDT, diazinon, group A pesticides, mercury and unknown toxicity.

Terminous Tract @ Hwy 12 will be a Core Monitoring location under the new MRPP. Assessment Monitoring will occur again at this site in 2011.

Table XIV-1. Terminous Tract Drain @ Highway 12 sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	None	2	5	2	5	2	6

Table XIV-2. Delta Drain—Terminous Tract off Glascock Rd sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	None	2	5	2	None	None	None

Table XIV-3. Delta Drain—Terminous Tract off Guard Rd sampling events per season and year. An irrigation season event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm season event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	None	2	4	2	None	None	None

Table XIV-4. Terminous Tract Drain @ Highway 12. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Field and Physical Parameters						
pH	4	6	3	5	3	7
Electrical Conductivity	4	6	3	5	3	7
Dissolved Oxygen	4	6	3	5	3	7
Total Dissolved Solids	2	5	2	5	2	6
Turbidity	2	5	2	5	3	6
E. coli	2	5	2	6	2	6
Color	2	5	2	5	3	7
Total Organic Carbon	2	5	2	6	2	6
Biological Oxygen Demand				1	2	2
Carbamates						
Aldicarb				5	2	6
Carbaryl				5	2	6
Carbofuran				5	2	6
Methiocarb				5	2	6
Methomyl				5	2	6
Oxamyl				5	2	6
Organochlorines						
DDD				5	2	6
DDE				5	2	6
DDT				5	2	6
Dicofol				5	2	6
Dieldrin				5	2	6
Endrin				5	2	6
Methoxychlor				5	2	6
Organophosphates						
Azinphos methyl				5	2	6
Chlorpyrifos	2	5	2	5	2	6
Diazinon	2	5	2	5	2	6
Dimethoate				5	2	6
Disulfoton				5	2	6
Malathion				5	2	6
Methamidophos				5	2	6
Methidathion				5	2	6
Parathion, Methyl				5	2	6
Phorate				5	2	6
Phosmet				5	2	6

Constituent	2005		2006		2007	
	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Pyrethroids						
Bifenthrin		1	2	5	2	6
Cypermethrin	2	5	2	5	2	6
Cyhalothrin, lambda	2	5	2	5	2	6
Permethrin	2	5	2	5	2	6
Cyfluthrin		1	2	5	2	6
Esfenvalerate/ Fenvalerate	2	5	2	5	2	6
Triazines						
Atrazine				5	2	6
Cyanazine				5	2	6
Diuron				5	2	6
Glyphosate				5	2	6
Linuron				5	2	6
Molinate				5	2	6
Paraquat dichloride				5	2	6
Simazine				5	2	6
Thiobencarb				5	2	6
Metals						
Arsenic				5	2	6
Boron				5	2	6
Cadmium				5	2	6
Copper				5	2	6
Lead				5	2	6
Nickel				5	2	6
Selenium				5	2	2
Zinc				5	2	6
Nutrients						
Nitrate as NO3				5	2	6
Nitrite as Nitrogen				5	2	6
Ammonia				5	2	6
Hardness				6	2	6
Total Phosphorus				5	2	6
Orthophosphate				5	2	6
TKN				5	2	6
Toxicity						
Ceriodaphnia dubia	2	5	2	5	2	6
Pimephales promelas	2	6	2	5	2	6
Selenastrum capricornutum	4	5	2	5	2	6
Hyalella azteca		5	1	1	1	1

Table XIV-5. Delta Drain—Terminous Tract off Glascock Rd. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2005		2006
	Storm	Irrigation	Storm
Field and Physical Parameters			

Constituent	2005		2006
	Storm	Irrigation	Storm
pH	2	6	3
Electrical Conductivity	2	6	3
Dissolved Oxygen	2	6	3
Total Dissolved Solids	2	5	2
Turbidity	2	5	2
E. coli	2	5	2
Color	2	5	2
Total Organic Carbon	2	5	2
Organophosphates			
Chlorpyrifos	2	5	2
Diazinon	2	5	2
Pyrethroids			
Bifenthrin		1	2
Cypermethrin	2	5	2
Cyhalothrin, lambda	2	5	2
Permethrin	2	5	2
Cyfluthrin		1	2
Esfenvalerate/ Fenvalerate	2	5	2
Toxicity			
Ceriodaphnia dubia	2	5	2
Pimephales promelas	2	6	2
Selenastrum capricornutum	2	5	2
Hyalella azteca		5	1

Table XIV-6. Delta Drain—Terminous Tract off Guard Rd. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2005		2006
	Storm	Irrigation	Storm
Field and Physical Parameters			
pH	2	4	4
Electrical Conductivity	2	4	4
Dissolved Oxygen	2	4	4
Total Dissolved Solids	2	4	2
Turbidity	2	4	2
E. coli	2	4	2
Color	2	4	2
Total Organic Carbon	2	4	2
Organophosphates			
Chlorpyrifos	2	4	2
Diazinon	2	4	2
Pyrethroids			
Bifenthrin			2
Cypermethrin	2	4	2
Cyhalothrin, lambda	2	4	2
Permethrin	2	4	2
Cyfluthrin			2
Esfenvalerate/ Fenvalerate	2	4	2

Constituent	2005		2006
	Storm	Irrigation	Storm
Toxicity			
Ceriodaphnia dubia	2	4	2
Pimephales promelas	2	4	2
Selenastrum capricornutum	2	4	3
Hyalella azteca		4	1

Exceedance History

Over the course of Coalition monitoring, exceedances of WQTLs for field and physical parameters, *E. coli,* nutrients, metals, pesticides, and water column and sediment toxicity have occurred at the current Terminous Tract @ Hwy 12 site. During the irrigation season of 2007, exceedances detected at the site included eight dissolved oxygen (DO), three electrical conductivity (EC), eight color, two dissolved solids (TDS), 14 *E. coli*, three arsenic, two cadmium, and one malathion. For all years of monitoring between 2005 and 2007, 33 exceedances of DO, 24 of EC, 39 of color, 18 of TDS, three *E. coli*, two arsenic, two cadmium and one malathion exceedance occurred. Water column toxicity to *Pimephales promelas* and *Selenastrum capricornutum* occurred twice each, and sediment toxicity to *Hyalella azteca* occurred three times (Table XIV-7).

Table XIV-7. All exceedances experienced in samples collected from the previous and current Terminous Tract Drain Coalition monitoring sites between February 2005 and September 2007.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Arsenic[1], µg/L	Cadmium, µg/L	Malathion[1], µg/L	Hyalella azteca, Survival (%)	Pimephales promelas, Survival (%)	Selenastrum capricornutum, Total Cell Count
Delta Drain- Terminous Tract off Glasscock Rd	Irrigation	17/May/2005	5.4		150		240						
Delta Drain- Terminous Tract off Glasscock Rd	Irrigation	21/Jun/2005			100								
Delta Drain- Terminous Tract off Glasscock Rd	Irrigation	19/Jul/2005	3.4		140								
Delta Drain- Terminous Tract off Glasscock Rd	Irrigation	16/Aug/2005	6		100		280						
Delta Drain- Terminous Tract off Glasscock Rd	Irrigation	20/Sep/2005	4.8		75						87.5	87.5	
Delta Drain- Terminous Tract off Glasscock Rd	Irrigation	27/Sep/2005	3.7										
Delta Drain- Terminous Tract off Glasscock Rd	Storm	16/Feb/2005	5.1		250	470	1600						
Delta Drain- Terminous Tract off Glasscock Rd	Storm	21/Mar/2005	6	848	150	540							
Delta Drain- Terminous Tract off Glasscock Rd	Storm	27/Feb/2006		1030	200	620	500						
Delta Drain- Terminous Tract off Glasscock Rd	Storm	15/Mar/2006		1091	250	650							
Delta Drain- Terminous Tract off Glasscock Rd	Storm	27/Apr/2006	5.9	754							93.75		
Delta Drain- Terminous Tract off Guard Rd	Irrigation	17/May/2005	5.3	1088	35	660							
Delta Drain- Terminous Tract off Guard Rd	Irrigation	21/Jun/2005	4.6	1099	50	610							
Delta Drain- Terminous Tract off Guard Rd	Irrigation	19/Jul/2005	2.7	809	70	480							
Delta Drain- Terminous Tract off Guard Rd	Irrigation	16/Aug/2005	4.7	701	50								
Delta Drain- Terminous Tract off Guard Rd	Storm	16/Feb/2005	6.8	1189	50	670	900						
Delta Drain- Terminous Tract off Guard Rd	Storm	21/Mar/2005		1408	30	830							
Delta Drain- Terminous Tract off Guard Rd	Storm	27/Feb/2006	6.2	1126	60	670	240						212500

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Arsenic[1], µg/L	Cadmium, µg/L	Malathion[1], µg/L	Hyalella azteca, Survival (%)	Pimephales promelas, Survival (%)	Selenastrum capricornutum, Total Cell Count
Delta Drain- Terminous Tract off Guard Rd	Storm	10/Mar/2006		1090									
Delta Drain- Terminous Tract off Guard Rd	Storm	15/Mar/2006		1119	45	650							
Delta Drain- Terminous Tract off Guard Rd	Storm	27/Apr/2006	5.2	1236							92.5		
Terminous Tract Drain @ Hwy 12	Irrigation	17/May/2005			100		240						
Terminous Tract Drain @ Hwy 12	Irrigation	21/Jun/2005	5.2		100								
Terminous Tract Drain @ Hwy 12	Irrigation	19/Jul/2005	3.7		100								
Terminous Tract Drain @ Hwy 12	Irrigation	16/Aug/2005	4.9		100								
Terminous Tract Drain @ Hwy 12	Irrigation	20/Sep/2005			80							87.5	
Terminous Tract Drain @ Hwy 12	Irrigation	16/May/2006	4.6		100		690	11					
Terminous Tract Drain @ Hwy 12	Irrigation	20/Jun/2006	4.26		85	1200	580						
Terminous Tract Drain @ Hwy 12	Irrigation	18/Jul/2006	2.7		70								
Terminous Tract Drain @ Hwy 12	Irrigation	15/Aug/2006	3.6		85								
Terminous Tract Drain @ Hwy 12	Irrigation	19/Sep/2006	4.1		76								
Terminous Tract Drain @ Hwy 12	Irrigation	10/Apr/2007			50								
Terminous Tract Drain @ Hwy 12	Irrigation	22/May/2007	6.58		44								
Terminous Tract Drain @ Hwy 12	Irrigation	12/Jun/2007	5.55		70								
Terminous Tract Drain @ Hwy 12	Irrigation	10/Jul/2007	4.58		90								
Terminous Tract Drain @ Hwy 12	Irrigation	07/Aug/2007	5.58		85		240		0.099				
Terminous Tract Drain @ Hwy 12	Irrigation	09/Aug/2007	4.8										
Terminous Tract Drain @ Hwy 12	Irrigation	04/Sep/2007	6.7		80		330		0.05				

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	Arsenic[1], µg/L	Cadmium, µg/L	Malathion[1], µg/L	Hyalella azteca, Survival (%)	Pimephales promelas, Survival (%)	Selenastrum capricornutum, Total Cell Count
Terminous Tract Drain @ Hwy 12	Storm	16/Feb/2005		950	200	580	1600						334000
Terminous Tract Drain @ Hwy 12	Storm	23/Feb/2005		1868									
Terminous Tract Drain @ Hwy 12	Storm	21/Mar/2005	6.3	1705	100	1000							
Terminous Tract Drain @ Hwy 12	Storm	04/Apr/2005		1742									
Terminous Tract Drain @ Hwy 12	Storm	27/Feb/2006		1781	100	950	1600						
Terminous Tract Drain @ Hwy 12	Storm	15/Mar/2006		1720	150	970							
Terminous Tract Drain @ Hwy 12	Storm	27/Apr/2006	6.7	1325									
Terminous Tract Drain @ Hwy 12	Storm	11/Feb/2007	5.24	873	200	570	370	11		0.05			
Terminous Tract Drain @ Hwy 12	Storm	28/Feb/2007		1469	90	840		12					
Terminous Tract Drain @ Hwy 12	Storm	06/Mar/2007	6.66	1665									
Constituent Priority			**E**	**E**	**E**	**E**	**E**	**E**			**D**	**D**	**D**

[1]Montitoring for this analyte was not initiated until May of 2006.

2007 Management Plan Monitoring Results

Management Plan Monitoring did not occur at this site.

Load Calculations

Load calculations are not relevant to the management of priority constituents in this site subwatershed.

Source Identification

Priority D Constituents

Hyalella azteca toxicity

Hyalella toxicity occurred in the September 2005 sample at the Glasscock Road and Highway 12 sites. Toxicity at both sites was low (12.5%) and this toxicity is not considered to be biologically meaningful. Sediment chemistry analyses were not performed and the exact toxic constituent and the source(s) are unknown. Also, because the sediment toxicity was experienced on a single date at two sites, and no toxicity has been experienced in the three years since, *Hyalella* will not be included in future management plan monitoring.

Selenastrum capricornutum toxicity

Selenastrum toxicity was experienced twice; February 2005 at the Highway 12 site and February 2006 at the Guard Road site. There were no exceedances of copper or herbicides associated with any of the toxicity events. No TIEs were performed for any of the exceedances. These toxicity events are most likely associated with the use of herbicides during the early winter period. It is clear that the cause of the toxicity is associated with a soluble constituent(s) and preventing storm water runoff would reduce or eliminate *Selenastrum* toxicity. At the time when this site becomes a priority, the Coalition will carefully review the PURs to determine which high solubility constituents should be targeted for focused outreach and management.

Pimephales promelas toxicity

Toxicity to *Pimephales* occurred in September 2005 at the Highway 12 and Glasscock Road sites and probably originated from an application upstream of the Glasscock Road site. Toxicity at both sites was low (12.5%) and this toxicity is not considered to be biologically meaningful. Neither exceedance was associated with an exceedance of any chemical that could cause toxicity. The source of the toxicity is unknown, and toxicity has not been experienced since that time. Also, because the *Pimephales* toxicity was experienced on a single date at two sites, and no toxicity has been experienced in the three years since, *Pimephales* will not be included in future management plan monitoring.

Priority E Constituents

Cadmium

Since the time of this exceedance, the WQTL for cadmium has increased to 5 µg/L and the exceedances listed above are therefore no longer considered an exceedance. As a result, the Coalition will not develop a strategy to manage cadmium.

DO

In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for Biological Oxygen Demand (BOD) during the September 2006, February, March, April and July 2007 monitoring events. Only one sample collected at Terminous Tract contained measurable amounts of BOD and that sample was associated with low DO. Two other samples experienced an exceedance of the DO WQTL (Table XIV-8) but had no measureable BOD in the sample. These results do not eliminate BOD as a cause of low DO and it is not clear what the cause of low DO at this site is. The Coalition will not attempt to further explore causes of low DO until such time as it becomes a higher priority.

Table XIV-8. Terminous Tract @ Hwy 12. BOD, pH and dissolved oxygen results for September 2006 – July 2007. ND = non-detect.

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
Terminous Tract Drain @ Hwy 12	9/19/2006	7.03	4.1	ND
Terminous Tract Drain @ Hwy 12	2/11/2007	7.18	5.24	6
Terminous Tract Drain @ Hwy 12	2/28/2007	7.32	8.24	ND
Terminous Tract Drain @ Hwy 12	4/10/2007	7.57	7.52	ND
Terminous Tract Drain @ Hwy 12	7/10/2007	7.38	4.58	ND

E. coli

Table XIV-9. Results of Bacteroides analysis. The Terminous Tract @ Hwy 12 site subwatershed was sampled three times daily for three days. A + indicates the DNA was detected but at too low of a concentration to estimate a percentage.

Station Code	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
544XTTHWT	8/16/2006	7:10	Grab	+	0	3.125
544XTTHWT	8/16/2006	13:20	Grab	0.78	0	0
544XTTHWT	8/16/2006	18:10	Grab	0	0	0
544XTTHWT	8/17/2006	7:50	Grab	100	0	+
544XTTHWT	8/17/2006	12:00	Grab	+	0	6.25
544XTTHWT	8/17/2006	16:10	Grab	25	0	12.5
544XTTHWT	8/18/2006	6:10	Grab	100	0	+

Station Code	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
544XTTHWT	8/18/2006	11:00	Grab	100	0	1.5625
544XTTHWT	8/18/2006	16:20	Grab	+	0	0

Table XIV-10. Values of E. coli, fecal coliform, and total coliform in MPN/100mL., and the average C_T value for the All bacteria, human Bacteroides, bovine Bacteroides, and chicken Bacteroides. C_T values are not comparable across samples and are not absolute measures of the quantity of DNA in the sample.

Station Code	Sample Date	Sample Time	Sample Type	E. coli	Fecal Coliform	Total Coliform	Avg All Bac	Avg Human	Avg Bovine	Avg Chicken
544XTTHWT	8/16/2006	18:10	Grab					39.29		39.94
544XTTHWT	8/16/2006	13:20	Grab				31.15	38.59		39.49
544XTTHWT	8/16/2006	18:10	Grab					39.29		39.94
544XTTHWT	8/17/2006	7:50	Grab				28.9	27.99	39.82	31.46
544XTTHWT	8/17/2006	12:00	Grab				28.8	27.03		31.94
544XTTHWT	8/17/2006	16:10	Grab				25.62	27.58		28.45
544XTTHWT	8/18/2006	6:10	Grab				28.03	27.32	28.39	30.44
544XTTHWT	8/18/2006	11:00	Grab				28.55	27.95	32.15	33.82
544XTTHWT	8/18/2006	16:20	Grab				33.22	30.38		39.26

E. coli exceedances occurred eight times since 2005 at the Highway 12 site and 14 times overall across all three sites. There is one small confined animal operation on the map but it is located a distance from Highway 12 and it is not known if the operation is still in operation. Results of the *E. coli*/Bacteroides study did not find any bovine signal in the sample (Tables XIV-9, XIV-10). There is some irrigated pasture at the east end of the Terminous Tract and several residences in the vicinity of the Highway 12 site. It is unknown if manure is used in the site subwatershed. The source of the *E. coli* is unknown but could be any or all of these sources. The Coalition will address additional sourcing when *E. coli* becomes a higher priority.

Color

Color is non-conserved indicator of biological and physical inputs to the system and is not possible to manage unless the causes are known. Determining the causes of color is not a priority and the Coalition will not attempt to manage these constituents.

Specific Conductivity/ Total Dissolved Solids (TDS)

Specific conductivity (EC) and Total Dissolved Solids (TDS) are measures of salt and are often found as exceedances together. EC and TDS exceedances are common in site subwatersheds in the Delta where shallow salty ground water commonly intrudes into the surface water drains. Also, irrigation water is salty due to the recirculation of the water from the Delta Mendota Canal back to the San Joaquin River. The Coalition recognizes that EC and TDS exceedances

need to be to be managed on a regional basis and will work with the Regional Board to develop a management plan when EC/TDS become a priority.

Arsenic

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). California Department of Pesticide Regulation records indicate no use of sodium cacodylate across the Coalition region between 1998 and 2007 for agricultural use.

At this point the source of arsenic is unknown although native soils can contain elevated concentrations of arsenic. The Coalition will work with the Regional Board to determine if it is feasible to obtain the necessary data to establish background levels when arsenic becomes a priority.

2008 Management Plan Monitoring

Toxicity to *Selenastrum* has not occurred since 2006 and toxicity to *Pimephales* has not occurred since 2005. Therefore the Coalition will not conduct additional Management Plan monitoring in this site subwatershed.