EAST SAN JOAQUIN WATER QUALITY COALITION
MONITORING AND REPORTING PROGRAM PLAN

January 4, 2006 – Original Report
March 8, 2006 – Revised Report
August 7, 2006 – Second Revised Report
December 8, 2006 – Third Revised Report

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List of Acronyms

CAC – County Agriculture Commissioners

ESJWQC – East San Joaquin Water Quality Coalition

CVRWQCB – Central Valley Regional Water Quality Control Board

PUR – Pesticide Use Reports

QAPP – Quality Assurance Project Plan

TDS – Total Dissolved Solids

DO – Dissolved Oxygen

pH – Power of hydrogen

EC – Electrical Conductivity

TOC – Total Organic Carbon

BOD – Biological Oxygen Demand

PQL – Practical Quantification Limit

WQO – Water Quality Objective

MP – Management practice

EPA – Environmental Protection Agency

MRPP – Monitoring and Reporting Program Plan

WER – Watershed Evaluation Report

DWR – (California) Department of Water Resources

DPR – (California) Department of Pesticide Regulation

USGS – United States Geological Survey

OP TMDL – Organophosphate Total Maximum Daily Load

UCD/UC Davis – University of California, Davis

DDT – dichlorodiphenyltrichloroethane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethylene

QRL – Quantitative Response Limit

CDFG – California Department of Fish and Game

LOQ – Limit of Quantification

MPN – Most Probable Number

MRP – Monitoring and Reporting Program

TIE – Toxicity identification evaluation

PAC – Private applicator certificate

BACI – Before-After-Control-Impact experimental design

SOP – Standard operating procedure

List of Terms

Agricultural Commissioner – County Agriculture Commissioner

ArcGIS – Geographic Information Systems mapping software

Central Valley – California Central Valley

Coalition – East San Joaquin Water Quality Coalition

Coalition/ESJWQC region – The region within the Central Valley that is monitored by the East San Joaquin Water Quality Coalition.

drainage –water that moves horizontally across the surface or vertically into the subsurface from land

EPA 303d list – US Environmental Protection Agency list of impaired water bodies.

landowners – one or more persons responsible for the management of the irrigated land

site subwatershed: Starting from the sampling site, all water bodies that drain, directly or indirectly, into the water body before the point where sampling occurs.

subwatershed – The topographic perimeter of the catchment area of a stream tributary. (EPA terms of environment: http://www.epa.gov/OCEPAterms/sterms.html)

Waiver – Central Valley Regional Water Quality Control Board Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands, Order No. R5-2006-0077, amending Order No. R5-2006-0053.

water body –standing or flowing water of any size that may or may not move into a larger body of water, including lakes, reservoirs, ponds, rivers, streams, tributaries, creeks, sloughs, canals, laterals and drainage ditches.

watershed – The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point. (EPA terms of environment: http://www.epa.gov/OCEPAterms/wterms.html)

INTRODUCTION

The East San Joaquin River Water Quality Coalition (hereafter referred to as the Coalition or ESJWQC) was formed in 2003 to enhance and improve water quality in the East San Joaquin River watershed, while sustaining the economic viability of agriculture, associated values of managed wetlands and sources of safe drinking water.

This Monitoring and Reporting Program Plan (MRPP) is prepared as mandated by the Monitoring and Reporting Program Order No. R5-2005-0833 for Coalition Groups under the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands Resolution No. R5-2003-0105. The Coalition MRPP provides the mechanism necessary to track progress in reducing the amount of waste discharged that affects the quality of the waters within the East San Joaquin Valley Watershed coalition boundaries. The accompanying Watershed Evaluation Report (WER) provides an assessment of the sources and impacts of waste in discharges from irrigated lands.

The MRPP has three main components. The first section of the report contains a description of the watershed characteristics and provides data and information describing the area's hydrology and drainage patterns, land use and crop data, chemical application, and programs and applicable management projects used to reduce or eliminate agriculture irrigation's adverse effects on water quality in the receiving water bodies. Information gathered for this section is based on data available on the California Department of Pesticide Regulation (DPR) website (http://calpip.cdpr.ca.gov/cfdocs/calpip/prod/main.cfm), GIS data obtained from the California Department of Water Resources (DWR), and the relevant County Agricultural Commissioners (CAC) 2002 Agricultural Crop and Livestock Reports. The information presented is based on the most updated data available at the time this report was written.

The second section of the report identifies the coalition's priorities with respect to Phase 1 and Phase 2 monitoring in specific site subwatersheds. Priorities for sampled constituents are based on currently established water quality impairments as listed on the US EPA's 303d listed water bodies. Specific constituents and sampling information are provided, as are sampling locations.

The third section of the report provides preliminary information on the Quality Assurance Program Plan and monitoring protocols. We are currently in the process of modifying the QAPP. Modifications include the addition of specific sites and constituents to be monitored during the 2006 irrigation season. We are proposing the addition of 6 sites and are requesting that the Regional Board approve those sites. Once approved, we can add those sites and constituents to the QAPP and finalize that document.

EAST SAN JOAQUIN WATER QUALITY COALITION

General Characteristics

Please refer to ESJWQC Watershed Evaluation Report (WER) for the area overview, land use, hydrology and a narrative description of each Coalition site subwatershed. All subwatersheds in the Coalition region are mapped for land use, and current and future monitoring locations are described and mapped.

HISTORICAL DATA AND ONGOING MONITORING

Historical Water Quality Data

The region has a long history of water quality studies on a variety of constituents. Sampling has been conducted on chemical water quality, toxicity, and benthic macroinvertebrate communities by several agencies and academic institutions including the CVRWQCB, DPR, DWR, California Department of Transportation, University of California Davis (UC Davis), and the U.S. Geological Survey (USGS). Constituents sampled for include organophosphate pesticides, metals, drinking water constituents, nutrients, and dissolved oxygen. An overwhelming majority of programs have monitored for organophosphate pesticides. The Coalition watershed area will continue to be monitored as part of programs such as the organophosphate Total Maximum Daily Load monitoring program (OP TMDL), and the Agricultural Waiver Phase II monitoring program, both performed by the CVRWQCB. Some of the monitoring programs and locations are associated with monitoring storm water runoff from urban areas or transportation corridors and are not relevant when addressing runoff from irrigated agriculture other than to provide baseline information.

Current Monitoring and Water Quality Status

Eleven water bodies within the Coalition area are listed on the EPA 303d list as impaired water bodies. Generally these locations are along the mainstem of the San Joaquin River, but also occur along the lower reaches of the main tributaries. Essentially the entire San Joaquin River through the Coalition area is on the 303d list. Listings include (but are not limited to) numerous constituents from selenium and boron to legacy pesticides (DDT), ammonia, electrical conductivity, and diazinon and chlorpyrifos. Unknown toxicity is also listed as a cause of impairment for several water bodies. Despite the fact that all listed water bodies are located downstream of urban regions known to discharge organophosphate pesticides, metals, and numerous other constituents, municipal discharge is listed as the source of impairment for only one site, Harding Drain. Agriculture is listed as a source of impairment for all sites on the 303d list, and 10 of the 11 sites are listed for either or both chlorpyrifos and diazinon.

The Department of Pesticide Regulation's (DPR) Surface Water Database was used to investigate pesticide concentrations in the Coalition region. This database was created in 1997 by DPR under agreement with the State Water Resources Control Board. This database contains the results from approximately 34,500 samples collected from 40 different sites in Stanislaus and Merced Counties from August 1991 through September 2003. This database was supplemented with information available to the Coalition through recent OP TMDL sampling programs. Data from TMDL sampling for 2003 and 2004 are available for analysis. The EPA 303d list of impaired water bodies was used to establish potential causes of impairment, and these were compared to the data available from the two databases.

The DPR Surface Water Database was searched for records of pesticides in the coalition region. The original focus was on diazinon, chlorpyrifos, and pyrethroids. Diazinon samples were collected at 39 sites listed in the database. Of the total 1370 individual samples tested for either diazinon or the metabolite diazoxon, 197 (14%) samples contained concentrations greater than 80 ng/l, which is the California Department of Fish and Game Quantitative Response Limit (QRL) guideline for short-term exposure (criteria maximum concentration). The 197 samples with concentrations greater than the guideline occurred at most of the 39 sites sampled. There have been exceedances in all years except 2003. The overwhelming majority of exceedances occurred in samples collected during the winter season, but samples collected during the summer also had exceedances.

Based on the DPR database, chlorpyrifos was monitored at 38 sites in the watershed. A total of 1486 samples were collected and analyzed for chlorpyrifos or chlorpyrifos OA. 147 (9.9%) of the samples had concentrations over 20 ng/l, which is the CDFG QRL for acute exposure. The 147 samples with concentrations that exceeded the guideline occurred at 22 different sites. There was no measured concentration of chlorpyrifos in 1200 samples. There have been exceedances of the chlorpyrifos criteria in the DPR database in almost every year. Exceedances in the database occurred during almost every

month of the year. Many of the sample locations are downstream of urban influences and the chlorpyrifos signals at those locations can't be definitively attributed to agricultural sources.

Permethrin was monitored for in 366 water column samples collected from 26 sites. All results were nondetects with a 0.5 ng/l limit of quantification (LOQ). Esfenvalerate was tested in 60 samples with all readings listed as non-detects with a LOQ of 50 ng/l at all sites except a single sample with a concentration of 0.0566 µg/l. Cypermethrin and lambda-cyhalothrin were monitored for in 17 samples, all were nondetects.

The Coalition initiated its monitoring program in July 2004 and has continued to monitor surface waters during the summer irrigation seasons and the winter storm water runoff season. This program is probably the most comprehensive yet undertaken in the Coalition region to characterize water quality. The results have been provided to the Regional Board in two monitoring reports submitted in April 2005 (includes results from the 2004 irrigation season monitoring) and December 2005 (includes the 2005 winter storm water runoff season and the 2005 irrigation season monitoring). We summarize those results below for the sampling that occurred in 2005.

Summary of exceedances of water quality objectives observed in 2004-2005

A summary of the exceedances is presented in Table 1.

Pesticides

Two pesticides (diazinon and chlorpyrifos) were detected in 13 samples in the ESJWQC region during the dormant and irrigation seasons of 2005. This is approximately 15 % of the samples tested. Of these, six samples (7%) had detections of chlorpyrifos exceeding the water quality standard (0.02 µg/L), and one sample (1%) had a detection of diazinon exceeding the water quality standard (0.05 µg/L). There were no detections of any pyrethroids in the water samples collected for analysis.

Toxicity

Overall, 12 water column toxicity exceedances (4% of all tests) were documented. Seven of these were for *Ceriodaphnia dubia*, and five were for *Selenastrum capricornutum*. There were no toxicity exceedances for *Pimephales promelas*. Overall there were five sediment toxicity exceedances documented for *Hyalella azteca* survival.

E. coli

Exceedances of *E. coli* standards were the most numerous type of exceedance in the ESJWQC region. There were 41 exceedances that had values above 200 MPN/100 mL and the only subwatersheds that did not have any exceedances were Highline Canal @

Highway 99 and Merced River @ Santa Fe. A proposal is being developed to determine the extent to which *E. coli* may be attributed to agriculture discharge.

Dissolved Oxygen

Determining exceedances of dissolved oxygen is difficult because it is not completely clear which beneficial uses should be applied to all water bodies in the region. Based on criteria outlined in the most recent semi-annual monitoring report (submitted January 3, 2006), there were three exceedances of dissolved oxygen during the year indicating that dissolved oxygen is not a major water quality issue within the Coalition.

pH

There were eight exceedances of the pH standard during the year. The majority of these exceedances was within 0.2 pH units from the upper pH limit and thus may not be actual exceedances because meter precision is 0.2 pH units. This indicates that pH is not a major water quality issue within the Coalition. Despite this, the coalition will attempt to determine the source of pH exceedances.

Total Dissolved Solids

There were a total of 13 TDS exceedances all from two subwatersheds, Hilmar Drain and Prairie Flower Drain. All samples collected from Hilmar Drain @ Central Avenue during 2005 had TDS water quality exceedances and six out of the seven collected samples from Prairie Flower Drain @ Crows Landing Road had TDS water quality exceedances. TDS does not appear to be a widespread water quality issue within the Coalition. However, the Coalition will design and perform a study to determine the source of the TDS problems in the two watersheds with exceedances.

Table 1. Water quality exceedances including E. coli, pH, dissolved oxygen (DO), electrical conductivity (EC), total dissolved solids (TDS), organophosphates (OPs), water column toxicity and sediment toxicity, observed at each subwatershed during the 2005 Coalition monitoring. An X indicates that there was an exceedance of a water quality objective for that constituent at some point during 2005. For organophosphates, Y denotes detection below the exceedances level. Blank space denotes no detection.

Subwatershed	*E. coli*	pH	DO	EC	TDS	OPs	Water Column Toxicity	Sediment Toxicity
Ash Slough @ Ave. 21	X					X		
Bear Creek @ Kibby Rd	X		X				X	
Cottonwood Creek @ Rd 20	X					Y		X
Dry Creek @ Rd 18	X	X						
Dry Creek @ Wellsford Rd	X	X				Y	X	X
Duck Slough @ Gurr Rd	X							X
Duck Slough @ Highway 99*	X					X	X	
Highline Canal @ Highway 99							X	X
Highline Canal @ Lombardy Ave	X	X		X	X	X		X
Hilmar Dr @ Central Ave	X			X	X		X	X
Jones Drain @ Oakdale Rd	X	X	X			Y	X	
Merced River @ Santa Fe Dr	X	X					X	
Prairie Flower Dr @ Crows Landing Rd			X	X	X	Y		X

*Duck Slough @ Highway 99 was previously called Duck Slough @ Pioneer Rd

Note: Deadman Creek @ Gurr Road is not included in this table because there were no exceedances experienced at that site during 2005 monitoring.

Monitoring Phases

Phase 1 Monitoring

Phase 1 monitoring will be conducted at all sites during both the storm season (October - March) and irrigation season (April – September). The coalition will attempt to initiate sampling during the dormant season after dormant spraying is initiated. Consequently the initial sampling event may not occur until January or February. Phase 1 monitoring at all sites will include: (1) acute water column toxicity tests with *Ceriodaphnia dubia, Pimephales promelas,* and chronic tests with *Selenastrum capricornutum*, (2) sediment toxicity test with *Hyalella azteca* (which occur one time each during storm and irrigation seasons), (3) surface water analyses for diazinon, chlorpyrifos, and selected pyrethroids, (4) measurement of water quality and physical parameters, including drinking water constituents, as described in the original MRP; and (5) evaluation of pesticide use information in the subwatershed using the most current Pesticide Use Reports (PUR) from California Department of Pesticide Regulation (DPR). For more details on the constituents sampled, see the Quality Assurance Project Plan.

The suite of both water column and sediment toxicity tests will provide an indication of toxicity in the water column resulting from water soluble pesticides as well as sediment toxicity resulting from hydrophobic pesticides. The three-species water column testing approach is a standard approach in the Central Valley of California. Sediment toxicity testing has been conducted less frequently in this area. Recent results from sediment toxicity tests with pyrethroids have shown that the amphipod *Hyalella azteca* is probably more sensitive than *Chironomus tentans.* Therefore, *Hyalella* is proposed as the sediment test species for Coalition monitoring.

Measurements of the various water quality parameters, physical parameters, and drinking water constituents may be useful for identifying non-pesticide stressors potentially toxic to the test species. The evaluation of pesticide use information by subwatershed will determine the pesticide use patterns in areas upstream of the monitoring sites if toxicity is reported. This information will be useful for identifying potential sources of toxicity if reported.

For all the initial screening toxicity tests at each site, 100% ambient water and a control will be used for the acute water column tests. If any measurement endpoint from any of the three toxicity tests is significantly different from the control, notification from the lab will occur within one business day from the completion of the analysis (or sooner if possible) and two concurrent actions will take place. First, an Exceedance Report will be filed with the CVRWQCB within one business day of receiving the results. Second, an additional sample from the site will be collected to determine if toxicity is persistent. Resampling will occur within two business days after notification from the laboratory that the sample is toxic. If the survival of the *Ceriodaphnia* or *Pimephales*, or growth of the *Selenastrum* is 50% less than the control samples, a Toxicity Identification Evaluation (TIE) will be conducted to determine the cause of toxicity. The Phase 1 TIE will be conducted to determine the general class of constituent (i.e., metal, non-polar organics)

causing toxicity. Phase 2 TIEs may also be utilized to identify specific constituents causing toxicity. If 100% mortality with a test species is experienced in any of the water samples, then a multiple dilution test - including a minimum of five sample dilutions - will be conducted with the same water sample to determine the magnitude of toxicity. Sediment toxicity testing at each site will be conducted once per sampling season (irrigation and storm) each year to determine the potential toxicity associated with sediment bound constituents.

Sites identified as toxic in the initial screen will be resampled to estimate the duration of the toxicant in the water body. Resampling will occur within two business days after notification from the laboratory that the sample is toxic. The Coalition will perform a GIS analysis of crop types and pesticide use to determine the potential sources(s) of the toxicant in the subwatershed. This will involve investigating several of the largest contributing areas within a subwatershed and may also include considering both site and event specific factors.

Upstream sampling is another method that could be used to locate potential sources of exceedances; however the Coalition has found this method to be inefficient and less effective than the alternatives proposed above for two primary reasons. First, identification of a source with a sampling event on a specific day may too narrowly focus outreach efforts on one or a few parcels when growers across the entire site subwatershed may be applying the same chemical earlier or later than the sampling event would detect. Second, properly identifying a source by sampling alone requires a very involved and complicated sampling design that is not very efficient in smaller water bodies with variable flow conditions. Also, the sampling design is not applicable to storm event sampling. Finally, upstream sampling is not applicable to nonconserved constituents such as pH, dissolved oxygen, or E. coli. The Coalition will provide a technical memo on the rationale by January 30, 2007 providing a more detailed explanation for not selecting upstream sampling as the method for source identification.

The Coalition has chosen to follow-up on exceedances by reviewing relevant PURs for upstream irrigated land to determine where applications occurred within relevant time to the sampling event. This way, all growers how have or might have contributed to the exceedance will be notified of the exceedance and provided information on management practices to reduce chemical discharge. In general, once potential sources are determined, targeted growers are notified of the exceedance(s) through mailings, and outreach and management practice information is provided through county-wide meetings and/or personal contact. Where exceedances have occurred more than once, Management Plans specific to the subwatershed upstream of the sampling site are being developed to more adequately address the problem.

In addition to the follow-up measures stated, specific information will be collected from land owners or operators on the type of management practices that are being used and the degree of implementation within the water body.

Phase 2 Monitoring

Phase 2 monitoring will be conducted at a site one year after the initiation of Phase 1. Note that in the past, the Coalition has stated that it would initiate Phase 2 sampling two years after the initiation of Phase 1 sampling. In the future, the Coalition will initiate Phase 2 monitoring after a single dormant and irrigation season. Phase 2 is an important phase in the monitoring Program in that it involves additional water quality analysis specific to constituents of concern. In order to better investigate the toxicities that have occurred over the initial monitoring season, it is important to begin the process of Phase 2 monitoring a year after Phase I monitoring. Phase 2 monitoring will include analysis of the following: (1) general physical parameters; (2) pesticides, metals and nutrients, and (3) pesticide use in the subwatershed upstream of the monitoring site. (Details of constituents sampled can be found in Coalition QAPP.) Specific constituents and parameters tested in Phase 2 monitoring are consistent with those outlined in the August 15, 2005 MRP, Table 1 (Table 3 - 5 below). Phase 1 constituents, including water column and sediment toxicity, will continue to be monitored to fulfill two full irrigation and storm seasons of sampling. After two years of monitoring, however, sites will continue to be sampled if any water quality objectives are exceeded during monitoring.

In order to determine the sources of exceedances during Phase 2 monitoring, pesticide use information will be compiled for the subwatershed that drains to the sampling site where an exceedance for pesticides, metals or toxicity has been reported. This information will allow us to determine the potential source(s) of the exceedance and over time will show pesticide use patterns or changes that occur in the irrigated lands upstream of the monitoring sites. A record of pesticide use will allow the Coalition to monitor how pesticide applications (and changes in use or management practices) affect the quality of the receiving water body. The list of pesticides detected in Phase 2 monitoring will be monitored (with Use Reports) to identify the location and type of discharge that may have caused toxicity or another water quality exceedance. The concentration of detected pesticides with accompanying flow measurements at the monitoring sites will be used to calculate the pesticide loads.

Determining the source of constituents other than pesticides is extremely difficult. The conserved constituents such as TDS may be traceable to sources but may be a function of soils and ground water in large areas and consequently not associated with any specific parcel. Nonconserved constituents are almost impossible to trace to sources. Constituents such as pH, DO, *E. coli* are either chemical or biological and are changed by physical processes (e.g. mixing) or chemical reactions (e.g. redox), or are subject to the four processes by which populations change in size (birth, death, immigration, emigration). The Coalition's approach to these constituents is to try to understand the underlying processes that result in the exceedance, e.g. elevated pH, low DO, or high *E. coli*. As a result, the Coalition is not involved in identifying sources, but rather performing additional analyses to determine the potential causes. For example, low DO has been a common exceedance across the Coalition region from the inception of the monitoring program. Dissolved oxygen has no particular source or sink and can change over space and time dramatically based on temperature, flow, benthic and suspended

algae, and organic matter. The Coalition has undertaken additional sampling and performed additional data analysis to determine if there are factors that could account for the low DO. Although there are additional analyses that need to be performed, it appears that there is a high correlation between Total Organic Carbon, Biological Oxygen Demand and dissolved oxygen and consequently, the low DO observed is a function of respiration associated with decomposition in the water. The Coalition will try to determine the type of organic carbon present which can provide an indication of the source. This involves gaining an understanding of the different particulate fractions (e.g., CPOM, FPOM) and their sources to determine which may or may not be recalcitrant and increase BOD. If this is accomplished, the DO exceedances can be ameliorated to a degree given the constraints of elevated water temperature and low flow conditions. There may be some overlap in the analyses to determine the causes for different exceedances. For example, *E. coli* propagation in the stream and dissolved oxygen dynamics may both be a function of organic carbon loads, but at this point, that is not understood and further testing and analysis needs to be conducted. The Coalition will address each of these exceedances over time and will provide more complete explanations of the monitoring and source identification steps for each constituent in the Long Term Monitoring Strategy that is being developed. The Coalition wishes to emphasize that it is committed to identifying the causes and sources of these exceedances and is undertaking additional sampling and analyses to solve these problems. Because these analyses are more research than normal monitoring, we cannot provide a time table for completion of these studies.

When monitoring indicates toxicity, it will be the Coalition's responsibility to notify the affected subwatershed landowners and operators about problems and work to solve those problems. Depending on the causes of toxicity, solutions could include a targeted outreach program with landowners and operators to promote the adoption of additional management practices or modifying uses of specific farm inputs to prevent movement of the constituent of concern into the impacted surface water.

County Agricultural Commissioners (CAC) in the Coalition region have committed to assisting in solving water quality problems identified through monitoring. The CAC will examine the pesticide use reports from upstream locations to insure that all label requirements are being followed. Continuing education programs for growers and crop consultants offered through the CAC office (e.g., annual worker safety information seminars and private applicator certification (PAC) examinations) are already in place and will be adjusted to address problems detected through monitoring. If a pesticide-related problem persists in an area, the CAC has the authority to require specific permit conditions when a pesticide is applied near a sensitive area or used in a way that could lead to water quality problems. The decision to use such authority will be based on conditions specific to the area and determined on a case by case basis.

The Coalition will collect information from landowners on the type of management practices being used and the level of implementation within the subwatershed. The effectiveness of many management practices in reducing toxicity is currently being

evaluated through several programs in the Central Valley and the Coalition will regularly communicate results of that research to land owners and the Regional Water Board.

Previously, we indicated that we would be developing an analysis to provide information on areas within the coalition region with the potential for high discharge of chemicals and the crops associated with those areas. The Coalition will no longer be undertaking this analysis because the information available to the coalition is not adequate to provide sound generalizations about any specific part of the Coalition region. On the other hand, PURs obtained from CACs provide specific information on applications that occur and provide insight on potential discharges from individual parcels. PURs have proven to be an effective tool and the Coalition plans to continue to use the reports as the primary method for identifying specific sources of toxicity or contaminants experienced in a water body.

A List of Phase 1 and Phase 2 sites is provided in Table 6.

Phase 3 Monitoring

Phase 3 monitoring will be used to determine the effectiveness of management practices in reducing toxicity (narrative water quality objective) at a monitoring site. Phase 3 monitoring will begin no later than two years from the start of Phase 2 monitoring. Continued toxicity testing will be conducted at a site to determine if management practices have successfully reduced the toxicity. Although reducing toxicity at a site is the primary goal of management practices, concentrations of constituents (i.e., pesticides) suspected in causing toxicity will also be monitored over time to determine if concentrations have been reduced.

Pesticide use information will be collected for site subwatersheds where toxicity has been reported to determine pesticide use patterns and changes in land areas upstream of the monitoring sites. Specific information will be collected from land owners or operators on the type of management practices that are being used and the degree of implementation within the drainage. The effectiveness of many management practices in reducing toxicity is currently being evaluated through several programs in the Central Valley and the Coalition will regularly communicate results of that research to land owners and the Regional Water Board. It is anticipated that multiple years of effort will be needed to evaluate the effectiveness of management practices due to various land use patterns and rainfall/runoff factors.

The following types of data will be collected in subwatersheds where upstream management practices are used to reduce discharge of toxic or harmful chemicals: 1) pesticide mixing, loading, and application practices; 2) pest management practices; and 3) management practices to address field runoff containing waste (salt, sediment, nitrogen etc.). Other available data such as management practices testing and evaluation in other regions will be useful for determining the effectiveness of management practices in reducing waste loads.

Statistical comparisons of data between pre- and post-management practices implementation periods will be difficult to achieve. Sample sizes will generally be small, and numerous covariates such as (but not limited to) antecedent rainfall, storm event rainfall, and flow (for winter storms), irrigation patterns, temperature, and pest outbreaks (for irrigation season) will use up precious degrees of freedom in statistical analyses. Despite this, we will attempt to apply a statistical test such as a Before-After-Control-Impact (BACI) design with relevant covariates, to analyze the data after sampling in Phase 3 is complete.

Monitoring Sites

Sample locations are prioritized according to the size of the water body (intermediate sized water bodies are generally the priority) and the area of irrigated land that is covered in the site subwatershed. Because many of the intermediate water bodies are located in Merced County, some proposed sampling sites are set in smaller water bodies in order to ensure greater coverage of sampling across the Coalition region. On the other hand, Coalition member counties that have very limited irrigated agriculture may have no sampling sites. In Calaveras, Tuolumne and Mariposa Counties, a very small portion of land is used for agriculture and the agriculture that does occur almost entirely consists of vineyards and orchards on drip or microspray irrigation. As such, these areas of the Coalition region are not considered a priority and tentative sites have not been selected in these counties. Sites have been chosen based on quantity and type of irrigated land and not on representation by county. In some instances the proposed sampling locations are located a significant distance upstream of the confluence of the intermediate-sized water body with the San Joaquin River. In these instances, the location of the proposed sample site is established in the most downstream position where agriculture is the predominant land use.

Sampling Locations

Sample site locations by latitude and longitude for coalition sampling from irrigation monitoring in 2004 up to irrigation monitoring in 2006 are presented in Tables 2a-2e.

Table 2a. ESJWQC Phase 1 sampling sites: irrigation 2004.

Site Name	LATITUDE	LONGITUDE
Ash Slough @ Avenue 21	37.05450	-120.41580
August Road Drain @ Crows Landing Bridge	37.43113	-120.99371
Deadman Creek @ Gurr Rd	37.19356	-120.56124
Duck Slough @ Gurr Road	37.21423	-120.55958
Merced River @ Santa Fe	37.42714	-120.67208

Table 2b. ESJWQC Phase 1 sampling sites: storm 2005.

Site Name	LATITUDE	LONGITUDE
Ash Slough @ Avenue 21	37.05448	-120.41575
Bear Creek @ Kibby Rd	37.31280	-120.41378
Cottonwood Creek @ Road 20	36.86860	-120.18180
Dry Creek @ Wellsford Road	37.66017	-120.87432
Duck Slough @ Gurr Road	37.21423	-120.55958
Duck Slough @ Hwy 99	37.25240	-120.39633
Highline Canal @ Hwy 99	37.41530	-120.75570
Highline Canal @ Lombardy Ave	37.45560	-120.72071
Hilmar Drain @ Central Ave	37.39058	-120.95820
Jones Drain @ Oakdale Road	37.44951	-120.60069
Lone Willow Slough @ Madera Ave	36.86030	-120.37493
Merced River @ Santa Fe	37.42714	-120.67208
Prairie Flower Drain @ Crows Landing Road	37.44220	-121.00236

Table 2c. ESJWQC Phase 1 sampling sites: irrigation and storm 2005.

Site Name	LATITUDE	LONGITUDE
Ash Slough @ Avenue 21	37.05448	-120.41575
Bear Creek @ Kibby Rd	37.31280	-120.41378
Cottonwood Creek @ Road 20	36.86860	-120.18180
Dry Creek at Road 18	36.98180	-120.22056
Dry Creek @ Wellsford Road	37.66017	-120.87432
Duck Slough @ Gurr Road	37.21423	-120.55958
Duck Slough @ Hwy 99	37.25240	-120.39633
Highline Canal @ Hwy 99	37.41530	-120.75570
Highline Canal @ Lombardy Ave	37.45560	-120.72071
Hilmar Drain @ Central Ave	37.39058	-120.95820
Jones Drain @ Oakdale Road	37.44951	-120.60069
Lone Willow Slough @ Madera Ave	36.86030	-120.37493
Merced River @ Santa Fe	37.42714	-120.67208
Prairie Flower Drain @ Crows Landing Road	37.44220	-121.00236

Table 2d. ESJWQC Candidate Monitoring Sites- 2006-12.

Site Name	LATITUDE	LONGITUDE
Berenda Creek @ Road 19	37.01818	-120.20154
Berenda Slough along Rd 18 1/2	37.01820	-120.32650
Black Rascal Creek @ Yosemite Rd	37.33208	-120.39470
Cavill Drain @ McGee Road	37.71102	-120.90084
Cottonwood Creek @ Sixmile Road	37.34116	-120.46781
Deadman Creek @ Hwy 59	37.19810	-120.48700
Deane Drain @ Gurr Road (entrance to Sharon Lateral)	37.24408	-120.55950
Dutchman Creek @ Hwy 99	37.18020	-120.32283
Hatch Drain @ Monte Vista Ave	37.52246	-121.01776
Livingston Drain @ Robin Ave	37.31712	-120.74122
South Slough @ Quinley Road	37.26990	-120.59714
Mustang Creek @ East Ave.	37.49181	-120.68399
Owens Creek @ Kiby Road	37.26256	-120.41421
Silva Drain @ Meadow Drive	37.42910	-120.62610
Western States Drain @ Central Ave	37.39792	-120.95821
Westport Drain @ Vivian Road	37.53784	-121.04788
Mariposa Creek @ Simonson Way	37.24711	-120.30593

Table 2e. ESJWQC Phase 1 and Phase 2 sampling sites: irrigation 2006.

Site Name	LATITUDE	LONGITUDE
Ash Slough @ Avenue 21	37.05448	-120.41575
Bear Creek @ Kibby Rd	37.31280	-120.41378
Berenda Slough along Rd 18 1/2	37.01820	-120.32650
Black Rascal Creek @ Yosemite Rd	37.33208	-120.39469
Cottonwood Creek @ Road 20	36.86860	-120.18180
Deadman Creek @ Gurr Road	37.19356	-120.56124
Deadman Creek @ Highway 59	37.19810	-120.48690
Dry Creek @ Road 18	36.98180	-120.22056
Dry Creek @ Wellsford Road	37.66017	-120.87432
Duck Slough @ Gurr Road	37.21420	-120.55960
Duck Slough @ Hwy 99	37.25240	-120.39633
Highline Canal @ Hwy 99	37.41530	-120.75570
Highline Canal @ Lombardy Ave	37.45560	-120.72071
Hilmar Drain @ Central Ave	37.39058	-120.95820
Jones Drain @ Oakdale Road	37.44951	-120.60069
South Slough @ Quinley Road	37.26990	-120.59714
Merced River @ Santa Fe	37.42714	-120.67208
Mustang Creek @ East Ave	37.49180	-120.68390
Prairie Flower Drain @ Crows Landing Road	37.44220	-121.00236
Silva Drain @ Meadow Drive	37.42919	-120.62605
South Slough @ Quinley Rd	37.26983	-120.59711

With the addition of the new monitoring locations for 2006 Irrigation sampling, the Coalition will be sampling 10 of the 15 intermediate-sized water bodies in the coalition region.

Location Maps of Sample Sites and Subwatershed Land Use

For site subwatershed descriptions, maps and land use information refer to Coalition Watershed Evaluation Report (p. 33-59). The site subwatershed maps are also provided in Appendix I of this document. Maps provide detail on the crops grown on each of the parcels in the site subwatersheds and the general hydrology of the site subwatersheds monitored in 2004-2005, 2006 storm and irrigation seasons, and proposed future monitoring sites. In order to view more detail, ArcGIS coverage of all maps that are included in the WER are also provided electronically along with the report.

Table 3. Constituents to be monitored during the three monitoring phases. All constituents that are not identified as Phase 2 constituents will be included in Phase 2 if an exceedance for that constituent was detected during Phase 1 monitoring. Analytical methods for each constituent will be as specified in Order No. R5-2006-0053 for Coalition Groups.

Constituent	PQL	Reporting Unit	Monitoring Phase
Physical Parameters			
Flow	1	CFS (Ft^3/Sec)	Phase 1, 2 & 3
PH	0.1	pH units	Phase 1, 2 & 3
Electrical Conductivity	100	µmhos/cm	Phase 1, 2 & 3
Dissolved Oxygen	0.1	mg O_2/L	Phase 1, 2 & 3
Temperature	0.1	Degrees Celsius	Phase 1, 2 & 3
Color	5	Color Unit	Phase 1, 2 & 3
Turbidity	1	NTUs	Phase 1, 2 & 3
Total Dissolved Solids	10	mg/L	Phase 1, 2 & 3
Total Organic Carbon	0.5	µg/L	Phase 1, 2 & 3
Drinking Water			
E. Coli	2	MPN/100ml	Phase 1
Toxicity [(a)]			
Water Column Toxicity			Phase 1 & 3
Algae	NA	% reduction	
Cerio/Pimephales	NA	% survival	
Sediment Toxicity	NA	% survival	
Pesticides			
Carbamates			Phase 2 (Phase 3)
Aldicarb	0.5	µg/L	
Carbaryl	0.5	µg/L	
Carbofuran	0.5	µg/L	
Methiocarb	0.5	µg/L	
Methomyl	0.5	µg/L	
Oxamyl	0.5	µg/L	
Organochlorines			Phase 2 (Phase 3)
DDD	0.02	µg/L	
DDE	0.01	µg/L	
DDT	0.01	µg/L	
Dicofol	0.1	µg/L	
Dieldrin	0.01	µg/L	
Endrin	0.01	µg/L	
Methoxychlor	0.05	µg/L	
Organophosphorus			Phase 2 (Phase 3)
Azinphos-methyl	0.1	µg/L	
Chlorpyrifos	0.02	µg/L	
Diazinon	0.02	µg/L	
Dimethoate	0.1	µg/L	

Constituent	PQL	Reporting Unit	Monitoring Phase
Disulfoton	0.1	µg/L	
Malathion	0.1	µg/L	
Methamidophos	0.2	µg/L	
Methidathion	0.1	µg/L	
Parathion-methyl	0.1	µg/L	
Phorate	0.2	µg/L	
Phosmet	0.2	µg/L	
Pyrethroids			Phase 2 (Phase 3)
Bifenthrin	0.05	µg/L	
Cyfluthrin	0.05	µg/L	
Cypermethrin	0.05	µg/L	
Esfenvalerate	0.05	µg/L	
Lambda-cyhalothrin	0.05	µg/L	
Permethrin	0.05	µg/L	
Herbicides			Phase 2 (Phase 3)
Atrazine	0.5	µg/L	
Cyanazine	0.5	µg/L	
Diuron	0.5	µg/L	
Glyphosate	5	µg/L	
Linuron	0.5	µg/L	
Molinate	0.5	µg/L	
Paraquat dichloride	0.5	µg/L	
Simazine	0.5	µg/L	
Thiobencarb	0.5	µg/L	
Metals			Phase 2 (Phase 3)
Cadmium	0.1	µg/L	
Copper	0.5	µg/L	
Lead	0.5	µg/L	
Nickel	1	µg/L	
Zinc	1	µg/L	
Selenium	1	µg/L	
Arsenic	1	µg/L	
Boron	10	µg/L	
Nutrients			Phase 2 (Phase 3)
Total Kjeldahl Nitrogen	500	µg/L	
Nitrate as NO3	50	µg/L	
Nitrite as Nitrogen	50	µg/L	
Ammonia	100	µg/L	
Hardness	10,000	µg/L	
Total Phosphorus	10	µg/L	
Soluble Orthophosphate	10	µg/L	

[(a)] In addition to TIEs, sites identified as toxic in the initial screen shall be resampled to estimate the duration of the toxicant in the water body. Additional samples upstream of the original site may also be collected to determine the potential source(s) of the toxicant in the subwatershed.

[(b)] Quantitation limits must be lower than LC50 or other applicable federal or state toxic or risk limits.

[©] Pesticides, metals and/or nutrients suspected in causing toxicity will be monitored in Phase 3.

Table 4. Parameters to be monitored at each location starting in the 2006 irrigation season. An * indicates a new site.

Site Name	Field Parameters	Metals	Nutrients	Physical Parameters	E. coli	WCT	Sediment Toxicity
Ash Slough @ Avenue 21	x	x	x	x	x	x	x
Bear Creek @ Kibby Rd	x	x	x	x	x	x	x
Cottonwood Creek @ Road 20	x	x	x	x	x	x	x
Deadman Creek @ Gurr Rd	x	x	x	x	x	x	x
Dry Creek @ Road 18	x	x	x	x	x	x	x
Dry Creek @ Wellsford Road	x	x	x	x	x	x	x
Duck Slough @ Gurr Road	x	x	x	x	x	x	x
Duck Slough @ Hwy 99	x	x	x	x	x	x	x
Highline Canal @ Hwy 99	x	x	x	x	x	x	x
Highline Canal @ Lombardy Ave	x	x	x	x	x	x	x
Hilmar Drain @ Central Ave	x	x	x	x	x	x	x
Jones Drain @ Oakdale Road	x	x	x	x	x	x	x
Merced River @ Santa Fe	x	x	x	x	x	x	x
Prairie Flower Drain @ Crows Landing Road	x	x	x	x	x	x	x
Berenda Slough along Rd 18 ½*	x			x	x	x	x
Black Rascal Creek @ Yosemite Road*	x			x	x	x	x
Deadman Creek @ Highway 59*	x			x	x	x	x
South Slough @ Quinley Road*	x			x	x	x	x
Mustang Creek @ East Ave*	x			x	x	x	x
Silva Drain @ Meadow Drive*	x			x	x	x	x

Table 5. Parameters to be monitored at each location starting in the 2006 irrigation season. An * indicates a new site for the 2006 Irrigation season.

Site Name	Organophosphates	Pyrethroids	Organochlorines	Carbamates	Herbicides
Ash Slough @ Avenue 21	x	x	x	x	x
Bear Creek @ Kibby Rd	x	x	x	x	x
Cottonwood Creek @ Road 20	x	x	x	x	x
Deadman Creek @ Gurr Rd	x	x	x	x	x
Dry Creek @ Road 18	x	x	x	x	x
Dry Creek @ Wellsford Road	x	x	x	x	x
Duck Slough @ Gurr Road	x	x	x	x	x
Duck Slough @ Pioneer Road	x	x	x	x	x
Highline Canal @ Hwy 99	x	x	x	x	x
Highline Canal @ Lombardy Ave	x	x	x	x	x
Hilmar Drain @ Central Ave	x	x	x	x	x
Jones Drain @ Oakdale Road	x	x	x	x	x
Merced River @ Santa Fe	x	x	x	x	x
Prairie Flower Drain @ Crows Landing Road	x	x	x	x	x
Berenda Slough along Rd 18 ½*	x	x			
Black Rascal Creek @ Yosemite Road*	x	x			
Deadman Creek @ Highway 59*	x	x			
South Slough @ Quinley Road*	x	x			
Mustang Creek @ East Ave*	x	x			
Silva Drain @ Meadow Drive*	x	x			

Field Parameters: temperature, DO, EC, pH, Discharge (Velocity)
Physical Parameters: color, turbidity, TDS, TOC
WCT (Water Column Toxicity): *Ceriodaphnia dubia*, *Pimephales promelas*, *Selenastrum capricornutum*
Sediment Toxicity: *Hyalella azteca*

Table 6. Phase 1 and Phase 2 subwatersheds. An * indicates a new site for the 2006 Irrigation season.

Site Name	Phase 1 subwatersheds	Phase 2 subwatersheds
Berenda Slough along Rd 18 ½*	x	
Black Rascal Creek @ Yosemite Road*	x	
Deadman Creek @ Highway 59*	x	
South Slough @ Quinley Road*	x	
Mustang Creek @ East Ave*	x	
Silva Drain @ Meadow Drive*	x	
Ash Slough @ Avenue 21	x	x
Bear Creek @ Kibby Rd	x	x
Cottonwood Creek @ Road 20	x	x
Dry Creek @ Road 18	x	x
Dry Creek @ Wellsford Road	x	x
Duck Slough @ Hwy 99	x	x
Highline Canal @ Hwy 99	x	x
Highline Canal @ Lombardy Ave	x	x
Hilmar Drain @ Central Ave	x	x
Jones Drain @ Oakdale Road	x	x
Prairie Flower Drain @ Crows Landing Road	x	x
Duck Slough @ Gurr Road		x
Merced River @ Santa Fe Drive		x
Deadman's Creek @ Gurr Rd.*		x

QAPP AND MONITORING PROTOCOLS

The Quality Assurance Program Plan (QAPP) is to be submitted as a separate document later in the spring, but prior to the initiation of sampling in the 2006 irrigation season. Specifically, because the QAPP must include a list of monitoring sites and constituents, we are requesting that the Regional Board provide the Coalition with written approval of the proposed sites and constituents.

Monitoring protocols

Full descriptions of the sampling protocols with Standard Operating Procedures (SOPs) for all measurements and the analytical procedures with their SOPs will be provided in the QAPP. Below we provide a brief description of the monitoring triggers and reporting triggers.

Storm season sampling protocol

During the storm season, the primary concern is the mobilization (render movable, bring into circulation) and movement (the act of being moved, changing position) of soluble constituents in storm water runoff during and following winter rains. These constituents can move from locations where applications take place to water bodies within the Coalition's area.

Sampling will be initiated during a storm event when a 0.30"- 0.50" rain within a 24-hour period is forecasted for the Coalition area. Note that this is a change from the previous MRPP which indicated that a storm of at least 0.50" was necessary for sampling to be initiated. The change is a function of conditions in the latter portion of the winter often generating runoff with smaller storms. However, early in the season or after long periods without rainfall, the 0.5" criterion is required. County Agricultural Commissioners will be consulted to confirm the initiation of pesticide applications. The coalition will attempt to initiate sampling during the dormant season after dormant spraying is initiated. Consequently the initial sampling event may not occur until January or February. A single grab sample for each constituent will be collected from each storm event according to the protocols specified in the QAPP to be submitted later. Sampling will be conducted to collect water during or shortly after the peak of the hydrograph. Sampling is to begin anywhere from 15 to 60 hours after the initiation of the storm event. Examination of several hydrographs from storms in the Coalition area from the last two years suggests that the timing of the peak of the hydrograph varies according to total rainfall, rainfall intensity, soils, and antecedent conditions.

During the initial sampling, field probes and meters will be used to collect standard water quality data in the field and water will be collected for laboratory analysis (see QAPP). In accordance with Order No. RS-2005-0833, the August 15, 2005 MRP, any evidence of statistically significant toxicity or the identification of a specific chemical constituent in

surface water in exceedance of an established water quality standard will trigger an Exceedance Report to the CVRWQCB. The Exceedance Report will be submitted to the CVRWQCB in the form of an email and will be submitted within 1 day following sampling or of the receipt of results. Exceedances involving field parameters will be reported within 1 day after sampling, and all exceedances of constituents analyzed by the laboratories (toxicity, drinking water parameters, and physical/chemical constituents) will be reported 1 day following receipt of the results from the laboratory.

In accordance with the August 15, 2005 MRP Order No. R5-2005-0833, for any constituent for which an Exceedance Report is submitted, a Communication Report will be submitted 45 business days following submission of the Exceedance Report. Each Communication Report will include a description of the follow-up monitoring and analyses that were conducted, actions taken to identify the sources of the exceedance(s), complete analytical results if available (if not available, a time schedule for delivery of the analytical results will be provided), and time schedules for delivery of the Management Practices Effectiveness information and the Evaluation Report.

Evaluation Report

In accordance with the time schedule established in the Communication Report, an Evaluation Report will be submitted. The Evaluation Report will include a description of the management practice(s) implemented and the chemicals/constituents targeted by the management practice(s), the reasons for implementing the specific practice(s), the methodology employed to evaluate the effectiveness of the practice(s), and the involvement of the stakeholders in evaluating the practice(s).

Irrigation season sampling

Irrigation season sampling will be conducted monthly from April through September provided irrigation has been initiated. All parameters measured during the winter runoff sampling will be included in the irrigation season sampling. Sediment toxicity tests will be performed once during the irrigation season. No TIEs are proposed for sediment toxicity even if the result of the toxicity test indicates significant toxicity. All triggers for reporting are as previously described.

Quality Assurance Program Plan

The QAPP will be provided after the Coalition received approval of the monitoring sites and constituents as outlined in this MRPP.

Monitoring Protocols - Sample Collection Methods

Monitoring protocols are outlined in the QAPP, which will be submitted at a later date.

Laboratory Quality Assurance Manual

Laboratory QAPPs and SOPs will be submitted with the full QAPP.

Watershed contact information

Executive Director East San Joaquin Water Quality Coalition
Parry Klassen
(559) 325-9855
parryk@comcast.net
ESJWQC mailing address
1201 L Street
Modesto, CA 95354

Wayne Zipser
Stanislaus County Farm Bureau
(209) 522-7278
Zipser@stanfarmbureau.org
1201 L Street
Modesto, CA 95354

Technical Program Manager
Michael Johnson, Ph.D.
Michael L. Johnson, LLC
(530) 400-6725 (cell)
(530) 297-4683 (office)
mbjohnson@ucdavis.edu
1815 Michelangelo Place
Davis, CA 95616

APPENDIX I

Watershed maps for sites sampled during the 2006 Irrigation and 2007 Storm seasons

Figure I-1. Land use for subwatersheds in Stanislaus County: Cavill Drain @ McGee Rd., Hatch Drain @ Monte Vista Ave., and Westport Drain @ Vivian Rd. Riley Slough was abandoned during the 2004 irrigation season due to access problems.

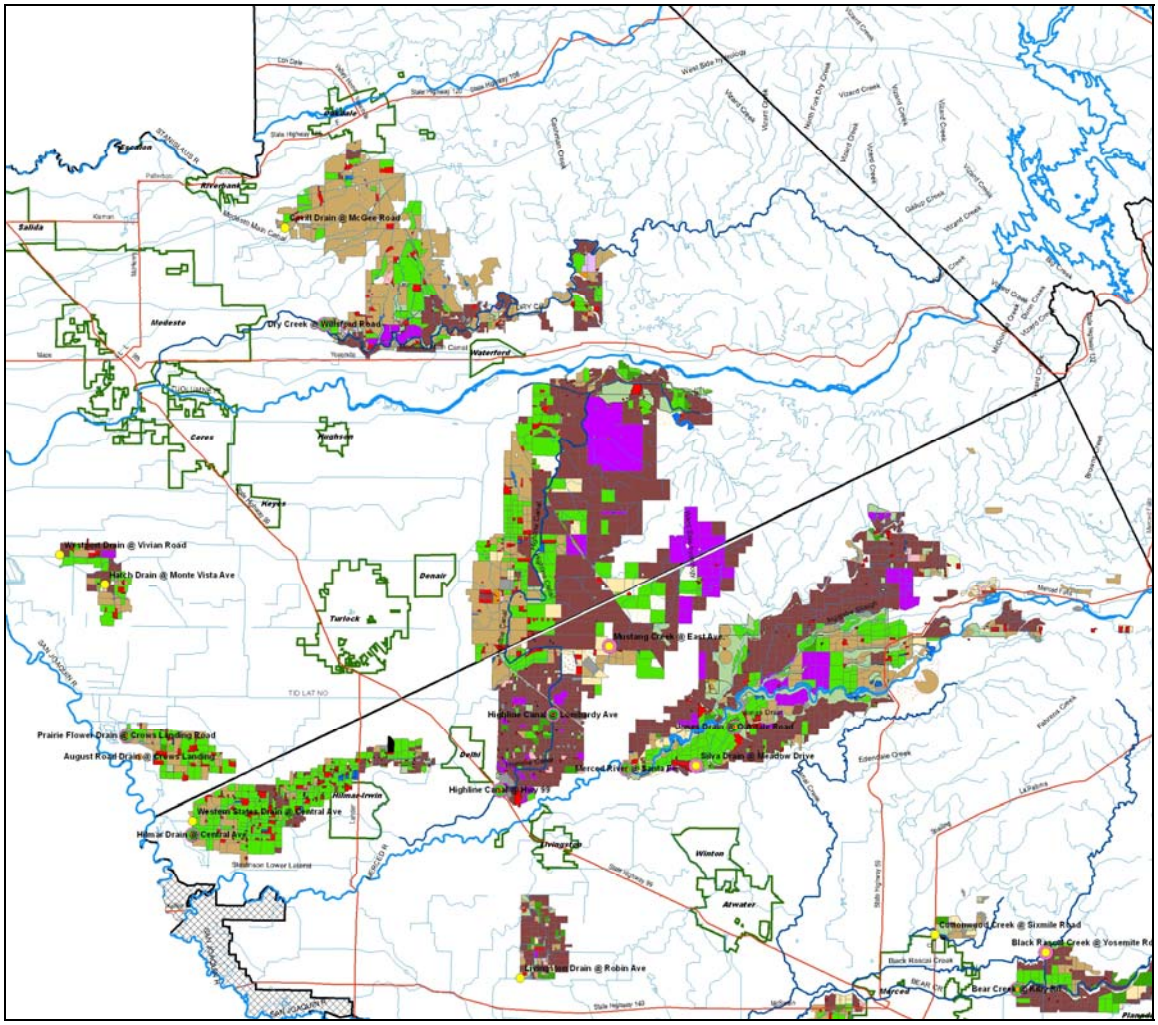


Figure I-2. Land use for subwatersheds in Merced County: Mustang Creek @ East Ave., Livingston Drain @ Robin Ave., Western States Drain @ Central Ave., Silva Drain @ Meadow Drive, Owens Creek @ Kibby Rd., Mariposa Creek @ Simonson Way, Mattos Drain @ Range Rd., Black Rascal Creek @ Kibby Rd., Dutchman Creek @ Hwy 99, Cottonwood Creek @ Six Mile Rd., Deadman Creek @ Hwy 59, and Deanne Drain @ Gurr Rd.

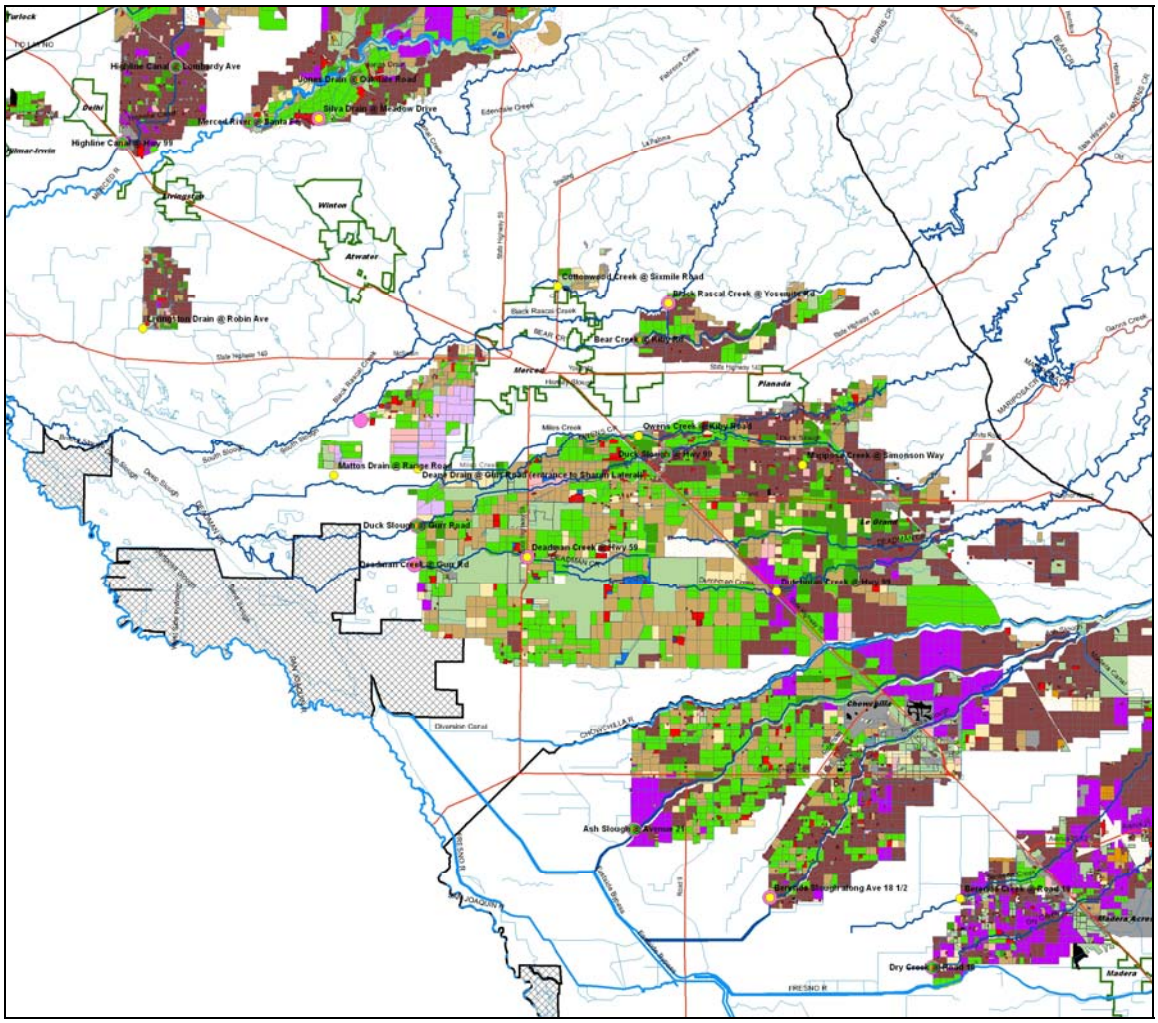
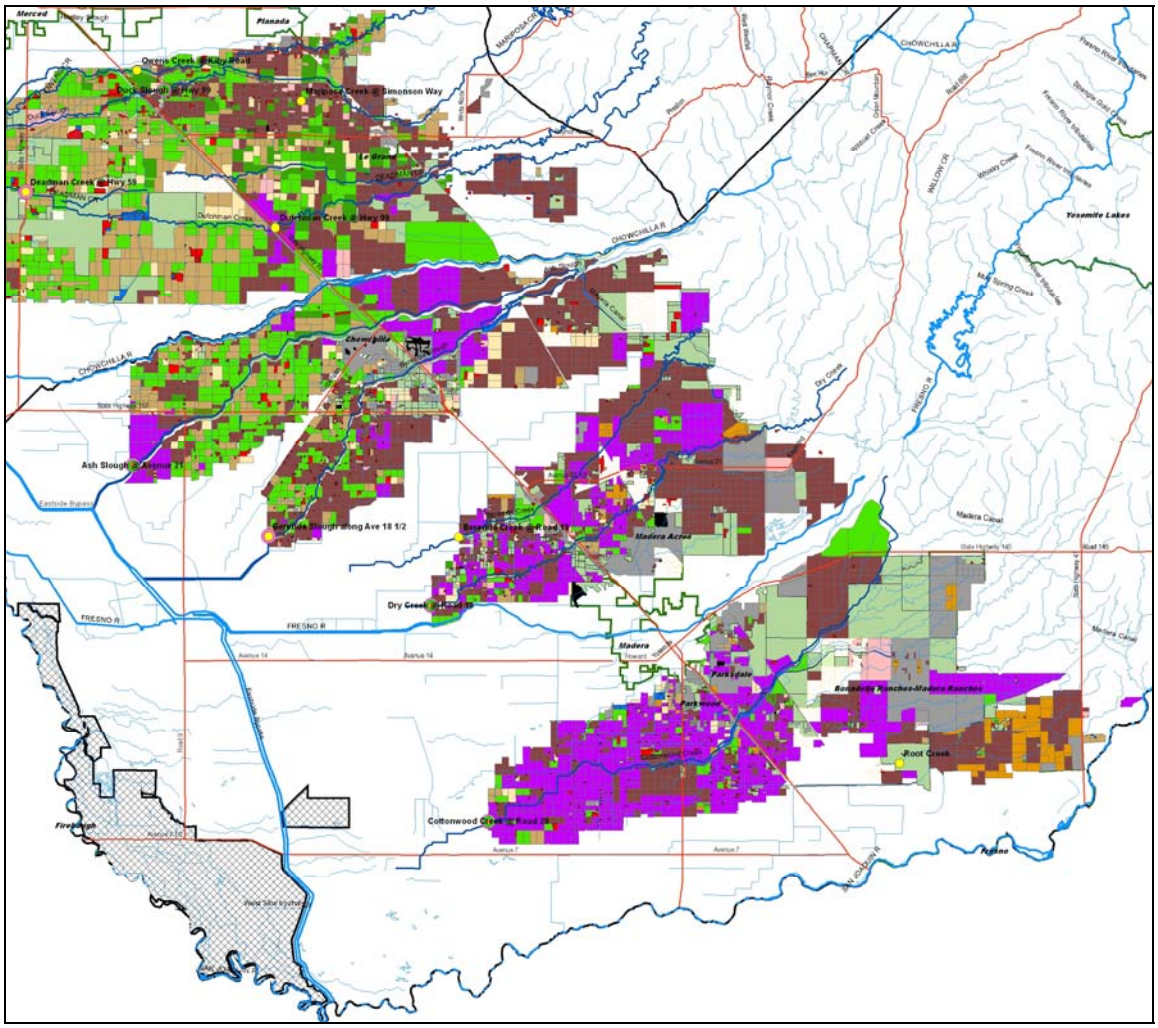


Figure I-3. Land use for subwatersheds in Madera County: Berenda Slough @ Dairyland Rd., Berenda Creek @ Kibby Rd., and Root Creek @ Rd. 35.



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