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2007 REVIEW OF MONITORING DATA
IRRIGATED LANDS CONDITIONAL WAIVER PROGRAM
13 JULY 2007**

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EXECUTIVE SUMMARY

Based on Program monitoring conducted from May 2004 through October 2006, the monitoring information in this 2007 Review provides a general understanding of the baseline water quality conditions in many Central Valley areas of irrigated agriculture. The discussions in this Review inform about data gaps, such as monitoring locations that require further investigation, and also about areas that warrant additional management practice implementation. It also provides insight into the types of water quality concerns that appear to be more pervasive in agricultural drainages within the Central Valley. In addition, source water quality, urban influences, legacy pollutants, and ambient conditions (e.g., air temperature, maintained nature of channels, hydraulic structures, low-flow conditions) contribute to water quality concerns. The stressors causing these impacts may be the result of a variety of factors, including land use, irrigation practices, crop type, land management practices and policies. In most cases, further investigation is necessary in order to understand the causes and develop the solutions. Finally, this review reveals where additional information is needed to help characterize the effects of irrigated agriculture on waters of the State. The information provided in this 2007 Review is summarized below.

Overview of Water Quality Concerns

General observations about water quality conditions in the Central Valley can be made based on three years of monitoring data that was considered in this 2007 Review, as follows:

1. There was less demonstrable toxicity to *Pimephales promelas* (fathead minnow) in tests conducted for Zone 1 than in the other Zones. The percentage of monitoring locations that had toxicity, compared to those that did not, increased as one moves down through the Central Valley. Ammonia is a contaminant that is associated with mortality to the fathead minnow, although high levels of pesticides will also cause minnow toxicity.
2. Toxicity to *Ceriodaphnia dubia* (water flea) was exhibited in a sufficient number of samples to warrant further review in all Zones. Toxicity to the water flea is associated with insecticides at concentrations lower than what would typically affect the fathead minnow. *Ceriodaphnia* is much less sensitive to ammonia than is *Pimephales*.
3. Toxicity to *Selenastrum capricornutum* (algal species) is widespread in the Central Valley. Toxicity to algae is generally associated with herbicides and metals, such as copper. Program monitoring for herbicides and metals began during irrigation season 2006; thus, just one season of data was available for this assessment. Future monitoring results will be needed to determine causes of algae toxicity. The California Rice Commission is undertaking special studies to help determine the causes of algal toxicity in Zone 1.

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4. Sediment toxicity occurred in all zones of the Central Valley. Studies conducted by the University of California in the Central Valley strongly suggest that sediment toxicity was caused by pyrethroids, which are replacement pesticides for organophosphates.
5. Predominant pesticides detected in water throughout the Central Valley monitoring sites include chlorpyrifos, diazinon, simazine, diuron, and DDT/breakdown products. Detections are not necessarily exceedances—some detections exceeded water quality trigger limits, while others did not.
6. The toxic effects of organophosphate pesticides, such as diazinon and chlorpyrifos, are found in all Zones. This information is based upon the results of toxicity tests and specific toxicity identification evaluations, and the detection of organophosphate pesticides at levels that exceed known toxicity thresholds for test species.
7. Salinity, as measured by electrical conductivity, is a concern in all Zones of the Central Valley although most notably in Zones 2, 3, and the northwest portions of Zone 4. Information that would clarify how much of this salinity is the result of background, or uncontrollable factors, and how much is contributed by irrigated agriculture is not available, and will require additional study. At this time, there is a concerted effort by many State and local agencies to address issues of salinity in the Central Valley. More information regarding Central Valley Salinity is available at <http://www.waterboards.ca.gov/centralvalley/cv-salts/index.html>.
8. The presence of pathogen indicators, such as fecal coliform and *E. coli*, are ubiquitous in water samples collected throughout the Central Valley, and are frequently measured at levels higher than the USEPA Recommended Criterion of 235 MPN/100 ml for *E. coli*. Not all strains of *E. coli* are pathogenic, but the presence of *E. coli* or fecal coliform is an indicator of fecal contamination. Several Coalitions have funded studies to determine the probable sources of *E. coli* contamination for specified locations and time periods. The University of California is conducting these studies, which characterize the source type through DNA analyses. Results are not available at this time.

Data Gaps

This review provides information about areas where data gaps exist. The gaps include the type of data that would be necessary to answer questions about water quality in Central Valley agriculture, as well as the locations and/or seasons for which more information would be necessary to provide an adequate assessment. An overview of these data gaps is as follows:

1. Pesticides, Metals, and Nutrients. This 2007 Review provides a baseline for water quality conditions in the various Zones. Approximately half of the monitoring data comes from Coalition group monitoring, which was conducted in two phases, according to the Irrigated Lands program (ILP)

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Monitoring and Reporting Program (MRP). The MRP separated the toxicity monitoring (Phase I) from the pesticide, metals and nutrient monitoring (Phase II). The intent of the MRP was for each Phase to be conducted for two consecutive years. Most Coalitions began Phase I monitoring in mid-irrigation season 2004. The fact that toxicity testing and chemical analyses were performed during different phases makes any source identification process much more complex.

2. Status vs. Trend. It should be emphasized that the information in this 2007 Review is not intended to assess changes in water quality resulting from implementation of management practices. The initial 2-3 years of monitoring data collected in the Irrigated Lands Program was primarily meant to provide baseline data for further decision-making. The data submitted by Coalition Groups and summaries that are provided herein suffice, for the most part, to give a baseline for the water bodies that have been monitored. In some cases, where water quality concerns exist, source identification coupled with management practice implementation will need to take place. Subsequent monitoring and reporting to include details on management practice implementation will provide data that could indicate improvements. The inability of the program to assess trends is not a failing of the program or of the Coalitions. Two years is simply an insufficient period to evaluate trends in highly variable water quality characteristics.
3. Standards Applied to Detected Results. Because the Irrigated Lands Conditional Waiver is a general waiver, it does not set forth the designated beneficial uses in each water body, nor the water quality criteria and objectives (i.e, water quality standards that apply to each water body). The applicable water quality standards can vary from water body to water body, and there is a need to determine if measurements are exceeding criteria. The Central Valley Water Board has tentatively identified a process by which it could set forth the beneficial uses by water body according to existing Basin Plan requirements, and thereby identify the limits to be used in implementing the water quality standards. When this process is completed, the true effects of irrigated agriculture on waters of the State will be more clearly defined.
4. Pesticides Applied vs. Pesticides Analyzed. The MRP requires that coalition monitoring include tests of the standard-use pesticides for which analytical methods have been established. The specific list of pesticides is available in MRP Order R5-2008-0833. Regional Board staff has determined that the list of pesticides for which there are established analytical methods is not comprehensive for all the pesticides that are in use in all areas of the Central Valley. A comparison of pesticides used in Zone 4 (Table Z4-1) and the baseline ILP MRP monitoring requirements, shows that not all pesticides are currently included in baseline monitoring. It is also true that approved environmental analytical procedures at environmentally sensitive levels do not exist for all of the pesticides that are registered for use in the State of California. An effective approach to monitor precisely for the pesticides that

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are being used has not been developed and will need to be in order to address this data gap.

5. Acute Effects vs. Long-Term Effects. The ILP MRP requires monitoring for the acute effects for aquatic toxicity species, which are primarily mortality and fertilization. Long-term effects, or sub-lethal effects, can be equally as detrimental to species survival, and include factors such as growth and reproduction. Testing for chronic effects is beyond the scope of the approved Conditional Waiver monitoring program requirements.
6. Seasonal Data Gaps. The ILP MRP requires monitoring of two storm events during the winter season, and monthly during irrigation season. The intent of more frequent irrigation season monitoring was to capture the effects of drainage from irrigated lands when water is being applied to the fields and when the application of pesticides takes place. However, data that is not captured includes occasions when drainage occurs from water that is applied for other purposes, such as pre-planting application, post-harvest application, and application of water for frost protection. Additionally, subwatershed areas in Zone 4 have incorrectly interpreted the irrigation season to include only when water is being supplied to the grower by the local irrigation water purveyor, which is an abbreviated period of time, as little as two months. This interpretation excludes monitoring for the remainder of the year, in areas that are quite arid and in which water is often being applied to fields year round.
7. Spatial Data Gaps. There are some areas of the Central Valley for which there is partial or no monitoring data available, or for which representative sites have not been designated. These areas have been identified within each of the Zone report sections. The largest geographical areas for which monitoring sites have not been identified are found in Zones 1 and 4. The Sacramento Valley Water Quality Coalition (Zone 1) is working with ILP staff to develop a long-term approach for monitoring to satisfy program objectives.

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SECTION I. INTRODUCTION

PURPOSE OF THE DISCUSSION

One objective of the Monitoring Program (established for irrigated agriculture in 2003) is to evaluate the effects of irrigated agriculture on surface waters of the State in the Central Valley. The purpose of this discussion is to provide a review of the first three years of monitoring (May 2004 through October 2006) that was conducted for the Irrigated Lands Program to the Central Valley Water Board and to Irrigated Lands Stakeholders (2007 Review).

This 2007 Review does not consider issues of compliance in the evaluation of data collected for the Monitoring Program. The intent of is solely to summarize the monitoring information and provide baseline information regarding water quality conditions, identify findings that can be made, and consider areas where the collection of more water quality data would be effective at understanding baseline conditions and providing guidance for management practice implementation.

STRUCTURE OF THE 2007 REVIEW

In order to facilitate the discussion of the monitoring data, the Central Valley Region has been conceptually divided into four 'Zones' for the purpose of this Review. These Zones are generally considered to be based on distinctions that are geographic and that result in variations in topography, hydrology, and crop type. Figure I identifies the location of these zones within the Central Valley, and they are further described as follows:

Zone 1 is comprised of the Sacramento River watershed that drains the northern part of the Central Valley into the Sacramento River. There are currently three active Coalition groups within Zone 1, including the Sacramento Valley Water Quality Coalition, the California Rice Commission, and the Goose Lake Coalition.

Zone 1 drains over 27,000 square miles of land, roughly 17 percent of the land area of California. The Sacramento River itself, more than 400 miles long, stretches from snow-capped Mount Shasta through the fertile Sacramento Valley to the San Francisco Bay Estuary, and it's watershed covers all or parts of 22 counties.

There are thousands of smaller water bodies in Zone 1, some with seasonal flow, and may include creeks and agricultural dominated water bodies. The latter include modified natural waterways or constructed agricultural drains that are used to convey water from field to field during the irrigation season, or move excess water for flood control. On average, over 22 million acre-ft of water flow through the Sacramento River watershed each year, making it the largest river in California. This is approximately one-third of the total runoff in the State. The most intensive runoff occurs in the upper watershed of the Sacramento River above Lake Shasta and on the rivers originating on the west slope of the Sierra Nevada. These watersheds produce an annual average of 1000 to 2000 acre-feet of runoff per square mile. The Feather River, which includes the Yuba River

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flows, and the American River are two major tributaries. The Feather River is considered to be a natural tributary to the Sacramento River. The Colusa Basin drain drains the west side of the Sacramento Valley from Willows south to Knights Landing.

Zone 2 includes parts of San Joaquin, Contra Costa, Alameda and Calaveras counties and the Delta, covering approximately 998,340 acres with approximately 544,667 acres that are considered irrigated lands. Participants in the ILP within Zone 2 include the San Joaquin and Delta Water Quality Coalition, and two irrigation districts – a small portion of the Oakdale Irrigation District and the entire South San Joaquin Irrigation District.

The four major drainages in Zone 2 are the San Joaquin River, Stanislaus River, Calaveras River, and Mokelumne River. There are thousands of other smaller water bodies in Zone 2, of which some are ephemeral (seasonal). Some of these include small streams and agricultural dominated water bodies, such as constructed agricultural basins and drains designed to convey water from field to field during the irrigation season or move excess water for flood control.

Zone 3 is essentially the San Joaquin River Drainage. It includes the irrigated lands within the geographic areas represented by the East San Joaquin Water Quality Coalition, the Westside San Joaquin River Watershed Coalition, and the San Luis Water District Watershed Coalition.

The Westside Coalition is comprised mostly of water districts (17 water agencies) that collectively formed a coalition along with several managed wetland areas (state and federal wildlife refuges or management areas), and some individual dischargers who are not water district members. The Westside Coalition geographic boundaries encompass about 450,000 acres of irrigated lands under the waiver, and also include an additional 97,000 acres that are covered under a waste discharge permit with the Regional Board (No. 5-01-234). The San Luis Water District borders the Westside Coalition area on the southwest, and filed with the ILP as a coalition on behalf of its members. The San Luis District boundaries encompass approximately 66,000 total acres, of which approximately 35,000 are irrigated for agricultural production. On the east side of the river, in Zone 3, the water districts chose not to represent their members to the ILP. Individual dischargers in Zone 3 on the east side of the river fall within the East San Joaquin Coalition boundaries, regardless of their water district affiliations.

The geographic boundaries of the East San Joaquin Coalition extend from approximately the Stanislaus River on the north to the east-west stretch of the San Joaquin River on the south. The coalition area extends to the Region 5 boundary on the east, but nearly all irrigated lands in the East Coalition lie in the western one-third of the area, primarily on the valley floor. The East San Joaquin Coalition boundaries contain approximately 1.2 million acres of irrigated lands.

The Zone 3 area also includes four of the five water districts on the east side of the San Joaquin River that filed with the ILP as individual dischargers under the

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ILP waiver program. These include Modesto, Turlock, and Merced Irrigation Districts, as well as a majority of the Oakdale Irrigation District also lies within the Zone 3 boundaries.

Zone 4 encompasses the entire Tulare Lake Basin including portions of Fresno, Kings, Tulare, and Kern Counties. The Coalition Groups that are active within Zone 4 include the Westlands Coalition, and the Southern San Joaquin Valley Water Quality Coalition. The Southern San Joaquin Valley Water Quality Coalition is comprised of four subwatersheds, each of which conducts their monitoring and reporting with a fairly independent approach.

This region receives the majority of its surface water runoff from the Kings, Kaweah, Tule, and Kern Rivers that flow out of the Sierra Nevada Mountains on the east side of the San Joaquin Valley. The development and use of water from these rivers has played a major role in the history and economic development of the region. Major statewide water projects in the Tulare Lake region include the State Water Project's California Aqueduct, which includes a State/federal joint use segment known as the San Luis Canal. The aqueduct is along the western side of the valley, and it also pumps water over the Tehachapi Mountains for use in Southern California.

Water from the Sacramento-San Joaquin Delta is imported into the region through the California Aqueduct for both agricultural and urban purposes. Federal Central Valley Project (CVP) water is also exported from the Delta through the San Luis Canal to agencies with federal water contracts on the west side of the valley, such as Westlands Water District. On the eastern side of the valley, the CVP's Friant-Kern Canal runs south along the foothills and transports San Joaquin River water to agencies along the valley's eastern side and extends into Kern County. In some instances, water can be returned to the San Joaquin River from Zone 4, through the various water transport systems, including the Fresno Slough.

Groundwater pumped from the Tulare Lake Basin's aquifers account for about 33 percent of the region's total annual water supply (DWR Bulletin 160-05). Most towns and cities along the east side of the valley, including Fresno, Visalia and Bakersfield, rely primarily on groundwater. On the valley's western side, smaller cities like Avenal, Huron, and Coalinga rely on imported surface water from the San Luis Canal to meet municipal demands because salinity, sulfate, boron, chloride, and selenium limit the uses of groundwater. Where groundwater quality is marginal to unusable for agriculture, farmers use good quality surface water to irrigate crops or blend higher quality surface water with poor quality groundwater to create a larger supply.

2007 REVIEW CONSIDERATIONS

Each individual monitoring program, whether it be University of California studies, Coalition Group Monitoring or SWAMP, has its own set of program objectives under which it operates. As a result there were some differences in the types of data collected, the requirements under which the data were collected and

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processed in the laboratory and compared to acceptance criteria. These differences are discussed throughout the Review, although the reader is advised to consider this when independent conclusions are being drawn from this report.

Some of the data provided were not utilized in this 2007 Review, due to questions regarding data quality, such as laboratory hold-time considerations, or the absence of laboratory quality control documentation. An assessment also requires an adequate quantity of good quality data. Some areas of the Central Valley have been monitored at a consistent frequency over the three-year period comprising six to eight sampling events per year. Other areas within the Central Valley have a much lower frequency of monitoring from which to infer findings from the water quality data. These data limitations need to be considered.

The results from the more frequently monitored areas that are summarized in this review are effective to provide baseline information regarding water quality, and monitoring sites from trend data can be developed over time. The areas for which less data is available can be considered in conjunction with other information, such as pesticide use data and field observations, there is a need for more thorough monitoring investigation.

Finally, it should be recognized that a thorough review of quality control for every monitoring event did not take place in all cases, in particular with respect to the more recently submitted Coalition monitoring data. Therefore the results described in this 2007 Review should be considered to be draft.

DATA INCLUDED IN THIS EVALUATION

Monitoring was initiated for the Irrigated Lands Program (ILP) in 2003 through a Water Board contract with the University of California (UC) to conduct an "Investigation of Water Quality In Agricultural Drains in the California Central Valley." An additional contract was developed to continue the study through the UC John Muir Institute for the Environment and the State Department of Fish and Game.

Sample collection and analyses also began with the implementation of the Monitoring and Reporting Program Plans (MRP Plans) for Coalition Groups and five Irrigation Districts, most of which began in the summer of 2004. In some instances, supplemental information from the Water Board's Surface Water Ambient Monitoring Program (SWAMP) is included in areas where minimal ILP specific monitoring data is available. The monitoring information used in this report has been generated through these programs up through to the submittal of the December 2006 Coalition Group Semi-Annual Monitoring Report.

The data that was included in this evaluation is summarized in Table I-1, Monitoring Data Summary, and incorporates monitoring from the following programs:

1. Central Valley Water Board Monitoring through the University of California (UC) Phase I in March and September of 2003 (Investigation of Water

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Quality in Agricultural Drains in the California Valley). This data includes primarily general water quality parameters, and two species of water column toxicity. (Supplemental Monitoring Sites)

2. Two years of monitoring (July 2004 through March 2006) from the Central Valley Water Board monitoring through the University of California John Muir Institute for the Environment, and State Department of Fish and Game. This data set includes general water quality parameters, three species water column tests (algae tests were added), sediment toxicity tests, as well as pesticides and metals. (Supplemental Monitoring Sites)
3. Two years of Monitoring from Individual Dischargers – monitoring conducted through the MRP Plans of these five Irrigation Districts have been monitoring exclusively for the pesticides that they apply on their properties adjacent to the canals. Their MRP Plans do not include toxicity monitoring, metals or nutrients, or any of the pesticides and other chemicals that may be entering their system prior to deliver to farmers, or that may be entering their system via agriculture drainages from adjacent farmlands. (referred to as MRP Plan or Coalition Monitoring Sites)
4. Approximately two years of Coalition Group monitoring which, based on the phased approach, included for most Coalitions the general water quality parameters, *E.-coli* as a pathogen indicator, three species of water column toxicity and sediment toxicity tests. These first two years of Coalition Group Monitoring generally did not include pesticides, metals or nutrients, although some Coalitions did monitor for some of these constituents during this time. Monitoring generally began during the irrigation season of 2004 and included storm season monitoring. (referred to as MRP Plan or Coalition Monitoring Sites)
5. One irrigation season of Coalition Group monitoring data that incorporated phase II of the Coalition MRP. For most coalitions, this monitoring included pesticides, metals, and nutrients in addition to the parameters listed in #4 above. (Referred to as MRP Plan or Coalition Monitoring Sites)
6. The data in this report also incorporates a small amount of supplementary monitoring collected by the CVRWQCB staff, either through the SWAMP program or by Irrigated Lands Program staff. The SWAMP monitoring data that was utilized in this Review consisted of water column toxicity monitoring and general field parameters, excluding nutrients. (Supplemental Monitoring Sites)

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**Table I-1
Monitoring Data Summary**

	Zone 1	Zone 2	Zone 3	Zone 4
Number of Monitoring Sites				
Coalition Sites (MRP Plan Sites)	43	29	46	30
Supplemental Sites	53	29	37	46
Total No. Sites	96	58	83	76
Number of Samples Collected*				
Coalition Sites (MRP Plan Sites)	277	194	528	126
Supplemental Samples	218	130	69	128
Total No. Samples	495	324	597	254
Number of Tests Performed				
Water Column Toxicity Tests	495	324	597	254
Sediment Toxicity Tests	92	73	162	71
Pesticide Tests	407	200	712	107
Metal Tests	341	141	182	87
Pathogen Tests	262	195	633	325
Other Measurements	754	463	1,145	820

* Based on number of water column toxicity tests

In general, the parameters or constituents that were monitored can be categorized as follows:

- Toxicity in sediment,
- Toxicity in water,
- Pesticides,
- Metals,
- Bacteriological analyses,
- Dissolved oxygen and pH,
- Salinity as measured by total dissolved solids and/or electrical conductivity, and
- Nutrients (phosphorus- and nitrogen-containing compounds including phosphate, nitrate, and ammonia).

The specific parameters, such as pesticides and metals, that were analyzed in individual samples, and the number of pesticides analyzed in each sample, were dependent upon the coalition or irrigation district specific monitoring plans, or the individual monitoring approaches utilized by the Central Valley Water Board if analyzed through UC or SWAMP. It is important to recognize that sampling frequency, total number of tests, and seasonality of monitoring did vary from Coalition to Coalition and from UC or SWAMP.

INTERPRETATION OF THE DATA

The data was compared to water quality standards that are listed and/or described in each of the Basin Plans for the Central Valley, where possible. These Basin Plans are the Sacramento-San Joaquin Water Quality Control Plan and the Tulare Lake Basin Water Quality Control Plan. Because of their

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geographic location, monitoring results from monitoring sites within the San Joaquin and Delta Coalition were also compared to water quality standards in the State Water Resources Bay-Delta Water Quality Control Plan. The application of standards and how they are compared to the monitoring results provided in this 2007 Review is dependent on the beneficial uses of the water body, as well as numeric and narrative objectives listed in the Basin Plans.

Comparison To Standards. Where applicable, this 2007 Review compares data to determine when numeric Basin Plan water quality objectives are exceeded. Where numeric objectives are not listed in the Basin Plan, or if they are not incorporated specifically by reference, as are the drinking water maximum contaminant levels (MCLs), an interpretation of narrative objectives was conducted. Both numeric objectives and limits selected through narrative interpretation are referred to as water quality “triggers” throughout this report. The interpretation of all objectives is contingent on the beneficial uses of the water body that is being monitored. Where specific beneficial use information for the monitored water bodies is not available, generalizations were presumed for the purpose of this Review. The reader is advised to consider this when independent conclusions are being drawn from this report.

The generalizations made in order to conduct this 2007 Review are as follows:

- Basin Plan water quality objectives are compared to the results. This includes numeric standards that are applied by reference in the Basin Plan, such as those listed in the California Drinking Water Maximum Contaminant Levels (MCLs);
- Most water bodies with monitoring sites are considered to include MUN (municipal water supply) as a beneficial use. The exceptions to this generalization occur only where Basin Plans specifically identify the beneficial uses of water bodies, and MUN is excluded. Examples of this exclusion are the waterbodies on the valley floor within Zone 4 (Tulare Lake Basin Plan, Table II-1);
- For the purpose of water quality assessment, it is assumed that all monitoring sites (with a few exceptions) are located on water bodies that are not constructed agricultural drains. Monitoring sites are generally assumed to have been located on waters of the State, including agricultural dominated water bodies. For monitoring sites on tributaries to water bodies with identified beneficial uses, the beneficial uses are established by the tributary rule.
- Attachment A to this 2007 Review provides the numeric values that were used to compare with the monitoring data for each Zone.

Due to these generalizations that are being made with respect to beneficial uses at each monitoring site, the objectives are referred to as water quality triggers

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and are compared to numeric or narrative standards for the findings identified in this 2007 Review.

Understanding Toxicity Results. The correlation between toxicity measurements and receiving water impacts is well documented by the USEPA (USEPA Technical Support document For Water Quality-based Toxics Control, March 1991). Studies were conducted in order to identify relationships between test results for *Ceriodaphnia dubia* (water flea) and *Pimephales promelas* (fathead minnow) to receiving water biological impact. The studies were able to show a strong correlation between the validity of toxicity tests as predictors of receiving water quality.

In addition to the water flea and fathead minnow tests, the Irrigated Lands Program monitoring utilizes one additional water column species, *Selenastrum capricornutum*, (algal species) and one sediment species (*Hyalella azteca*). Each of these species responds to different stressors in different ways, and in the absence of additional chemical data, or follow-up toxicity identification evaluations (TIE), toxicity test results can provide clues about the causes of water quality stressors.

When 100% mortality to the test species is observed in a field sample, the magnitude of toxicity can be quantified by diluting the sample with clean control water. The control water is shown to be non-toxic to the test species by exposing the organisms to the control water in a control sample. If 100% mortality is observed in a field sample, a series of dilutions of the field sample (using control water to dilute) are generally prepared and tested for toxicity to the test species. Toxic units are defined as dividing 100 by the percentage of the field sample portion in a dilution in which half of the test organisms survive. There are some references to dilution series and toxic units throughout this Review.

In general it can be said that the minnow is responsive to ammonia toxicity, and pesticides that are orders of magnitude levels higher than what might affect the water flea species. Mortality in the water flea is an indicator of insecticide toxicity, and if sufficient pesticide testing occurs at the same time as toxicity samples are collected, the cause of water flea toxicity can be compared to literature value LC50s for that species. Reduced growth to the *Selenastrum* is linked to metals including copper compounds and to herbicides such as diuron or simazine. Increased algal growth can also be caused by nutrients that are present in sample water, which may be a factor that complicates algae toxicity test results. However, these are only very general guidelines and it is critical to understand that all of the information collected at each monitoring site must be considered as a whole before conclusions are made.

Another value of the toxicity monitoring, is that it could provide critical information about the cumulative effect of multiple stressors, such as multiple pesticides or metals. Individually, each of these parameters may not be sufficiently high to result in an exceedance, but in combination they may well add to the toxicity and result in a detriment to water quality. Additionally, some chemical combinations

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may result in a synergistic effect, which means that one or more chemical may physically react with another to create an increase in toxicity.

Toxicity monitoring of fathead minnow and water flea for the Irrigated Lands Program incorporates acute toxicity testing. Chronic and long-term effects, such as reproductive effects are not evaluated.

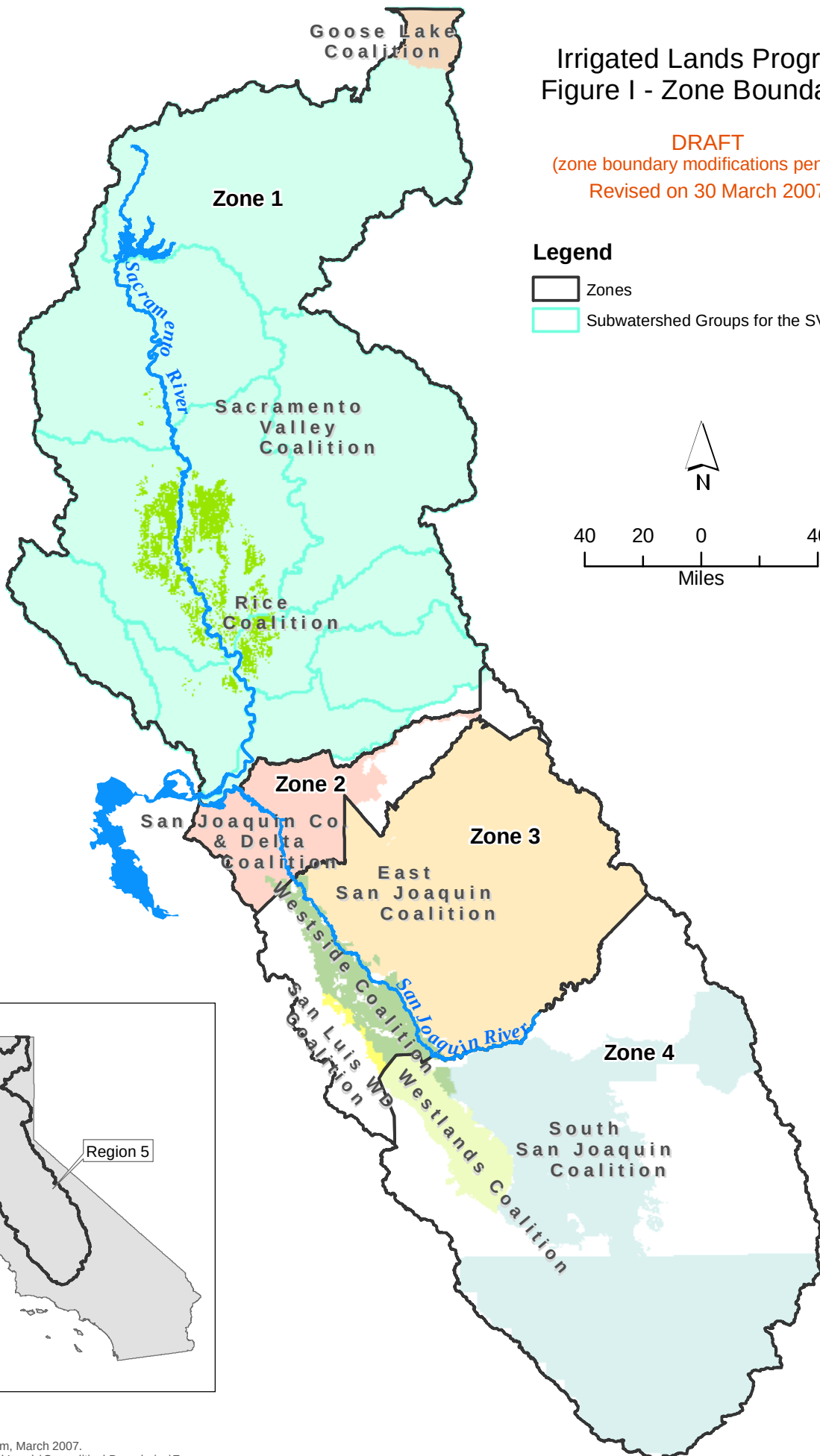
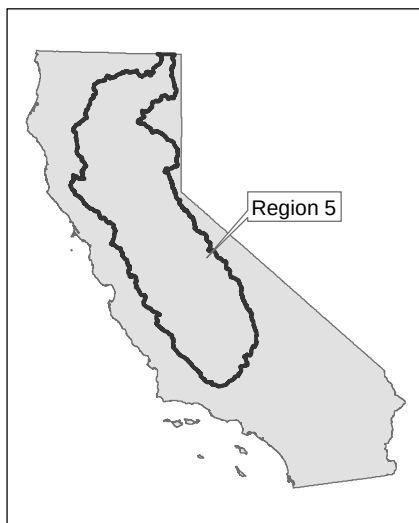
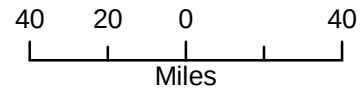
The following sections provide additional information about each zone, including crop production, pesticide use, monitoring locations and data summaries.

Irrigated Lands Program Figure I - Zone Boundaries

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(zone boundary modifications pending)
Revised on 30 March 2007

Legend

- Zones
- Subwatershed Groups for the SVWQC



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SECTION II. ZONE DATA SUMMARIES

ZONE 1

Zone 1 Description

Zone 1 is the Sacramento River watershed that drains the northern part of the Central Valley into the Sacramento River. It supports approximately 2,152,000 acres of irrigated agriculture using both surface and groundwater for irrigation. Zone 1 includes irrigated lands within the geographic areas represented by the Sacramento Valley Water Quality Coalition (SVWQC) (which is subdivided into 10 subwatersheds), the Goose Lake Coalition, and the California Rice Commission. The California Rice Commission drainages are included within the SVWQC area, but are focused on acres planted predominantly with rice.

Pesticide Use information for Zone 1 is summarized in Appendix B. The Appendix lists the primary crops by acreage that were grown in 2005 sorted by county. The Appendix also references a selection of the types and quantity of pesticides that are recorded as being used for these crops (Department of Pesticide Regulation for 2005).

Table Z1-1 identifies the CWA 303(d) listed water bodies within Zone 1 that have sources listed as agriculture or unknown toxicity that could be related to agricultural operations. Note that some listed constituents are no longer registered for use.

Table Z1-1
Summary of 303 (d) listed analytes by subwatershed areas

Listed Water Body	Subwatershed Area	Constituent
Butte Slough	Butte/Yuba/Sutter	Diazinon
Delta Waterways, northern portion	Butte/Yuba/Sutter Placer/Nevada/S. Sutter/N. Sacramento Sacramento/Amador	Chlorpyrifos DDT Diazinon Group A Pesticides PCBs Unknown toxicity
Delta Waterways; northwestern portion	Butte/Yuba/Sutter Placer/Nevada/S. Sutter/N. Sacramento Sacramento/Amador	Chlorpyrifos DDT Diazinon EC Group A Pesticides Unknown toxicity
Feather River, Lower (Lake Oroville Dam to Confluence with Sacramento River)	Butte/Yuba/Sutter	Chlorpyrifos Group A Pesticides Unknown toxicity Diazinon
Main Drainage Canal	Butte/Yuba/Sutter	Diazinon
Wadsworth Canal	Butte/Yuba/Sutter	Diazinon
Colusa Basin Drain	Colusa Basin	Azinphos-methyl Malathion Carbofuran Methyl parathion Diazinon Molinate/ordram Group A Pesticides Unknown toxicity
Jack Slough	Colusa Basin	Diazinon
Sacramento River (Knights Landing to the Delta)	Colusa Basin Solano/Yolo Butte/Yuba/Sutter Placer/Nevada/S. Sutter/N.	Diazinon

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Listed Water Body	Subwatershed Area	Constituent
	Sacramento Sacramento/Amador	
Sacramento River (Red Bluff to Knights Landing)	Colusa Basin Drain Butte/Yuba/Sutter Solano/Yolo Placer/Nevada/S. Sutter/N. Sacramento Sacramento/Amador	Unknown toxicity
American River, Lower (Nimbus Dam to confluence with Sacramento River)	El Dorado	Unknown toxicity
Cache Creek, Lower (Clear Lake to the Settling Basin near Yolo Bypass)	Lake/Napa Solano/Yolo	Unknown Toxicity
Clear Lake	Lake/Napa	Nutrients
Fall River	Pit River	Sedimentation/siltation
Pit River	Pit River	Nutrients Organic enrichment/low dissolved oxygen Water temperature
Arcade Creek	Placer/Nevada/S. Sutter/N. Sacramento	Diazinon
Bear River, Lower (below Camp Far West Reservoir)	Placer/Nevada/S. Sutter/N. Sacramento	Diazinon
Chicken Ranch Slough	Placer/Nevada/S. Sutter/N. Sacramento	Diazinon
Morrison Creek	Placer/Nevada/S. Sutter/N. Sacramento	Chlorpyrifos Diazinon
Natomas East Main Drainage Canal (aka Steelhead Creek, downstream of confluence with Arcade Creek)	Placer/Nevada/S. Sutter/N. Sacramento	Diazinon PCBs
Natomas East Main Drainage Canal (aka Steelhead Creek, upstream of confluence with Arcade Creek)	Placer/Nevada/S. Sutter/N. Sacramento	PCBs
Strong Ranch Slough	Placer/Nevada/S. Sutter/N. Sacramento	Diazinon
Wolf Creek	Placer/Nevada/S. Sutter/N. Sacramento	Fecal coliform
Elder Creek	Sacramento/Amador	Diazinon
Elk Grove Creek	Sacramento/Amador	Diazinon
Lower Bear River Reservoir	Sacramento/Amador	Copper
Clover Creek Oak Run Creek South Cow Creek	Shasta/Tehama	Fecal coliform
Sacramento River (Cottonwood Creek to Red Bluff)	Shasta/Tehama Butte/Yuba/Sutter	Unknown toxicity
Sacramento River (Keswick Dam to Cottonwood Creek)	Shasta/Tehama Butte/Yuba/Sutter	Unknown toxicity

A general description of the nine SVWQC subwatersheds and Goose Lake is provided below.

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Butte/Yuba/Sutter Subwatershed. This subwatershed encompasses portions of Butte, Yuba and Sutter counties. The major land uses include agriculture and grazing. Major agricultural crops include orchards (almonds, walnuts, peaches, prunes, and olives), row crops (beans and tomatoes), rice, alfalfa, and pasture. The main crops in this subwatershed include rice, walnut, almonds, prunes, peaches, pears and tomatoes. The major pesticides applied in Butte/Yuba/Sutter Subwatershed, based on weight, were copper compounds, propanil, mineral oil/petroleum distillates, and sulfur (California Pesticide Information Portal, California Department of Pesticide Regulation, 2005 database update). There are four 303(d) listed waterbodies in the Butte/Yuba/Sutter Subwatershed (Table Z1-1). Butte Slough, Wadsworth Canal, and Main Drainage Canal are listed for diazinon. The lower Feather River is listed for diazinon, chlorpyrifos, Group A pesticides, and unknown toxicity. Potential sources are primarily agriculture.

Colusa Basin Subwatershed. The Colusa Basin Subwatershed encompasses portions of Colusa County and Glenn County. The major land use is agriculture, with major crops including rice, almonds, prunes, walnuts, wheat, pasture alfalfa/hay, corn, and row crops (tomatoes, melons, squash, beets and cucumbers). The Colusa Basin Subwatershed has two 303(d) listed waterbodies with several constituents potentially from agricultural sources. The Colusa Basin Drain is listed for azinphos-methyl, carbofuran, diazinon, malathion, methyl parathion, molinate/ordram, Group A pesticides, and unknown toxicity, and Jack Slough is listed for diazinon.

Solano/Yolo Subwatershed. This subwatershed encompasses portions of Solano and Yolo Counties. Variable topography includes steep, mountainous uplands, low well-rounded hills, and level soils suitable for irrigated crops or dry farming. The major land uses are agriculture and grazing. The major irrigated crops include field crops such as alfalfa hay, wheat, field corn, sorghum/milo and safflower for oil. The minor irrigated crops include walnuts, grapes, prunes, almonds, vegetables (predominately processing tomatoes), seeds (dry beans and sunflowers), and nursery stock. Pesticide usage in this subwatershed is ranked 19th in Yolo County and 29th in Solano County, out of 58 counties. Both aerial and ground applications of pesticides are utilized.

Various management practices are being implemented within the Yolo/Solano Subwatershed. Examples include slough restoration, winter cover cropping (reduces storm water runoff as well as the associated sediments) and tailwater ponds and sediment traps, which, when properly maintained, can capture suspended solids from irrigation runoff.

There is currently one water body that is CWA 303(d) listed for constituents that could be affected by irrigated agriculture in this Subwatershed. Cache Creek (Clear Lake to the Settling Basin near Yolo Bypass) is listed for unknown toxicity (Table Z1-1).

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El Dorado Subwatershed. The El Dorado Subwatershed is located within El Dorado County. Approximately half of the watershed is designated as National Forest, which includes timber harvest activities. Agricultural use occurs on slightly less than 4,000 acres, with the majority of acreage planted in wine grapes. Apples are the second largest crop after wine grapes, followed by pears, walnuts, cherries, peaches and plums. In addition, approximately 500 acres are planted in conifer trees that are sold during the holidays. There are no aerial applications of pesticides in El Dorado County.

Major drainages include the South Fork American River and the North and Middle Forks of the Cosumnes River. The lower American River is currently on the 303(d) list of impaired waterbodies for unknown toxicity. Soil erosion is naturally occurring in this area, but can be exacerbated by agricultural practices if growers are not proactive. There are various management practices, such as cover crops and proper maintenance of irrigation systems, which can help to control excessive land disturbances.

Lake/Napa Subwatershed. Portions of Lake County and Napa County encompass this subwatershed. The major land uses include pasture, rangeland, vineyards and orchards. The major agricultural crops include cattle, field and seed crops, wine grapes, pears, walnuts and nursery products, with minor crops such as apples, peaches, strawberries, melons, vegetables, eggs, cheese, wool and timber. There has been a recent increase in the number of registered organic growers in this area.

This subwatershed contains two CWA 303(d) listed waterbodies: Cache Creek (which originates from Clear Lake) is listed for unknown toxicity and Clear Lake is listed for nutrients. Soil erosion is a naturally occurring problem in this area and can be exacerbated by agricultural practices if growers are not proactive.

Pit River Subwatershed. The Pit River Subwatershed is located primarily in Modoc County with additional acreage in Lassen, Siskiyou and Shasta counties. The major drainages include the Fall River and the North and South Forks of the Pit River. Elevation differences in this watershed are dramatic, with the Warner Mountains at 9,800 feet and the Fall River Valley at 3,200 feet. Major land uses include grazing and timber harvest. Common crops produced in the Pit River Subwatershed include: alfalfa hay, alfalfa/orchard grass hay, timothy hay, assorted grass hay, oats, barley, wheat, potatoes, irrigated pasture, strawberries, nursery plants, wild rice, peppermint, garlic, onions, and various vegetable seeds. Pesticide usage in this area is ranked 37 out of 58 in the state.

There are two 303(d) listed waterbodies within this subwatershed: the Fall River for sedimentation/siltation and the Pit River for nutrients, organic enrichment/low dissolved oxygen, and elevated water temperature (Table Z1-1).

Placer/Nevada/S.Sutter/N.Sacramento Subwatershed. This subwatershed (PNSSNS) encompasses portions of four counties: Placer, Sacramento, Sutter and El Dorado. The major land uses include agriculture, grazing and timber

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harvest. Placer County crops include fruit and nut crops, rice, pasture, and hay. Northern Sacramento County produces wine grapes, market milk, nursery stock, orchard crops (apples, oranges, peaches, plums, pears and walnuts), poultry, field corn, calves and cattle, silage corn, rice and processing tomatoes.

The main drainages are the American River and the Sacramento River. The PNSSNS Subwatershed contains eight waterbodies that are 303(d) listed, with agriculture identified as the potential source of contamination. The Lower Bear River, Chicken Ranch Slough, Strong Ranch Slough, and Arcade Creek are listed for diazinon. The Natomas East Main Drainage Canal downstream of the confluence with Arcade Creek is listed for diazinon and PCBs, and the Natomas East Main Drainage Canal upstream of the confluence with Arcade Creek is listed for PCBs. Morrison Creek is listed for chlorpyrifos and diazinon, and Wolf Creek is listed for fecal coliform.

Sacramento/Amador Subwatershed. This subwatershed encompasses portions of Sacramento and Amador counties. Crops produced include: wine grapes, citrus, mixed pasture, corn (field and silage), grain and hay, alfalfa, walnuts, rice, tomatoes, nursery stock, calves and carrel, poultry and safflower. The two main drainages are the Mokelumne River and its major tributary, the Cosumnes River. The Cosumnes River contains three segments: the Lower, Middle and Upper Forks. The main tributaries to the Cosumnes River are Deer Creek and Laguna Creek. There are three CWA 303(d) listed waterbodies in the Sacramento/Amador Subwatershed: Elder Creek and Elk Grove Creek are listed for diazinon, and Lower Bear River Reservoir is listed for copper.

Shasta/Tehama Subwatershed. Portions of Shasta and Tehama Counties encompass this subwatershed. The major land use is agriculture, which includes pasture, orchards, field and forage crops, row crops, and vineyards. Major crop types are irrigated and non-irrigated pasture, alfalfa/grass and small grains, walnuts, prunes/plums, almonds, olives, corn, dry beans, wheat, rice, and grapes. Clover Creek, Oak Run Creek and South Cow Creek are CWA 303(d) listed for fecal coliform (Table Z1-1). Potential sources may include agriculture and grazing.

Upper Feather River Subwatershed. Nevada, Plumas and Sierra Counties make up this subwatershed. Water bodies include Spanish and Greenhorn Creeks, which converge and drain into the East Branch of the North Fork of the Feather River. The Indian Valley watershed is also located on the East Branch of the North Fork of the Feather River. Indian, Lights and Wolf Creeks converge in Indian Valley and unite with Spanish Creek to form the East Branch of the North Fork of the Feather River.

The major crops consist primarily of alfalfa, hay, and pasture that may be irrigated, non-irrigated, or range. Logging is a major activity within the subwatershed, and is a potential contributor to sediment load in the watershed.

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Goose Lake. The California portion of the Goose Lake Watershed is located in Modoc County. However, a large percentage of the Goose Lake watershed resides in Oregon, which makes watershed management a process that incorporates the jurisdiction of two different state agencies. For the purposes of the Irrigated Lands Program, monitoring will occur at two sites, which are tributaries to Goose Lake and which lie solely within the State of California.

The major land uses include hay and alfalfa production, timber, livestock grazing and a small percentage of orchards. The major agricultural crops include alfalfa hay, orchard grass hay, native meadow hay and irrigated pasture. There are two small orchards (less than 15 acres each), one produces plums and the other produces apples. Soil erosion is a naturally occurring problem in this area and can be exacerbated by agricultural practices if growers are not proactive. There have been various management practices and restoration projects implemented to control excessive land disturbances. Monitoring in this remote watershed began in 2007 during the spring snowmelt season, which is considered the storm runoff for this high elevation watershed.

Monitoring Data Results

Approximate location of sampling sites are shown on Figure Z1-1, MRP Plan Monitoring Sites and Figure Z1-2, Supplemental Monitoring Sites. Supplemental monitoring sites are those sites that were used for the UC Davis Phase I and Phase II studies. Monitoring site identification and the number of tests for toxicity, pesticides or pathogen indicators that were conducted at each site are provided in Table Z1- 2, Summary of Monitoring Site Identification and Number of Tests. The 2007 Review for Zone 1 includes data collected between April 2003 and December 2006.

Table Z1-2
Summary of Monitoring Site Identification and Number of Tests
2003 through 2006

Site ID	Site Name	Subwatershed	No. of Sediment Toxicity Tests	No. of Water Flea Tests	No. of Algae Tests	No. of Minnow Tests	No. of Pesticide Tests	No. of Bacteria Tests
1	Lassen Creek Above Railroad Trestle	Goose Lake	0	0	0	0	0	0
2	Willow Creek Above County Rd 46 Bridge	Goose Lake	0	0	0	0	0	0
3	Butte Slough at Lower Pass Rd (BS1)	Butte/Yuba/Sutter	4	18	21	19	13	0
4	Colusa Basin Drain #5 (CBD5)	Colusa Basin	4	18	21	19	13	0
5	Colusa Basin Drain above Knights Landing (CBD1)	Colusa Basin	4	18	21	19	13	0
6	Jack Slough Site (JS)	Colusa Basin	2	10	10	10	7	0
7	Lower Coon Creek	Placer/Nevada/Sutter/Nsac	2	8	9	9	6	0
8	Sacramento Slough Bridge (SSB) ¹	Butte/Yuba/Sutter	4	18	21	19	13	0
9	Anderson Creek at Ash Creek Rd	Shasta/Tehama	2	6	5	7	7	7

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Site ID	Site Name	Subwatershed	No. of Sediment Toxicity Tests	No. of Water Flea Tests	No. of Algae Tests	No. of Minnow Tests	No. of Pesticide Tests	No. of Bacteria Tests
10	Big Indian Creek at Bridge	Sacramento/Amador	1	3	2	3	3	2
11	Burch Creek at Woodson Ave Bridge	Shasta/Tehama	1	7	4	5	4	4
12	Burch Creek west of Rawson Rd	Shasta/Tehama	0	1	0	1	2	1
13	Butte Creek at Gridley Rd Bridge	Butte/Yuba/Sutter	3	9	9	10	11	12
14	Butte Slough at Pass Rd	Butte/Yuba/Sutter	2	8	7	7	14	6
15	Capell Creek upstream from Lake Berryessa	Lake/Napa	0	0	0	0	0	5
16	Colusa Drain above Knights Landing	Colusa Basin	0	0	0	0	0	1
17	Colusa Drain near Maxwell Rd	Colusa Basin	2	10	8	11	12	11
18	Coon Creek at Striplin Rd	Placer/Nevada/Sutter/Nsac	2	8	8	8	15	15
19	Cosumnes River at Twin Cities Rd	Sacramento/Amador	2	6	6	6	12	6
20	Dry Creek at Alta Mesa Rd	Sacramento/Amador	2	7	6	7	0	7
21	Fall River at Fall River Ranch Bridge	Pit River	0	2	2	2	2	9
22	Gilsizer Slough	Butte/Yuba/Sutter	2	7	7	7	7	7
23	Indian Creek at Arlington Bridge	Upper Feather River	0	4	4	4	0	0
24	Indian Creek downstream from Indian Valley	Upper Feather River	0	0	0	0	0	8
25	McGaugh Slough at Finley Rd East	Lake/Napa	1	4	3	4	4	4
26	Middle Fork Feather River at County Rd A-23	Upper Feather River	0	4	4	4	0	8
27	North Canyon Creek	El Dorado	2	9	8	9	10	11
28	Pine Creek at Nord Gianella Rd	Butte/Yuba/Sutter	1	5	5	5	9	8
29	Pit River at Canby Bridge	Pit River	0	4	4	4	2	9
30	Pit River at Pittville	Pit River	0	4	4	4	2	12
31	Pope Creek upstream from Lake Berryessa	Lake/Napa	0	0	0	0	0	5
32	Rough and Ready Pumping Plant (Rd 108)	Solano/Yolo	2	9	8	8	15	15
33	Sacramento Slough (SRWP station)	Butte/Yuba/Sutter	0	0	0	0	0	1
34	Shag Slough at Liberty Island Bridge	Solano/Yolo	3	9	9	10	10	10
35	Spanish Creek above confluence with Greenhorn Creek	Upper Feather River	0	0	0	0	0	8
36	Spanish Creek below confluence with Greenhorn Creek	Upper Feather River	0	4	4	4	0	0

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Site ID	Site Name	Subwatershed	No. of Sediment Toxicity Tests	No. of Water Flea Tests	No. of Algae Tests	No. of Minnow Tests	No. of Pesticide Tests	No. of Bacteria Tests
37	Stone Corral Creek	Colusa Basin	3	10	9	11	12	12
38	Stony Creek on Hwy 45 near Rd 24	Colusa Basin	4	8	8	8	15	8
39	Toe Drain at NE corner of Little Holland	Solano/Yolo	0	2	2	2	2	2
40	Tule Canal at I-80	Solano/Yolo	2	8	6	8	5	15
41	Ulati Creek at Brown Rd	Solano/Yolo	2	7	7	7	7	7
42	Wadsworth Canal at South Butte Rd	Butte/Yuba/Sutter	1	8	8	8	15	14
43	Z Drain - Dixon RCD	Solano/Yolo	4	14	15	15	14	12
	Coalition Monitoring Site Subtotals		64	277	275	284	276	262
44	Antelope Creek at Kansas Ave	Shasta/Tehama	0	6	6	6	10	0
45	Bear River at Pleasant Grove Rd	Butte/Yuba/Sutter	1	4	4	4	4	0
46	Big Chico Creek at Grape	Butte/Yuba/Sutter	1	0	0	0	0	0
47	Butte Creek at Durnel Dr.	Butte/Yuba/Sutter	1	0	0	0	1	0
48	Butte Creek at Gridley Rd	Butte/Yuba/Sutter	0	4	4	4	4	0
49	Butte Creek on Durham Dayton Hwy	Butte/Yuba/Sutter	1	4	4	4	0	0
50	Butte Slough at Lower Pass Rd	Butte/Yuba/Sutter	0	0	0	0	0	0
51	China Slough at Tehama and Vina Rd	Shasta/Tehama	1	3	3	3	3	0
52	Colusa Basin Drain #5	Colusa Basin	0	0	0	0	0	0
53	Colusa Basin Drain above Knights Landing	Colusa Basin	0	0	0	0	0	0
54	Colusa Drain at Hwy 162	Colusa Basin	1	0	0	0	0	0
55	Comanche Creek (Angel Slough) at Dayton Rd.	Butte/Yuba/Sutter	1	4	4	4	4	0
56	Creek at Hawkins Rd	Solano/Yolo	0	6	0	6	0	0
57	Drain at Mace Blvd	Solano/Yolo	0	5	0	6	0	0
58	Drain at Robben Rd	Solano/Yolo	0	10	0	8	0	0
59	Drain at Robben Rd and Midway Rd	Solano/Yolo	0	8	0	8	0	0
60	Drain at Ulati Creek at Hwy 113	Solano/Yolo	0	8	0	8	0	0
61	Drain South of Rd 14	Solano/Yolo	0	0	0	1	0	0
62	Drain to Walker Cr at County Rd F	Colusa Basin	0	2	2	2	2	0
63	East Drain at 4 Mile Rd	Colusa Basin	0	8	0	8	0	0
64	Gordon Slough at Rd 19	Solano/Yolo	0	8	0	8	0	0
65	Hamilton Slough at Hwy 99	Butte/Yuba/Sutter	1	5	5	5	5	0
66	Jack Slough	Colusa Basin	0	0	0	0	0	0
67	Knight's Landing Ridge	Colusa Basin	0	8	0	8	0	0

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Site ID	Site Name	Subwatershed	No. of Sediment Toxicity Tests	No. of Water Flea Tests	No. of Algae Tests	No. of Minnow Tests	No. of Pesticide Tests	No. of Bacteria Tests
	Cut North at Rd 16							
68	Knight's Landing Ridge Cut South at Rd 16	Colusa Basin	0	7	0	7	0	0
69	Lateral to Gordon Slough at Rd 19	Solano/Yolo	0	9	0	8	0	0
70	Live Oak Slough @ Eager Rd	Colusa Basin	1	0	0	0	0	0
71	Main Drainage Canal at Colusa Hwy	Butte/Yuba/Sutter	0	4	4	4	4	0
72	Mud Creek at Meridian	Butte/Yuba/Sutter	1	0	0	0	0	0
73	Mud Creek at Sacramento Ave	Placer/Nevada/Sutter/Nsac	0	4	4	4	4	0
74	North Main Canal at Sankey Rd	Placer/Nevada/Sutter/Nsac	1	4	4	4	4	0
75	N-S Ditch along Natomas Rd	Placer/Nevada/Sutter/Nsac	1	4	4	4	4	0
76	Sand Creek at Miller Rd	Solano/Yolo	0	7	0	8	0	0
77	Simmerly Slough at Ellis Ave	Colusa Basin	1	4	4	4	4	0
78	Spring Creek at E. Camp Rd	Colusa Basin	0	3	3	3	3	0
79	Spring Creek at Walnut Dr	Colusa Basin	3	13	13	13	20	0
80	Stone Corral Creek at 4 Mile Rd	Colusa Basin	0	8	0	8	0	0
81	Stony Creek at Hwy 45	Colusa Basin	0	4	4	4	4	0
82	Stony Creek at Hwy 32	Colusa Basin	1	0	0	0	0	0
83	Stony Creek on Hwy 45 near Rd 24	Colusa Basin	1	3	3	3	5	0
84	Sycamore Slough at Hwy 45	Solano/Yolo	0	7	0	6	0	0
85	Tributary Home Colony Canal	Colusa Basin	0	4	4	4	4	0
86	Unnamed Canal at Cutting Rd b/t Co. Rd. P and 6th Ave	Shasta/Tehama	1	0	0	0	1	0
87	Unnamed Canal at Hwy 45	Colusa Basin	1	5	5	5	5	0
88	Unnamed Ditch at SW corner of Levee and Riego Rd	Placer/Nevada/Sutter/Nsac	1	3	3	3	3	0
89	Unnamed Drain along Sutter Island X Rd	Sacramento/Amador	1	0	0	0	0	0
90	Unnamed Drain of Walker Creek on Co. Rd. 28	Colusa Basin	2	9	9	9	9	0
91	West Adams Canal at Rd 89	Solano/Yolo	1	5	5	5	5	0
92	West Drainage at Del Paso Rd	Solano/Yolo	0	3	0	3	0	0
93	Willow Slough at Rd 27	Solano/Yolo	0	1	0	1	0	0
94	Willow Slough at Rd 99	Solano/Yolo	1	5	5	5	5	0
95	Winters Canal at Rd 86A	Solano/Yolo	1	4	4	4	9	0

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Site ID	Site Name	Subwatershed	No. of Sediment Toxicity Tests	No. of Water Flea Tests	No. of Algae Tests	No. of Minnow Tests	No. of Pesticide Tests	No. of Bacteria Tests
96	Yankee Slough at Swanson Rd	Butte/Yuba/Sutter	1	5	5	5	5	0
	Supplemental Monitoring Site Subtotals		28	218	115	217	131	0
	TOTALS		92	495	390	501	407	262

Shaded = Sample sites used in Coalition monitoring

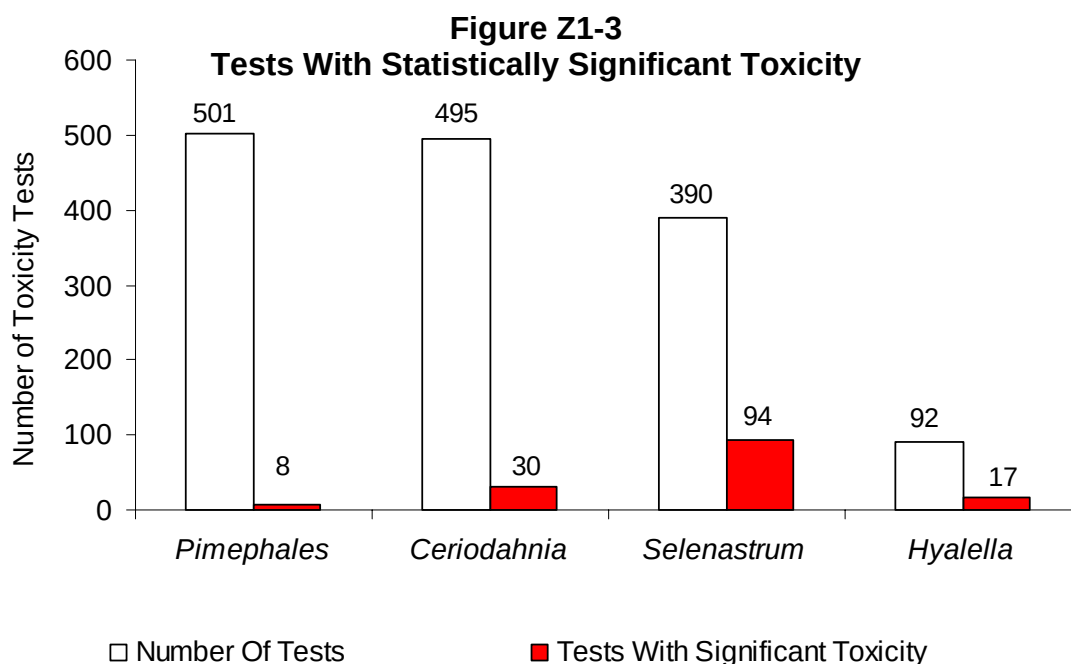
Unshaded = Sample sites used in Supplemental Monitoring

1. Site number 8, Sacramento Slough Bridge, was located at Sacramento Slough near Karnak (SS1) prior to 2005. The site was moved in 2005 for field safety. Results from both sites are combined in this table.

Data summaries for identified general analytical categories are described below. Each section includes a discussion of the frequency of detection and the magnitude of detected constituent measurements, along with notable characteristics pertaining to the results. The summaries include an evaluation of results that exceeded or may have exceeded numeric or narrative water quality objectives. The location or spatial distribution of particular types or ranges of results have been emphasized in some cases, where evaluation of this information is considered critical.

AQUATIC AND SEDIMENT TOXICITY. Samples were collected for all three aquatic species and for one sediment test species. As discussed in the introduction to this 2007 Review, the three different water toxicity test species react differently to different types of stressors. The same stressor will affect more than one species, but those effects will be observed at different concentrations. In some cases, these differences can provide clues to the cause of toxicity.

Figure Z1-3 shows the number of tests with statistically significant toxicity as compared to the number of tests conducted on the four test species.



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The following sections discuss the results for each of the toxicity test species, as well as possible causes for identified toxicity. Tables Z1-3 to Z1-6 present toxicity test results for each species, with results divided into three categories of reduced survival: up to 20%, > 20% to 50%, and > 50%. In the current MRP, a reduction in survival of 50% or greater requires the coalition to perform a TIE, and resampling is required anytime a test is statistically significant. A proposed change in the MRP would not require resampling when reduced survival is $\leq 20\%$, even if it is statistically significant.

Pimephales promelas (fathead minnow). The monitoring results for tests that had toxicity to fathead minnow are summarized on Table Z1-3, and the monitoring locations are depicted on Figure Z1-4, Toxicity to *Pimephales promelas*. There were a total of 8 tests with statistically significant toxicity to fathead minnow. Six of these events were found in the area of Butte/Yuba/Sutter Subwatershed and two on Colusa Basin Subwatershed. Overall, 1.6% percent of the total fathead minnow tests (501 total) showed statistically significant toxicity. Six percent of the individual monitoring locations had toxicity to fathead minnow toxicity at least one time, although monitoring frequency at each site varies.

Table Z1-3
Monitoring Sites with Toxicity to *Pimephales promelas*

					No of Tests - Percent Reduction Compared to Laboratory Control			
Site ID	Site Name	Sample Type	Subwatershed	No of Tests	Up to 20%	>20% to 50%	>50%	Total
3	Butte Slough at Lower Pass Rd (BS1)	MRPPlan	Butte -Yuba-Sutter	19	0	2	0	2
4	Colusa Basin Drain #5 (CBD5)	MRPPlan	Colusa Basin	19	0	0	1	1
55	Comanche Creek (Angel Slough) at Dayton Rd.	Supplemental	Butte-Yuba-Sutter	4	1	0	0	1
65	Hamilton Slough at Hwy 99	Supplemental	Butte-Yuba-Sutter	5	1	0	0	1
73	Mud Creek at Sacramento Ave	Supplemental	Butte-Yuba-Sutter	4	1	1	0	2
90	Unnamed Drain of Walker Creek on Co. Rd. 28	Supplemental	Colusa Basin	9	1	0	0	1
			Total	60	4	3	1	8

Ceriodaphnia dubia (water flea). The monitoring results for tests that had toxicity to water flea are summarized on Table Z1-4, and the locations where these occurred are identified on Figure Z1-5. The table below indicates that 30 sample tests resulted in statistically significant toxicity to water flea, which is 6.1% of the total number of *Ceriodaphnia* tests (495). Water flea toxicity is generally associated with insecticide toxicity. Out of the 96 monitoring locations, 21% had a test result with toxicity to water flea at least one time, although monitoring frequency at each site varied.

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**Table Z1-4
Monitoring Sites with Toxicity to *Ceriodaphnia dubia***

Site ID	Site Name	Sample Type	Subwatershed	No. of Tests	No. of Tests with Percent Reduction as Compared to Laboratory Control			
					Up to 20%	>20% to 50%	>50%	Total
3	Butte Slough at Lower Pass Rd (BS1)	MRPPlan	Butte - Yuba - Sutter	18	0	0	2	2
5	Colusa Basin Drain above Knights Landing (CBD1)	MRPPlan	Colusa Basin	18	0	1	0	1
11	Burch Creek at Woodson Ave Bridge	MRPPlan	Shasta - Tehama	7	0	1	3	4
14	Butte Slough at Pass Road	MRPPlan	Butte - Yuba - Sutter	8	0	0	1	1
20	Dry Creek at Alta Mesa Road	MRPPlan	Sacramento - Amador	7	0	1	0	1
22	Gilsizer Slough	MRPPlan	Butte - Yuba - Sutter	7	1	0	0	1
25	McGaugh Slough at Finley Road East	MRPPlan	Lake - Napa	4	0	0	1	1
32	Rough and Ready Pumping Plant (RD 108)	MRPPlan	Colusa Basin	9	0	0	1	1
36	Spanish Creek below confluence with Greenhorn Ck	MRPPlan	Upper - Feather - Yuba	4	0	1	0	1
41	Ulaties Creek at Brown Road	MRPPlan	Solano - Yolo	7	0	1	0	1
43	Z Drain – Dixon RCD	MRPPlan	Solano - Yolo	14	0	1	0	1
49	Butte Creek on Durham Dayton Hwy	Supplemental	Butte - Yuba - Sutter	4	0	0	1	1
58	Drain at Robben Rd.	Supplemental	Solano - Yolo	10	0	0	2	2
62	Drain to Walker Cr at County Rd F	Supplemental	Colusa Basin	2	0	0	1	1
69	Lateral to Gordon Slough at Rd. 19	Supplemental	Solano - Yolo	9	0	0	1	1
74	North Main Canal at Sankey Rd.	Supplemental	Placer - Nevada - SSutter - NSac	4	0	0	1	1
78	Spring Creek at E. Camp Rd.	Supplemental	Colusa Basin	3	0	0	1	1
79	Spring Creek at Walnut Drive	Supplemental	Colusa Basin	13	0	0	4	4
88	Unnamed Ditch at SW corner of Levee and Riego Rd	Supplemental	Placer - Nevada - SSutter - NSac	3	0	0	1	1
90	Unnamed Drain of Walker Creek on Co. Rd. 28	Supplemental	Colusa Basin	9	0	0	3	3
			Total	160	1	6	23	30

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Selenastrum capricornutum (algal species). The monitoring results for tests that had toxicity to *Selenastrum* are summarized on Table Z1-5, and the locations where these occurred are identified on Figure Z1-6. The table below indicates that 94 sample tests resulted in statistically significant toxicity to *Selenastrum*, approximately 24.1% of the 390 *Selenastrum* tests. Thirty-six of these *Selenastrum* toxic tests were located in the Butte/Yuba/Sutter Subwatershed. *Selenastrum* is a species that is monitored because of its sensitivity to herbicides and metals. Out of the 96 monitoring locations, 27% had a test result with toxicity at least one time, although monitoring frequency at each site varied. The California Rice Commission is undertaking an expansion of their routine monitoring program in an effort to identify the source of algal toxicity.

**Table Z1-5
Monitoring Sites with Toxicity to *Selenastrum capricornutum***

Site ID	Site Name	Sample Type	Subwatershed	No. of Tests	No. of Tests with Percent Reduction as Compared to Laboratory Control			
					Up to 20%	>20% to 50%	>50%	Total
3	Butte Slough at Lower Pass Rd (BS1)	MRPPlan	Butte - Yuba - Sutter	21	0	7	3	10
4	Colusa Basin Drain #5 (CBD5)	MRPPlan	Colusa Basin	21	0	8	3	11
5	Colusa Basin Drain above Knights Landing (CBD1)	MRPPlan	Colusa Basin	21	0	6	4	10
6	Jack Slough Site (JS)	MRPPlan	Butte - Yuba - Sutter	10	0	3	1	4
7	Lower Coon Creek	MRPPlan	Placer - Nevada - SSutter - NSac	9	0	0	2	2
8	Sacramento Slough near Karnak (SS1)	MRPPlan	Butte - Yuba - Sutter	21	0	6	4	10
11	Burch Creek at Woodson Ave Bridge	MRPPlan	Shasta - Tehama	4	0	1	0	1
14	Butte Slough at Pass Road	MRPPlan	Butte - Yuba - Sutter	7	2	0	0	2
28	Pine Creek at Nord Gianella Road	MRPPlan	Butte - Yuba - Sutter	5	0	0	1	1
29	Pit River @ Canby Bridge	MRPPlan	Pit River	5	0	1	0	1
38	Stony Creek on Hwy 45 near Rd 24	MRPPlan	Colusa Basin	8	0	1	0	1
41	Ulati Creek at Brown Road	MRPPlan	Solano - Yolo	7	0	1	0	1
44	Antelope Creek at Kansas Avenue	Supplemental	Shasta - Tehama	6	1	0	0	1
51	China Slough at Tehema and Vina Rd	Supplemental	Shasta - Tehama	3	0	2	0	2
65	Hamilton Slough at Hwy 99	Supplemental	Butte - Yuba - Sutter	5	1	3	0	4
73	Mud Creek at Sacramento Ave	Supplemental	Butte - Yuba - Sutter	4	0	0	1	1
77	Simmerly Slough at Ellis Avenue	Supplemental	Butte - Yuba - Sutter	4	2	2	0	4

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					No. of Tests with Percent Reduction as Compared to Laboratory Control			
Site ID	Site Name	Sample Type	Subwatershed	No. of Tests	Up to 20%	>20% to 50%	>50%	Total
79	Spring Creek at Walnut Drive	Supplemental	Colusa Basin	13	0	3	3	6
83	Stony Creek on Hwy 45 near Rd 24	Supplemental	Colusa Basin	3	0	2	0	2
85	Tributary Home Colony Canal	Supplemental	Shasta - Tehama	4	0	0	1	1
87	Unnamed Canal at Hwy 45	Supplemental	Colusa Basin	5	2	1	0	3
88	Unnamed Ditch at SW corner of Levee and Riego Rd	Supplemental	Placer - Nevada - SSutter - NSac	3	0	3	0	3
90	Unnamed Drain of Walker Creek on Co. Rd. 28	Supplemental	Colusa Basin	9	2	1	0	3
91	West Adams Canal at Road 89	Supplemental	Solano - Yolo	5	1	0	0	1
95	Winters Canal at Road 86A	Supplemental	Solano - Yolo	4	0	0	4	4
96	Yankee Slough at Swanson Road	Supplemental	Placer - Nevada - SSutter - NSac	5	1	4	0	5
			Total	212	12	55	27	94

Hyaella azteca (sediment amphipod). The monitoring results for tests with toxicity to *Hyaella* are summarized on Table Z1-6, and the locations where these occurred are identified on Figure Z1-7. The table below indicates that 17 sediment sample tests resulted in statistically significant toxicity, which is about 18.5% of the 92 *Hyaella* tests. Out of the 96 monitoring locations, 13.5% had a test result with sediment toxicity at least one time, although monitoring frequency at each site varied.

Table Z1-6
Monitoring Sites with Toxicity to *Hyaella azteca*

					No. of Tests with Percent Reduction as Compared to Laboratory Control			
Site ID	Site Name	Sample Type	Subwatershed	No of Tests	Up to 20%	>20% to 50%	>50%	Total
10	Big Indian Creek at Bridge	MRPPlan	Sacramento - Amador	1	0	1	0	1
19	Cosumnes River at Twin Cities Rd	MRPPlan	Sacramento - Amador	2	2	0	0	2
20	Dry Creek at Alta Mesa Road	MRPPlan	Sacramento - Amador	2	0	0	1	1
27	North Canyon Creek	MRPPlan	El Dorado	2	1	0	0	1
28	Pine Creek at Nord Gianella Road	MRPPlan	Butte - Yuba - Sutter	1	1	0	0	1
34	Shag Slough at Liberty Island Bridge	MRPPlan	Solano - Yolo	3	1	0	0	1
38	Stony Creek on Hwy 45 near Rd 24	MRPPlan	Colusa Basin	4	1	1	0	2

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					No. of Tests with Percent Reduction as Compared to Laboratory Control			
Site ID	Site Name	Sample Type	Subwatershed	No of Tests	Up to 20%	>20% to 50%	>50%	Total
42	Wadsworth Canal at South Butte Rd	MRPPlan	Butte - Yuba - Sutter	1	1	0	0	1
43	Z Drain – Dixon RCD	MRPPlan	Solano - Yolo	4	1	1	1	3
55	Comanche Creek (Angel Slough) at Dayton Rd.	Supplemental	Butte - Yuba - Sutter	1	1	0	0	1
79	Spring Creek at Walnut Drive	Supplemental	Colusa Basin	3	0	0	1	1
89	Unnamed Drain Along Sutter Island X Rd	Supplemental	Sacramento - Amador	1	1	0	0	1
90	Unnamed Drain of Walker Creek on Co. Rd. 28	Supplemental	Colusa Basin	2	0	0	1	1
			Total	27	10	3	4	17

PESTICIDES. Much of the pesticide use is summarized in Appendix B, Crops and Pesticide Use. The quantifiable results as compared to water quality triggers for the more commonly detected pesticides are presented in Table Z1-7. The trigger limits to which results were compared are provided in Appendix A. The approximate locations where these detections occurred are provided in Figure Z1-8. Areas within Zone 1 that could receive prioritized consideration, based on the 2007 Review data, are the following:

- Colusa Basin Subwatershed: Site No. 90 (Un-named Drain of Walker Creek on County Road 28) had multiple significant toxicity results for water toxicity species (fathead minnow, water flea, algal species), as well as one exceedance in sediment toxicity. In addition, multiple pesticide detections that exceeded trigger limits were observed. Site No. 79 (Spring Creek at Walnut Avenue) had multiple toxic results for water flea and algal species, as well as one for sediment toxicity. This monitoring site also had multiple detections of the organophosphate pesticides, diazinon and chlorpyrifos.

- Butte/Yuba/Sutter Subwatershed: Site No. 96 (Yankee Slough at Swanson Road) had multiple detections of chlorpyrifos, diazinon and malathion over the trigger limits. This site also had multiple toxic results for algal species. Site No. 3, Butte Slough at Lower Pass Road, had multiple toxic results for fathead minnow, water flea and algal species.

- Solano/Yolo Subwatershed: Site Nos. 94 and 95 (Willow Slough at Road 99 and Winters Canal at Road 86A) had multiple measurements of organochlorine or organophosphate pesticides, as well as toxicity at site No. 95. Site No. 43, Z-Drain, had multiple toxic results for sediment toxicity, as well as one for water flea.

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Shasta/Tehama Subwatershed: Site No. 11 (Burch Creek at Woodson Avenue Bridge) had multiple toxic results for *Ceriodaphnia* and one measured value of diazinon over the Basin Plan Objective.

**Table Z1-7
Pesticides Tests and Results Greater than Trigger Limits**

Site ID	Site Name	Sample Type	Subwatershed	No. of Tests	Diazinon	Chlorpyrifos	Other	Total
11	Burch Creek at Woodson Ave Bridge	MRP Plan	Shasta - Tehama	4	1	0	0	1
18	Coon Creek at Striplin Road	MRP Plan	Placer - Nevada - SSutter - NSac	15	0	2	0	2
22	Gilsizer Slough	MRP Plan	Butte - Yuba - Sutter	7	1	0	0	1
27	North Canyon Creek	MRP Plan	El Dorado	10	1	0	1	2
28	Pine Creek at Nord Gianella Road	MRP Plan	Butte - Yuba - Sutter	9	1	1	0	2
32	Rough and Ready Pumping Plant (RD 108)	MRP Plan	Colusa Basin	15	0	0	5	5
37	Stone Corral Creek	MRP Plan	Colusa Basin	12	0	1	0	1
38	Stony Creek on Hwy 45 near Rd 24	MRP Plan	Colusa Basin	16	1	1	1	3
42	Wadsworth Canal at South Butte Rd	MRP Plan	Butte - Yuba - Sutter	15	1	0	0	1
44	Antelope Creek at Kansas Avenue	Supplemental	Shasta - Tehama	10	0	1	1	2
45	Bear River at Pleasant Grove Rd.	Supplemental	Butte - Yuba - Sutter	4	0	2	0	2
62	Drain to Walker Cr at County Rd F	Supplemental	Colusa Basin	2	0	1	1	2
71	Main Drainage Canal at Colusa Highway	Supplemental	Butte - Yuba - Sutter	4	1	0	0	1
74	North Main Canal at Sankey Rd.	Supplemental	Placer - Nevada - SSutter - NSac	4	0	0	2	2
75	N-S Ditch along Natomas Rd	Supplemental	Placer - Nevada - SSutter - NSac	4	0	1	1	2
78	Spring Creek at E. Camp Rd.	Supplemental	Colusa Basin	3	1	0	0	1
79	Spring Creek at Walnut Drive	Supplemental	Colusa Basin	30	8	2	2	12
83	Stony Creek on Hwy 45 near Rd 24	Supplemental	Colusa Basin	6	0	1	0	1
87	Unnamed Canal at Hwy 45	Supplemental	Colusa Basin	5	0	0	0	0
90	Unnamed Drain of Walker Creek on Co. Rd. 28	Supplemental	Colusa Basin	10	0	8	1	9
94	Willow Slough at Road 99	Supplemental	Solano - Yolo	5	0	1	9	10
95	Winters Canal at Road 86A	Supplemental	Solano - Yolo	9	9	0	1	10
96	Yankee Slough at Swanson Road	Supplemental	Placer - Nevada - SSutter - NSac	5	1	5	3	9
			Total	204	26	27	28	81

PATHOGENS. Monitoring for *E. coli* , as a pathogen indicator was conducted and data results were compared to the USEPA recommended criteria of 235

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MPN/100 mL. Results of *E. coli* monitoring are depicted on Table Z1-8 and Figure Z1-9. The presence of the pathogen indicator was shown to be ubiquitous and measurements greater than the water quality trigger for the different subwatersheds from the lowest frequency in El Dorado County at 12.5% of the tests exceeding trigger levels up to 43.5% at Shasta Tehama Subwatershed.

The Coalitions within Zone 1 are undertaking a study through University of California at Davis, which will utilize DNA analysis to help determine probable sources of *E. coli* at some of the monitoring locations.

Table Z1-8
Monitoring Results for *Escherichia coli*

Site ID	Site Name	Sample Type	Subwatershed	No. of Tests	No Tests Greater than Trigger Limit
9	Anderson Creek at Ash Creek Road	MRP Plan	Shasta/Tehama	7	6
10	Big Indian Creek at Bridge	MRP Plan	Sacramento/Amador	2	1
11	Burch Creek at Woodson Ave Bridge	MRP Plan	Shasta/Tehama	4	2
13	Butte Creek at Gridley Rd Bridge	MRP Plan	Shasta/Tehama	12	2
14	Butte Slough at Pass Road	MRP Plan	Butte/Yuba/Sutter	6	1
15	Capell Creek upstream from Lake Berryessa	MRP Plan	Lake/Napa	5	1
16	Colusa Drain above Knights Landing	MRP Plan	Colusa Basin	1	1
17	Colusa Drain near Maxwell Road	MRP Plan	Colusa Basin	11	5
18	Coon Creek at Striplin Road	MRP Plan	Colusa Basin	15	9
19	Cosumnes River at Twin Cities Rd	MRP Plan	Placer/Nevada/Sutter/Nsac	6	1
20	Dry Creek at Alta Mesa Road	MRP Plan	Sacramento/Amador	7	1
22	Gilsizer Slough	MRP Plan	Sacramento/Amador	7	2
24	Indian Creek downStream from Indian Valley	MRP Plan	Upper Feather River	8	1
25	McGaugh Slough at Finley Road East	MRP Plan	Lake Napa	4	3
26	Middle Fork Feather River at County Road A-23	MRP Plan	El Dorado	8	1
27	North Canyon Creek	MRP Plan	Butte/Yuba/Sutter	11	2
28	Pine Creek at Nord Gianella Road	MRP Plan	Butte/Yuba/Sutter	8	2
29	Pit River @ Canby Bridge	MRP Plan	Pit River	9	3
31	Pope Creek upstream from Lake Berryessa	MRP Plan	Lake/Napa	5	1
32	Rough and Ready Pumping Plant (RD 108)	MRP Plan	Solano/Yolo	15	2
35	Spanish Creek above confluence with	MRP Plan	Upper Feather River	8	3

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Site ID	Site Name	Sample Type	Subwatershed	No. of Tests	No Tests Greater than Trigger Limit
	Greenhorn Ck				
37	Stone Corral Creek	MRP Plan	Colusa Basin	12	2
38	Stony Creek on Hwy 45 near Rd 24	MRP Plan	Colusa Basin	8	1
39	Toe Drain at NE corner of Little Holland	MRP Plan	Solano/Yolo	2	1
40	Tule Canal at I-80	MRP Plan	Solano/Yolo	15	4
41	Ulatis Creek at Brown Road	MRP Plan	Solano/Yolo	7	4
42	Wadsworth Canal at South Butte Rd	MRP Plan	Butte/Yuba/Sutter	14	4
43	Z Drain – Dixon RCD	MRP Plan	Solano/Yolo	12	8
			Total	229	74

DATA GAPS. Monitoring frequency varies significantly for different Coalitions within Zone 1. For example, there are no available monitoring results for this 2007 review for the Goose Lake Coalition area. While there is significant data available for the Sacramento Valley Water Quality Coalition area, the number of data points varies from subwatershed to subwatershed.

There were several monitoring results for metals, which were not accompanied by hardness data. Hardness provides critical information to be able to evaluate aquatic life protection for some metals. Staff did conduct some review and evaluated the likely hardness value that would be necessary to cause an exceedance in the measured value of metals. In all cases, it would have been unlikely that the water would be sufficiently soft to cause metal toxicity.

There are areas to the north of Cache Creek in Lake and Napa Counties, west of the Colusa Drain in Yolo County, and in the Pit and Fall Rivers region that remain unmonitored at this time. The southern areas of Solano County also remain unmonitored, but urban and industrial effects will make it challenging to locate sites that represent primarily agricultural influences. Water Board staff will evaluate these areas during the next site selection process.

Background levels for certain parameters will need to be evaluated in order to determine if agriculture is contributing to the measured values that exceed water quality triggers. For example, boron is naturally occurring in the Solano/Yolo subwatershed but it has yet to be determined through analysis and data accumulation as to whether or not agricultural practices are contributing to the problem. Agriculture contributions could occur through soil amendment additions for alfalfa and other crops, or by the use of well water for irrigation. A Management Plan effort has been initiated by the Sacramento Valley Coalition to address this question.

Detections of *E.coli* occur throughout Zone 1, and identification of the sources is necessary. Coalitions are also conducting studies to help interpret DNA

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information that could identify sources of the pathogen indicator for the locations that have been monitored.

Zone 1 Summary

The following summarizes monitoring performed in Zone 1:

There were 501 toxicity tests performed on *Pimephales promelas* (fathead minnow) of which 8 were found to be toxic, or 1.6%. The number of monitoring sites that had fathead minnow toxicity, out of the total number of sites tested was 8.0% (6 out of 76 sites).

There were 495 tests performed for *Ceriodaphnia dubia* (water flea), of which 29 were toxic to the water fleas, or 6.1%. Out of the total number of sites tested, 26.7% (20 out of 75 sites) of the monitoring sites indicated toxicity to the water flea.

For *Selenastrum capricornutum* (algal species), a total of 390 tests were performed with 94 showing toxicity at 26 sites, or 24.1%. Out of the total number of sites monitored, 41% were toxic to algae (24 out of 59 sites).

Toxicity for *Selenastrum* is generally indicative of herbicide or metal toxicity. At some sites in 2006, metals were analyzed with *Selenastrum* toxicity. There was no identified correlation between metals analyzed and algae toxicity, in part because of the limited information available via toxicity identification evaluation (TIE), or simultaneous herbicide and metals measurements. There is some inconclusive TIE information that indicates a non-polar organic with a short half-life as the contaminant for some of the toxicity. The California Rice Commission in Zone 1 is developing an alternative approach to identifying algae toxicity.

Sediment toxicity is high compared to the number of samples taken. Pyrethroids are suspected, based on studies conducted by the University of California. There were 92 sediment samples collected for testing with *Hyalella azteca* with 17 samples showing toxicity at 13 sites, or 18.5%. Out of the total number of sites monitored, 25% showed sediment toxicity (13 out of 52 sites).

Pesticides were measured at values greater than trigger limits 81 times in Zone 1, which is approximately 20% of 407 pesticide sampling events. Most of these measurements were for diazinon and chlorpyrifos for which the numerical objectives were exceeded 26 and 27 times, respectively.

Of the 229 *E. coli* samples collected, 74 were greater than the water quality trigger of 235 MPN/100mL, which is approximately 28.2% of 262 tests. The Sacramento Valley Water Quality Coalition in Zone 1 has joined efforts with a research project being conducted at the University of California to utilize DNA information as an aid for source identification.

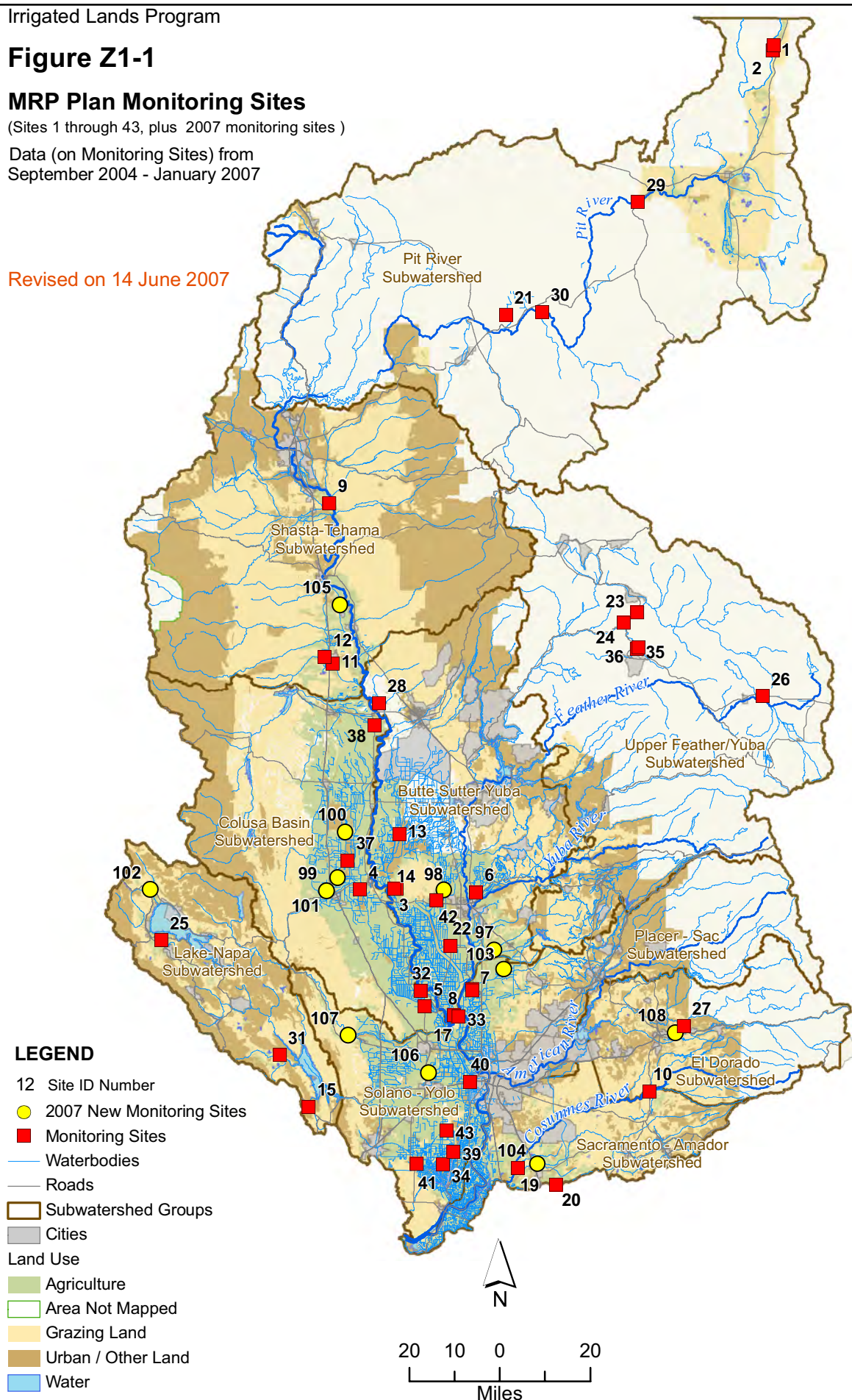
Figure Z1-1

MRP Plan Monitoring Sites

(Sites 1 through 43, plus 2007 monitoring sites)

Data (on Monitoring Sites) from
September 2004 - January 2007

Revised on 14 June 2007



Sources:

- Department of Conservation. 2004. Division of Land Resources. Farm Land Mapping and Monitoring Program.
- US EPA. 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

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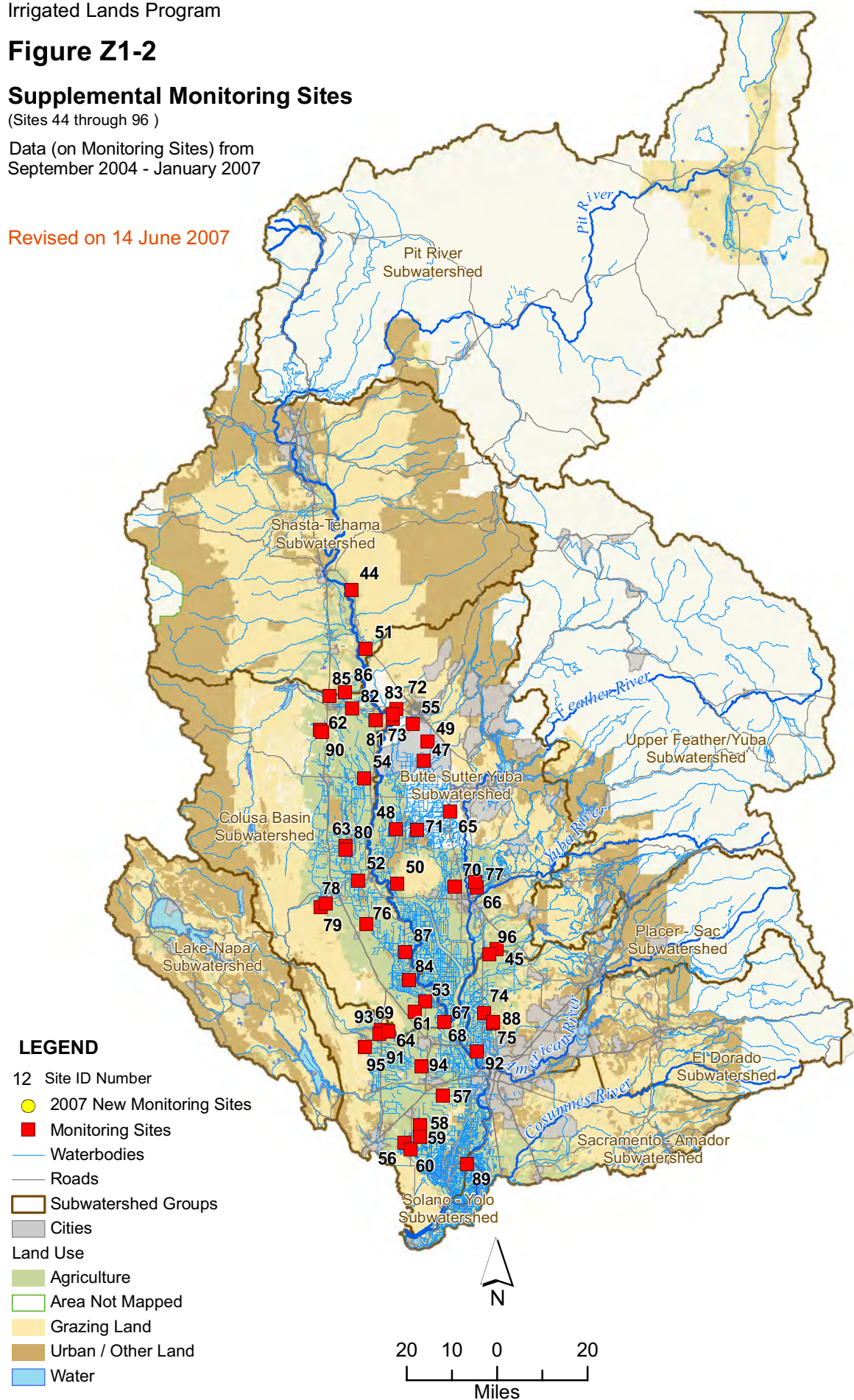
Figure Z1-2

Supplemental Monitoring Sites

(Sites 44 through 96)

Data (on Monitoring Sites) from
September 2004 - January 2007

Revised on 14 June 2007



DLH

Figure Z1-4

Toxicity to *Pimephales promelas*

April 2003 - December 2006

Revised on 3 July 2007

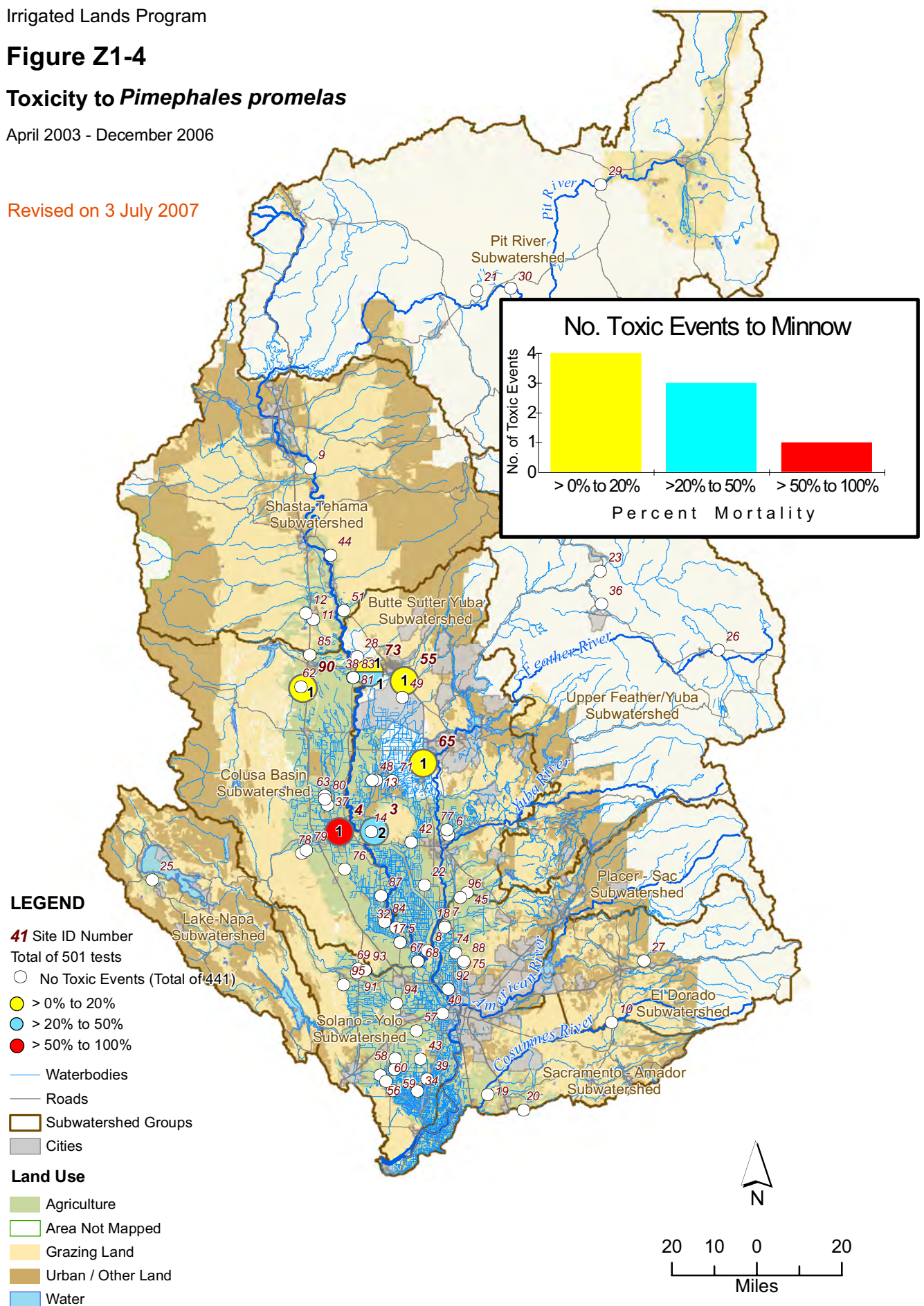
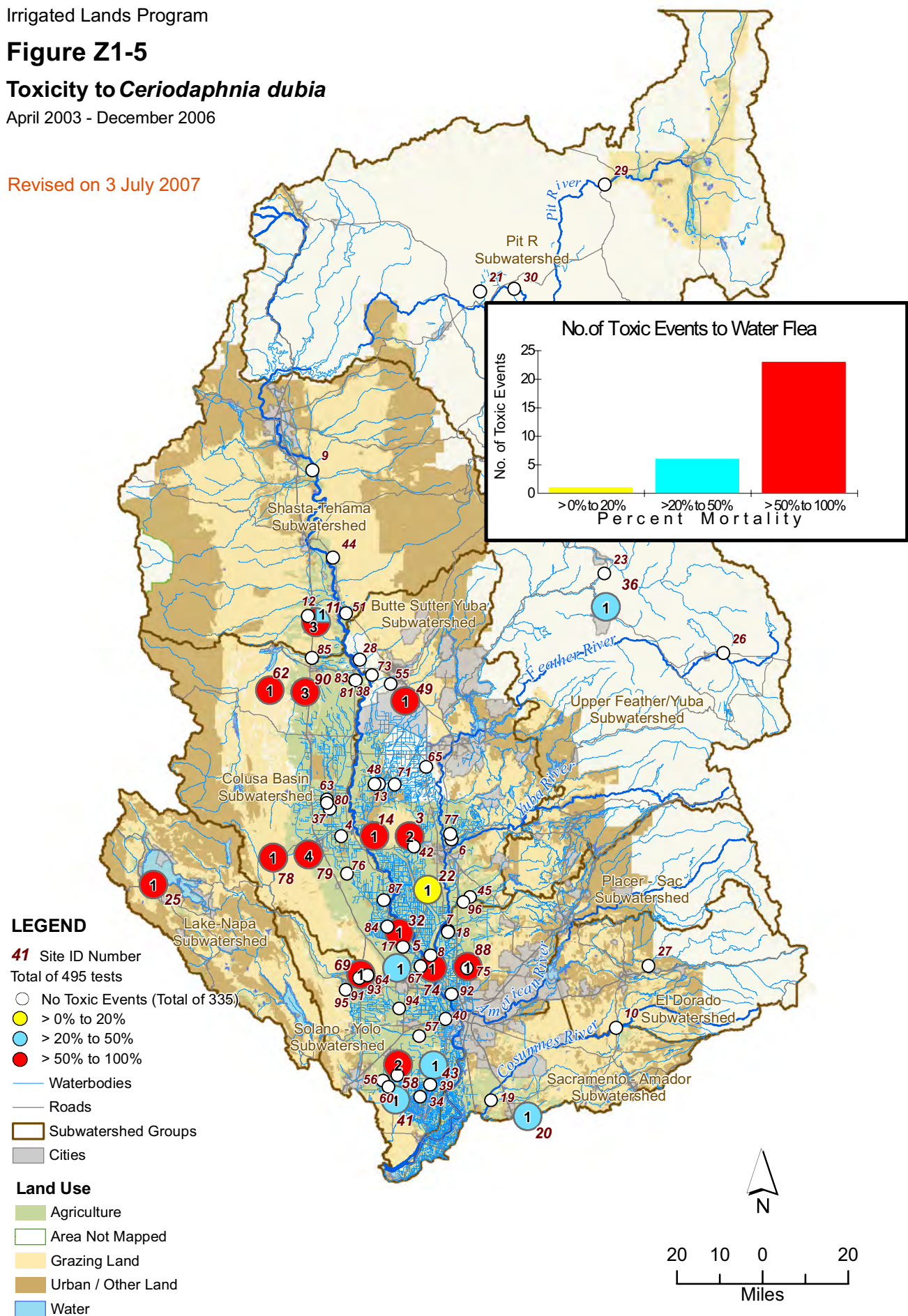


Figure Z1-5

Toxicity to *Ceriodaphnia dubia*

April 2003 - December 2006

Revised on 3 July 2007



Sources:

- Department of Conservation. 2004. Division of Land Resources. Protection. Farm Land Mapping and Monitoring Program.
- US EPA. 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

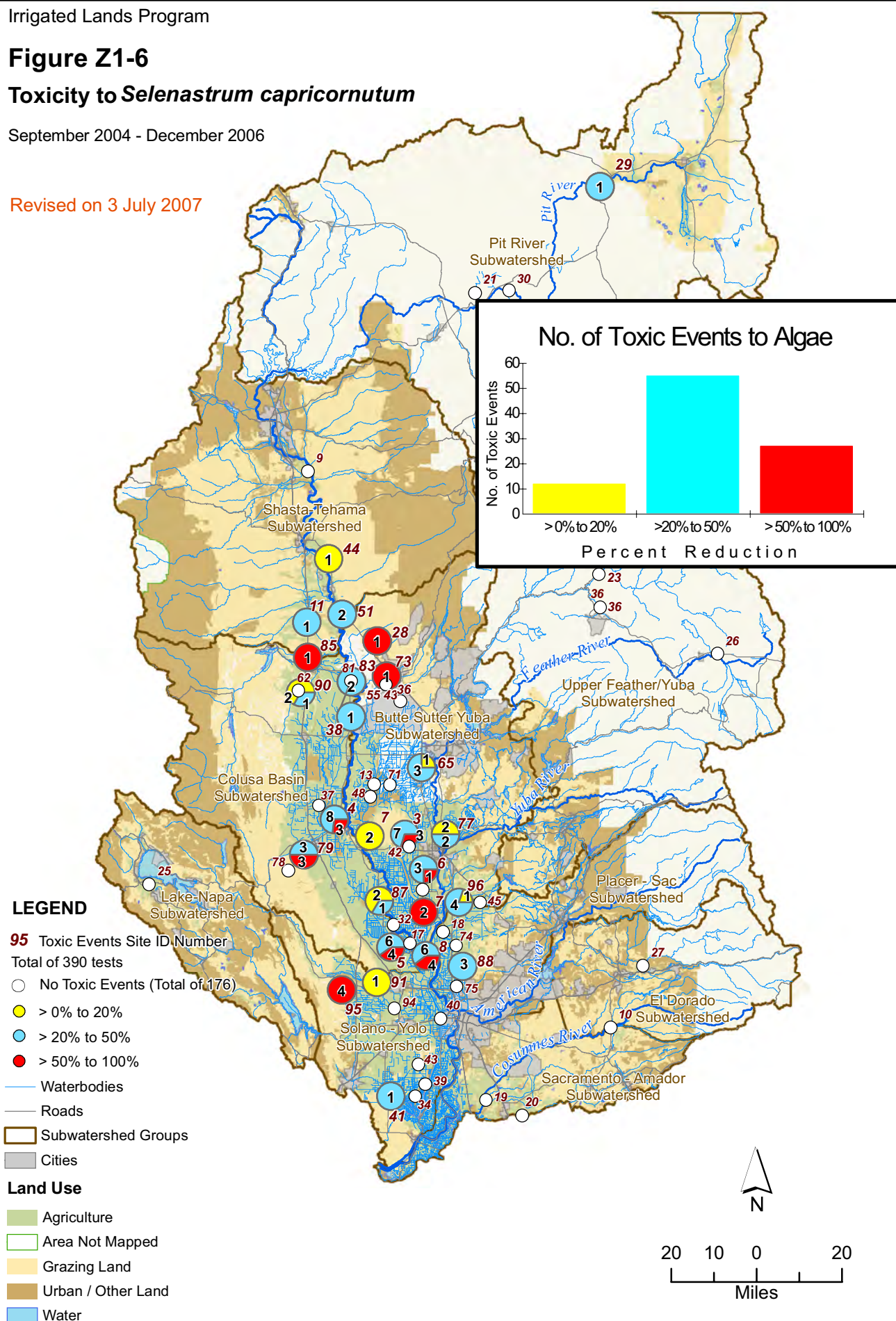
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Figure Z1-6

Toxicity to *Selenastrum capricornutum*

September 2004 - December 2006

Revised on 3 July 2007



Sources:

- Department of Conservation. 2004. Division of Land Resources. Farm Land Mapping and Monitoring Program.
- US EPA. 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

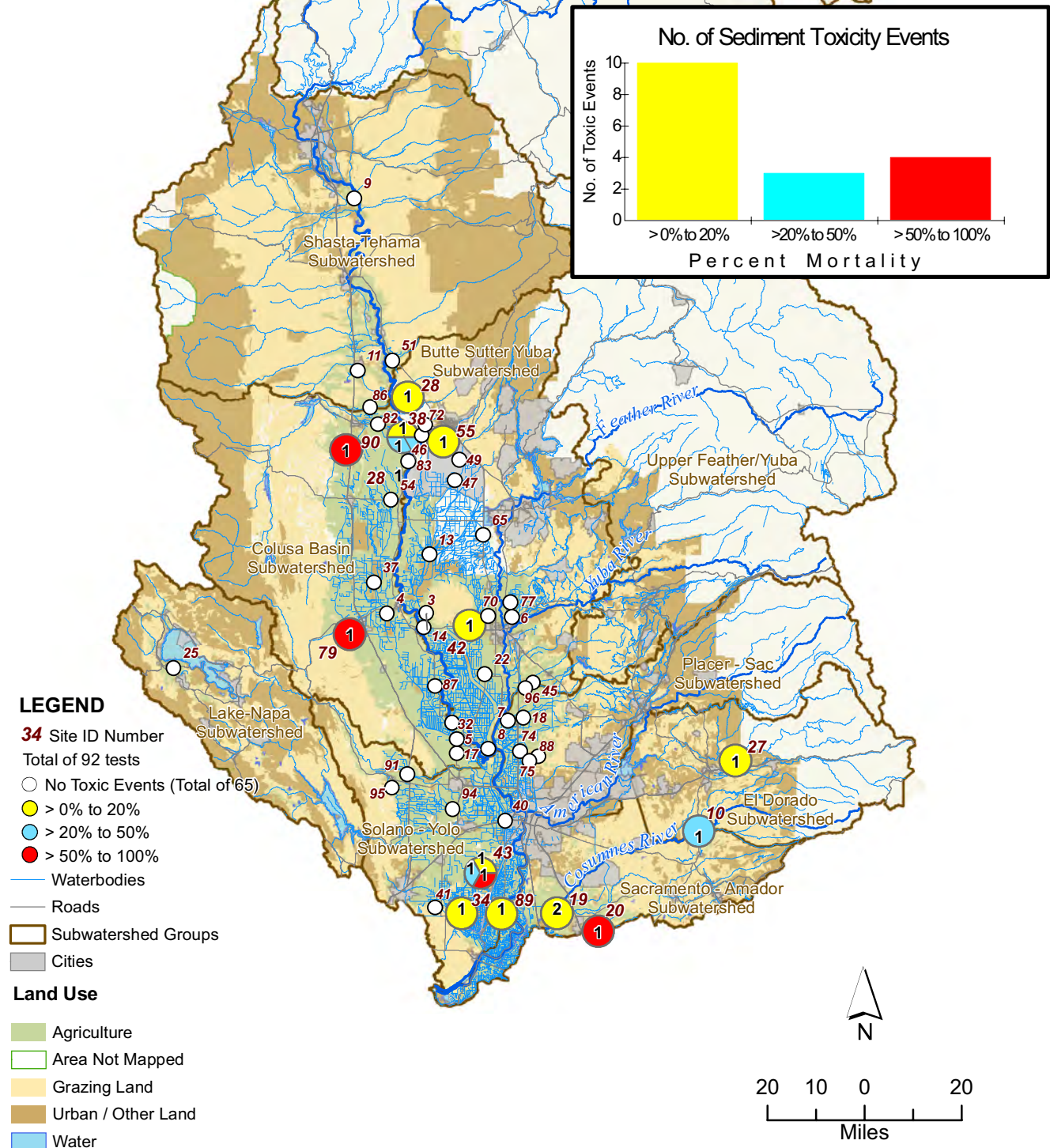
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Figure Z1-7

Toxicity to *Hyaella azteca* (Sediment)

August 2004 - September 2006

Revised on 3 July 2007



Sources:

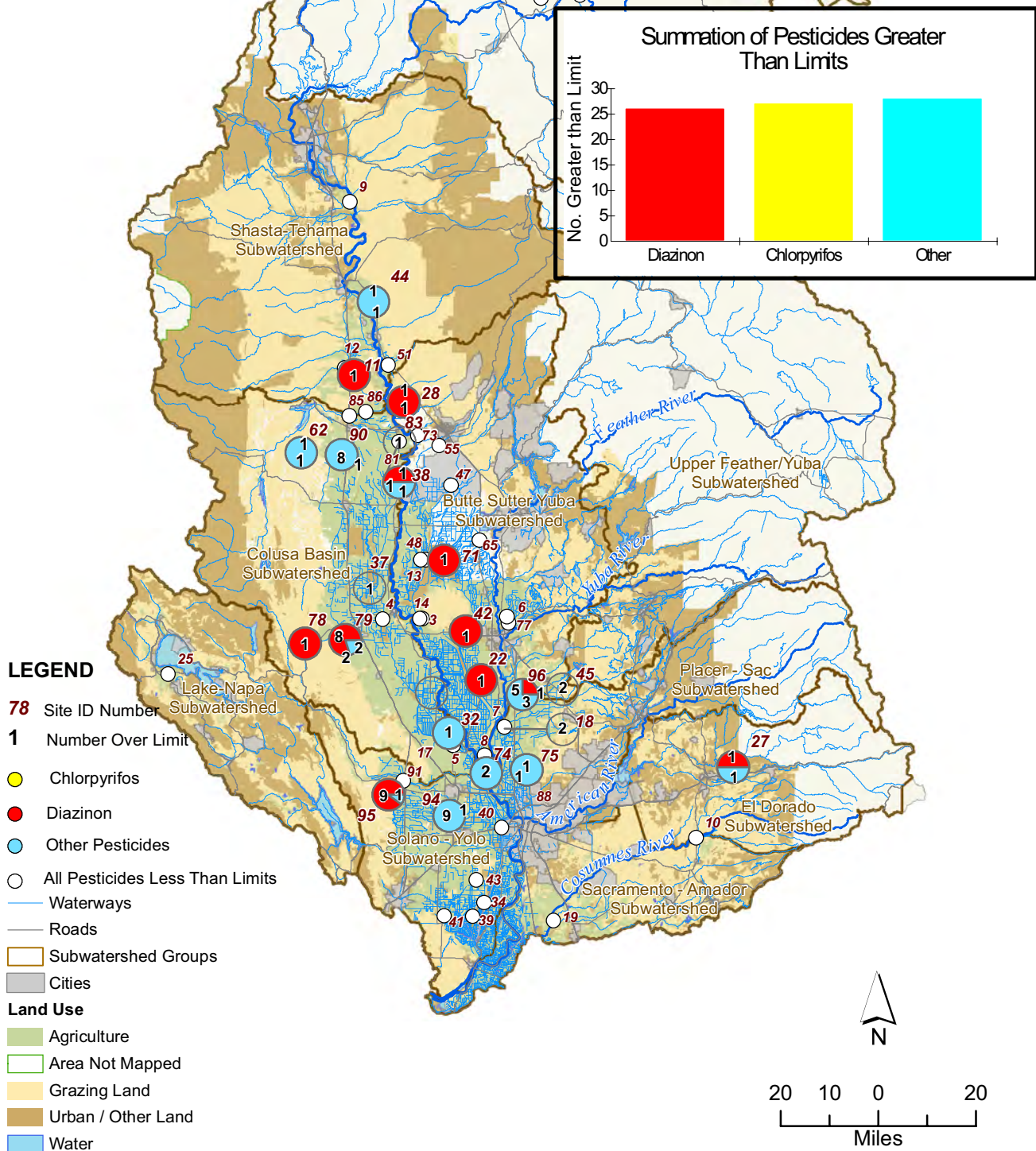
- Department of Conservation. 2004. Division of Land Resources. Protection. Farm Land Mapping and Monitoring Program.
- US EPA. 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

Figure Z1-8

Monitoring Results for Pesticides

July 2004 - December 2006

Revised on 3 July 2007



Sources:

- Department of Conservation. 2004. Division of Land Resources. Protection. Farm Land Mapping and Monitoring Program.
 - US EPA. 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

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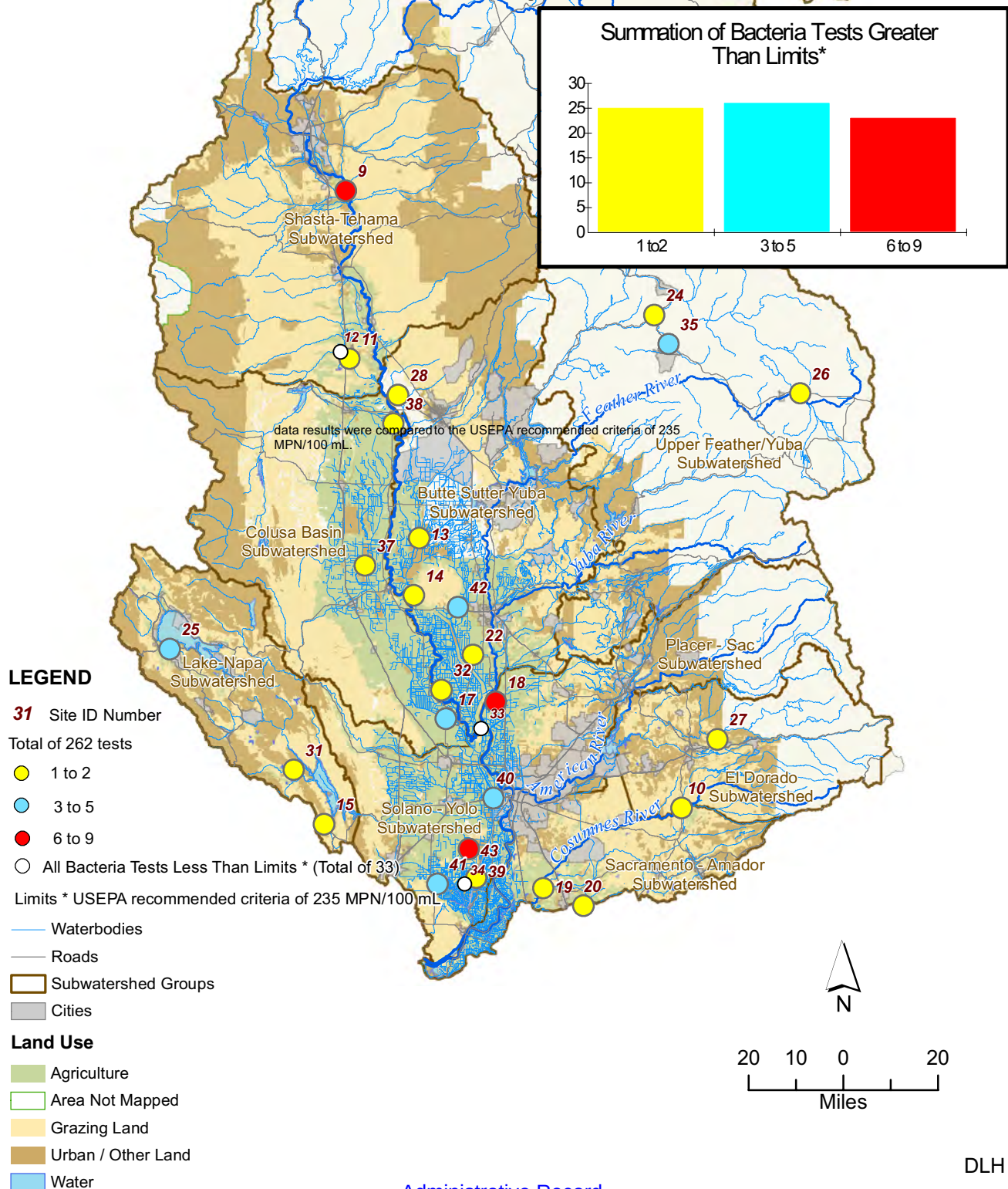
Figure Z1-9

Irrigated Lands Program

Monitoring Results for *Escherichia coli*

September 2004 - December 2006

Revised on 3 July 2007



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ZONE 2

Zone 2 Description

Zone 2 includes portions of San Joaquin, Contra Costa, Alameda and Calaveras counties and the Sacramento-San Joaquin River Delta, covering approximately 998,340 acres with approximately 544,667 acres that are considered irrigated lands. The four major drainages in Zone 2 are the San Joaquin River, Stanislaus River, Calaveras River, and Mokelumne River. Many complex hydrologic systems are influenced by seasonal precipitation. Water management systems are designed to convey water from field to field for irrigation purposes, and complexities increase with the pumping of Delta water for agriculture, and to provide drinking water to southern California. The manipulated re-direction of fresh water supply, and pumping of Delta water south can create an influx of saline water to the northwest portion of Zone 2 that otherwise might not take place. Water flows fluctuate due to natural conditions as well, depending on tidal influences, snow melt, rainfall, and agricultural irrigation. Generally, water flow is heaviest in the winter months.

Many Zone 2 growers utilize an intricate system of conveyance canals for purposes of returning tail water back to upstream farms. This system allows the growers to transport and reuse runoff or tail water in upgradient areas. As a result, this sometimes affects the direction of flow in these water channels, compounding the difficulty in determining the source(s) of contaminants.

Over 100 different types of crops are grown in Zone 2. Predominant crops include asparagus, tomatoes, stone fruits, wine grapes, and irrigated pasture. The type of crops grown in any given area within Zone 2 varies greatly depending on soil type, hydrology, and farming history.

Pesticide Use information for Zone 2 is summarized in Appendix B. The Appendix lists the primary crops by acreage that were grown in 2005 sorted by county. The Appendix also references a selection of the types and quantity of pesticides that are recorded as being used for these crops (Department of Pesticide Regulation for 2005).

Monitoring Data

Table Z2-1 lists the monitoring locations, general analytical categories, and the periods of time at each location for which sample data were generated for this 2007 Review. The monitoring locations for Zone 2, indicated by site number, are shown on Figure Z2-1.

Table Z2-1
Summary of Monitoring Date Ranges

Site No.	Monitoring Site	Physical Parameters	Toxicity	Pesticides	Metals	Bacteria
1	8 Mile and Rio Blanco Rds.	7/3/03 - 9/25/03	7/3/03 - 9/25/03	None	None	None
2	Bear Creek at Alpine Rd	1/27/05 - 8/10/05	4/12/05 - 8/10/05	1/27/05 - 7/27/05	6/15/05 - 7/27/05	None
3	Bear Creek at Harney Ln.	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	None
4	Beaver Slough at Blossom Rd.	4/3/03 - 6/12/03	4/3/03 - 6/12/03	None	None	None

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Site No.	Monitoring Site	Physical Parameters	Toxicity	Pesticides	Metals	Bacteria
5	Calaveras River @ Belota Intake	8/24/04 - 9/23/04	8/24/04 - 9/23/04	*8/24/04 - 9/23/04	None	8/24/04 - 9/23/04
6	Calaveras River at Clements Rd.	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	None
7	Calaveras River at Pezzi Rd	1/27/05 - 8/10/05	1/27/05 - 8/10/05	1/27/05 - 7/27/05	6/15/05 - 7/27/05	None
8	Delta Drain- Terminous Tract off Glascock Rd	2/16/15 - 4/27/06	2/16/15 - 4/27/06	*2/16/05 - 3/15/05	None	2/16/05 - 3/15/05
9	Delta Drain- Terminous Tract off Guard Rd	2/16/05 - 4/27/06	2/16/05 - 4/27/06	*2/16/05 - 3/15/05	None	2/16/05 - 3/15/05
10	Drain 11 @ Walthal Slough (Top of Bank)	None	None	9/2/04 - 12/22/05	None	None
11	Drain 12 @ French Camp Rd Headwall/Southside of RR	None	None	9/2/04 - 12/22/05	None	None
12	Drain 14 @ Lone Tree Ck (Top of Bank)	None	None	9/2/04 - 12/22/05	None	None
13	Drain at Bowman Rd.	4/1/03 - 9/4/03	4/1/03 - 9/1/03	None	None	None
14	Drain at Wing Levee Road	3/26/03 - 9/25/03	3/26/03 - 9/25/03	None	None	None
15	Drain to Brack Dr at Woodbridge Rd	None	8/28/04	8/28/2004	None	None
16	Drain to Grant Line Canal off Wing Levee Rd.	3/26/06 - 9/25/03	7/21/04 - 2/15/05	7/21/04 - 2/16/05	7/21/04 - 2/16/05	None
17	Drain to North Canal along Bonetti Drive	8/28/04 - 4/12/05	8/28/04 - 4/12/05	8/28/04 - 4/12/05	None	None
18	Drain to North Canal at South Bonetti Rd.	7/21/04 - 2/16/05	7/21/04 - 9/14/04	7/21/04 - 2/16/05	7/21/04 - 2/16/05	None
19	Drain to Pixley Slough at Davis Rd	8/28/04	8/28/04	8/28/2004	None	None
20	Drain to San Joaquin River off South Manthey Rd.	7/21/04 - 2/16/05	7/21/04 - 8/31/04	7/21/04 - 2/16/05	7/21/04 - 2/16/05	None
21	Duck Creek at Highway 4	8/24/04 - 9/29/06	8/24/04 - 9/29/06	*8/24/04 - 9/19/06	None	8/24/04 - 9/19/06
22	French Camp Slough @ Airport Way	2/16/05 - 9/19/06	2/16/05 - 9/19/06	*2/16/05 - 9/19/06	5/16/06 - 9/19/06	2/16/05 - 9/19/06
23	Grant Line Canal @ Clifton Court Rd	2/16/05 - 9/19/06	2/16/05 - 9/19/06	*2/16/05 - 9/19/06	5/16/06 - 9/19/06	2/16/05 - 9/19/06
24	Grant Line Canal near Calpack Rd	2/16/05 - 9/19/06	2/16/05 - 9/19/06	*2/16/05 - 9/19/06	5/16/06 - 9/19/06	2/16/05 - 9/19/06
25	Kellogg Creek @ Hwy 4	2/16/05 - 4/27/06	2/16/05 - 4/27/06	*2/16/05 - 3/15/06	None	2/16/05 - 3/15/06
26	Kellogg Creek along Hoffman Ln	9/20/05 - 9/19/06	9/20/05 - 9/19/06	*9/20/05 - 9/19/06	5/16/06 - 9/19/06	9/20/05 - 9/19/06
27	Little John Creek at Newcastle Rd.	4/1/03 - 9/5/03	4/1/03 - 9/5/03	None	None	None
28	Littlejohns Creek @ Jacktone Rd	8/24/04 - 9/19/06	8/24/04 - 9/19/06	*8/24/04 - 9/19/06	5/16/06 - 9/19/06	8/24/04 - 9/19/06
29	Lone Tree Creek @ Brennan Rd	9/20/05 - 4/27/06	9/20/05 - 4/27/06	*9/20/05 - 3/15/06	None	9/20/05 - 3/15/06
30	Lone Tree Creek @ Jacktone Rd	8/24/04 - 9/19/06	8/24/04 - 9/19/06	*8/24/04 - 9/19/06	5/16/06 - 9/19/06	8/24/04 - 9/19/06
31	Lone Tree Creek at Newcastle Rd.	3/26/03 - 9/23/03	3/26/03 - 9/23/03	None	None	None
32	Marsh Creek @ Balfour Ave	2/16/05 - 4/27/06	2/16/05 - 4/27/06	*2/16/05 - 3/15/06	None	2/16/05 - 3/15/06
33	Marsh Creek @ Concord Ave	9/20/05 - 9/19/06	9/20/05 - 6/20/06	*9/20/05 - 6/20/06	5/16/06 - 6/20/06	9/20/05 - 6/20/06
34	Marsh Creek @ Marsh Creek Rd	3/15/2006	None	None	None	None
35	Mid Roberts Island Drain at Woodsbro Road	7/14/04 - 8/10/05	7/14/04 - 8/10/05	7/14/05 - 7/28/05	5/16/06 - 9/19/06	None
36	Mokelumne River @ Bruella Rd	8/24/04 - 9/19/06	8/24/04 - 9/19/06	*8/24/04 - 9/19/06	5/16/06 - 9/19/06	8/24/04 - 3/15/06
37	Mokelumne River @ Fish Hatchery	9/20/05	9/20/05	*9/20/2005	None	9/20/05
38	Mormon Slough at Jack Tone Road	5/16/06 - 9/19/06	5/16/06 - 9/19/06	*5/16/06 - 9/19/06	None	5/16/06 - 9/19/06
39	Mormon Slough on Jack Tone Rd	7/14/04 - 9/8/04	7/14/04 - 9/8/04	7/14/04 - 9/8/04	7/14/04 - 9/8/04	None
40	Paddy Creek at Jack Tone Rd.	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	None
41	Pixley Slough at Eightmile Rd	7/14/04 - 8/10/05	7/14/04 - 8/10/05	7/14/04 - 7/28/05	7/14/04 - 7/28/05	None
42	Pixley Slough at Ham Ln	6/16/05 - 7/28/05	6/16/05 - 7/28/05	6/16/05 - 7/28/05	6/16/05 - 7/28/05	None
43	Potato Slough @ Hwy 12	8/24/04 - 4/27/06	8/24/04 - 3/15/06	*8/24/04 - 3/15/06	None	8/24/04 - 3/15/06
44	Return Irrigation Drain at MCD Rd.	4/3/03 - 9/25/03	4/3/03 - 9/25/03	None	None	None
45	Roberts Island Drain along House Road	5/16/06 - 9/19/06	5/16/06 - 9/19/06	*5/16/06 - 9/19/06	None	5/16/06 - 9/19/06
46	Roberts Island Drain at Holt Road	5/16/06 - 9/19/06	5/16/06 - 9/19/06	*5/16/06 - 9/19/06	None	5/16/06 - 9/19/06
47	Sand Creek at Highway 4 Bypass	5/16/06 - 9/19/06	5/16/06 - 9/19/06	*5/16/06 - 9/19/06	None	5/16/06 - 9/19/06
48	SJR Source Water to Canal at Holt and Nueger Roads	4/1/03 - 9/25/03	4/1/03 - 9/25/03	None	None	None
49	Sweet Lateral	6/23/04 - 1/22/06	None	6/23/04 - 1/22/06	None	None
50	Terminous Tract Drain @ Hwy 12	2/16/05 - 9/19/06	2/16/05 - 9/19/06	*2/16/05 - 9/19/06	5/16/06 - 9/19/06	2/16/05 - 9/19/06

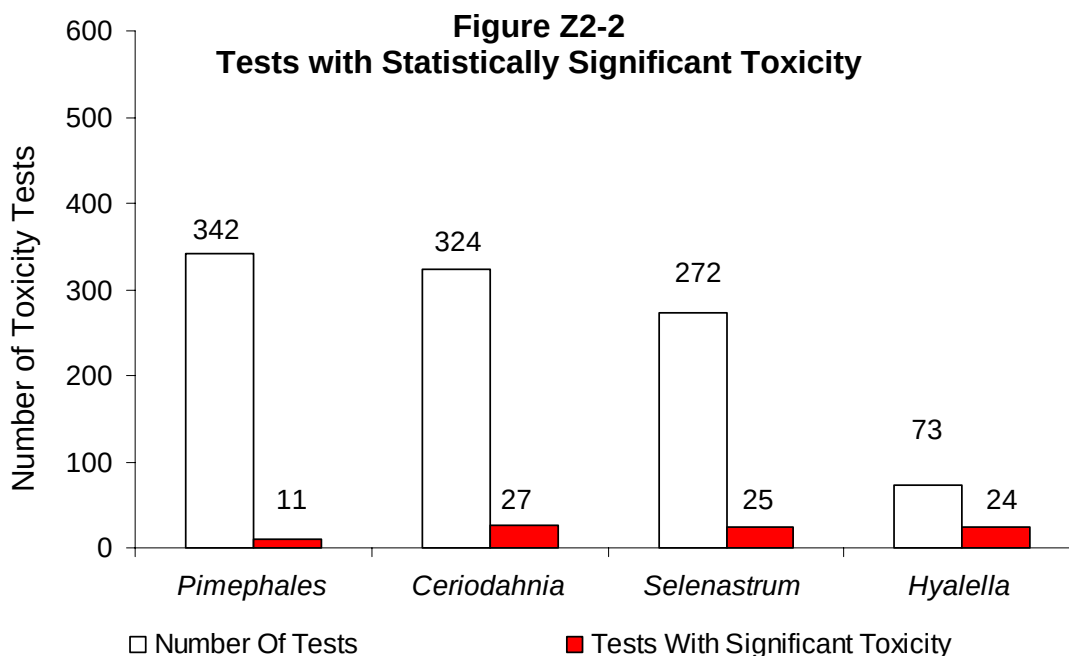
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Site No.	Monitoring Site	Physical Parameters	Toxicity	Pesticides	Metals	Bacteria
51	Tom Paine Slough at El Rancho Rd.	7/24/03 - 9/25/03	7/24/03 - 9/25/03	None	None	None
52	Tom Paine Slough at Paradise Rd.	8/27/04	8/27/04	8/27/04	None	None
53	Unnamed Canal at Howard Road	6/16/05 - 8/10/05	6/16/05 - 8/10/05	6/16/05 - 7/28/05	6/16/05 - 7/28/05	None
54	Unnamed canal at west end of Woodbridge Rd	7/14/04 - 9/8/04	7/14/04 - 9/8/04	7/14/04 - 9/8/04	7/14/04 - 9/8/04	None
55	Unnamed Drain to Lone Tree Creek at Jack	6/20/06 - 9/19/06	6/20/06 - 9/19/06	*6/20/06 - 9/19/06	None	6/20/06 - 9/19/06
56	Unnamed Slough at Wildwood Rd	8/28/2004	8/28/2004	8/28/2004	None	None
57	Unnamed Slough at Woodsbro Rd. and Burns cutoff Levee	4/1/03 - 9/25/03	4/1/03 - 9/25/03	None	None	None
58	Upstream Kellogg Creek @ Hoffman Ln	3/15/2006	None	None	None	None

*Except for chlorpyrifos and diazinon, there are no data available for pesticides before 2006 irrigation season.

AQUATIC AND SEDIMENT TOXICITY. Water column and/or sediment toxicity testing data were collected from 52 locations within Zone 2 between March 2003 and September 2006. The toxicity tests included the water column species *Pimephales promelas* (fathead minnow), *Ceriodaphnia dubia* (water flea), *Selenastrum capricornutum* (green algae), and the sediment test species *Hyalella azteca* (a bottom-dwelling amphipod).

Figure Z2-2 shows the number of tests with significant toxicity as compared to the number of tests conducted on the four test species. The results from a cumulative 1,011 toxicity tests from 52 locations are summarized in this 2007 Review. Of these tests, 87 (8.6%) resulted in significant toxicity to the test species exhibited by the ambient sample, when compared to the laboratory control.



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The percentage of toxic events compared to the number of tests for each species are: fathead minnow at 3%, water flea at 8%, algae at 9%, and *Hyaella* at 33%.

Seventeen percent of the different monitoring sites exhibited toxicity to fathead minnow at least one time, 28.8% of the sites exhibited toxicity to water flea, 23% of the sites exhibited algae toxicity, and sediment toxicity occurred in 23% of the monitoring sites in Zone 2.

Table Z2-2, Summary of Toxicity Test Frequency, provides details regarding the number of tests and those that resulted in toxicity for each species and site where toxicity testing occurred.

**Table Z2-2
Summary of Toxicity Test Frequency**

Site Number	Monitoring Site		<i>Ceriodaphnia dubia</i>	<i>Hyaella azteca</i>	<i>Pimephales promelas</i>	<i>Selenastrum</i>	Totals
1	8 Mile and Rio Blanco Rds.	Number of Tests	4	0	4	0	8
		Toxic Events	0	0	0	0	0
2	Bear Creek at Alpine Rd	Number of Tests	4	2	4	4	14
		Toxic Events	1	0	0	0	1
3	Bear Creek at Harney Ln.	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
4	Beaver Slough at Blossom Rd.	Number of Tests	3	0	3	0	6
		Toxic Events	0	0	0	0	0
5	Calaveras River @ Belota Intake	Number of Tests	2	0	2	2	6
		Toxic Events	0	0	0	0	0
6	Calaveras River at Clements Rd.	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
7	Calaveras River at Pezzi Rd	Number of Tests	8	1	8	8	25
		Toxic Events	1	1	0	3	5
8	Delta Drain- Terminous Tract off Glascock Rd	Number of Tests	9	4	10	8	31
		Toxic Events	0	2	1	0	3
9	Delta Drain- Terminous Tract off Guard Rd	Number of Tests	7	3	8	8	26
		Toxic Events	0	1	0	1	2
13	Drain at Bowman Rd.	Number of Tests	5	0	4	0	9
		Toxic Events	0	0	0	0	0
14	Drain at Wing Levee Road	Number of Tests	8	0	8	0	16
		Toxic Events	0	0	0	0	0
15	Drain to Brack Dr at Woodbridge Rd	Number of Tests	0	1	0	0	1
		Toxic Events	0	0	0	0	0
16	Drain to Grant Line Canal off Wing Levee Rd.	Number of Tests	8	1	8	8	25
		Toxic Events	2	1	0	0	3
17	Drain to North Canal along Bonetti Drive	Number of Tests	0	2	0	0	2

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Site Number	Monitoring Site		<i>Ceriodaphnia dubia</i>	<i>Hyaella azteca</i>	<i>Pimephales promelas</i>	<i>Selenastrum</i>	Totals
		Toxic Events	0	0	0	0	0
18	Drain to North Canal at South Bonetti Rd.	Number of Tests	5	0	5	5	15
		Toxic Events	0	0	0	0	0
19	Drain to Pixley Slough at Davis Rd	Number of Tests	0	1	0	0	1
		Toxic Events	0	0	0	0	0
20	Drain to San Joaquin River off South Manthey Rd.	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
21	Duck Creek at Highway 4	Number of Tests	7	2	7	7	23
		Toxic Events	1	0	0	0	1
22	French Camp Slough @ Airport Way	Number of Tests	12	5	14	14	45
		Toxic Events	1	1	0	1	3
23	Grant Line Canal @ Clifton Court Rd	Number of Tests	11	3	14	13	41
		Toxic Events	0	2	0	0	2
24	Grant Line Canal near Calpack Rd	Number of Tests	15	5	14	15	49
		Toxic Events	3	4	0	1	8
25	Kellogg Creek @ Hwy 4	Number of Tests	8	3	10	12	33
		Toxic Events	1	2	2	1	6
26	Kellogg Creek along Hoffman Ln	Number of Tests	8	1	8	8	25
		Toxic Events	1	0	0	0	1
27	Little John Creek at Newcastle Rd.	Number of Tests	7	0	6	0	13
		Toxic Events	1	0	0	0	1
28	Littlejohns Creek @ Jacktone Rd	Number of Tests	14	6	17	16	53
		Toxic Events	0	0	1	2	3
29	Lone Tree Creek @ Bernnan Rd	Number of Tests	3	1	4	4	12
		Toxic Events	1	0	1	3	5
30	Lone Tree Creek @ Jacktone Rd	Number of Tests	14	5	17	17	53
		Toxic Events	0	2	1	2	5
31	Lone Tree Creek at Newcastle Rd.	Number of Tests	7	0	8	0	15
		Toxic Events	1	0	0	0	1
32	Marsh Creek @ Balfour Ave	Number of Tests	10	4	9	9	32
		Toxic Events	2	4	0	0	6
33	Marsh Creek @ Concord Ave	Number of Tests	5	1	5	5	16
		Toxic Events	0	0	1	0	1
35	Mid Roberts Island Drain at Woodsbro Road	Number of Tests	2	1	2	2	7
		Toxic Events	0	0	0	0	0
36	Mokelumne River @ Bruella Rd	Number of Tests	18	5	16	15	54
		Toxic Events	5	0	0	3	8
37	Mokelumne River @ Fish Hatchery	Number of Tests	1	0	1	1	3

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Site Number	Monitoring Site		<i>Ceriodaphnia dubia</i>	<i>Hyaella azteca</i>	<i>Pimephales promelas</i>	<i>Selenastrum</i>	Totals
		Toxic Events	0	0	0	0	0
38	Mormon Slough at Jack Tone Road	Number of Tests	4	0	5	5	14
		Toxic Events	0	0	0	0	0
39	Mormon Slough on Jack Tone Rd	Number of Tests	5	0	5	5	15
		Toxic Events	0	0	0	5	5
40	Paddy Creek at Jack Tone Rd.	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
41	Pixley Slough at Eightmile Rd	Number of Tests	9	2	9	9	29
		Toxic Events	0	0	0	1	1
42	Pixley Slough at Ham Ln	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
43	Potato Slough @ Hwy 12	Number of Tests	12	1	11	10	34
		Toxic Events	3	0	0	0	3
44	Return Irrigation Drain at MCD Rd.	Number of Tests	8	0	8	0	16
		Toxic Events	0	0	0	0	0
45	Roberts Island Drain along House Road	Number of Tests	4	1	5	5	15
		Toxic Events	0	0	0	0	0
46	Roberts Island Drain at Holt Road	Number of Tests	4	2	5	5	16
		Toxic Events	0	2	0	0	2
47	Sand Creek at Highway 4 Bypass	Number of Tests	7	2	6	5	20
		Toxic Events	3	2	1	0	6
48	SJR Source Water to Canal at Holt and Nueger Roads	Number of Tests	8	0	8	0	16
		Toxic Events	0	0	2	0	2
50	Terminus Tract Drain @ Hwy 12	Number of Tests	12	4	15	14	45
		Toxic Events	0	0	1	2	3
51	Tom Paine Slough at El Rancho Rd.	Number of Tests	5	0	7	0	12
		Toxic Events	0	0	0	0	0
52	Tom Paine Slough at Paradise Rd.	Number of Tests	0	1	0	0	1
		Toxic Events	0	0	0	0	0
53	Unnamed Canal at Howard Road	Number of Tests	4	1	4	4	13
		Toxic Events	0	0	0	0	0
54	Unnamed canal at west end of Woodbridge Rd	Number of Tests	5	0	5	5	15
		Toxic Events	0	0	0	0	0
55	Unnamed Drain to Lone Tree Creek at Jack	Number of Tests	3	1	4	4	12
		Toxic Events	0	0	0	0	0
56	Unnamed Slough at Wildwood Rd	Number of Tests	0	1	0	0	1
		Toxic Events	0	0	0	0	0
57	Unnamed Slough at Woodsbro Rd. and Burns cutoff Levee	Number of Tests	9	0	9	0	18

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Site Number	Monitoring Site		<i>Ceriodaphnia dubia</i>	<i>Hyalella azteca</i>	<i>Pimephales promelas</i>	<i>Selenastrum</i>	Totals
		Toxic Events	0	0	0	0	0
	Total Number of Tests		324	73	342	272	1011
	Total Toxic Events		27	24	11	25	87

Figures Z2-3, Minnow Toxicity, Z2-4 Water Flea Toxicity, Z2-5 Algae Toxicity, and Z2-6 *Hyalella* in Sediment, identify the approximate location of all water column and sediment toxicity tests.

When toxicity was found at sufficiently high levels, laboratory procedures were initiated to identify the cause of the toxicity in most cases. Toxicity Identification Evaluation (TIE) procedures are laboratory procedures designed for this purpose. In combination with land use information, a TIE can provide valuable guidance regarding source identification.

Not all TIEs resulted in an identification of the likely cause of toxicity. Others were effective in identifying a general class of compound that was the apparent toxicant. The general class of toxicants that caused toxicity in Zone 2 were identified by the laboratory as non-polar organics, metabolically activated organic compounds, or organophosphate pesticides, depending on the type of information obtained from TIE results. A narrower class of toxicants can be identified from more specific TIE results. Organophosphate pesticides are non-polar, metabolically activated compounds. Two specific toxicants—ammonia and chlorpyrifos (an organophosphate pesticide)—were also identified.

Examples of toxicant identification evaluated in Zone 2 are as follows:

- Monitoring site at Lone Tree Creek at Bernnan Road resulted in 0% survival for the fathead minnow and water fleas on the sample collected 27 February 2006. The TIE procedures identified ammonia was the cause of toxicity. An additional clue that could lead to source identification of the toxicant was the measured result of the pathogen indicator, *E.coli*, at greater than 1600 MPN/100ml.
- Sand Creek at Highway 4 Bypass had low survival of water flea (16%) for samples collected on 16 May 2006. This coincided with detection of chlorpyrifos at 0.089 ug/L, which is a concentration that could account for the measured toxicity. Also detected were concentrations of DDT (0.054 ug/L) and dieldrin (0.076 ug/L), which are banned pesticides. Pesticide use reports did not document any chlorpyrifos or organochlorine use upstream of the site.
- The monitoring site Bear Creek at Alpine Road had one toxicity test that resulted in 0% survival to water flea on 27 July 2005. Chlorpyrifos was detected at 0.214 ug/L. Studies available in the literature have shown that 50% or greater mortality to *Ceriodaphnia* occurs when chlorpyrifos

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exceeds concentrations in the range of 0.07 to 0.12 ug/L, which suggests that chlorpyrifos was the cause of toxicity for this sampling event.

Approved TIE procedures for sediment do not exist, and experimental techniques are still under development. However, some pesticides data were generated for samples collected through the ILP program. As part of a large study of sediment samples collected from agriculturally affected channels, University of California research has concluded that much of the observed sediment toxicity throughout Central Valley can be explained by the measured concentrations of just five relatively hydrophobic insecticides: biphenthrin, permethrin, esfenvalerate, lambda-cyhalothrin, and chlorpyrifos.

PESTICIDES. Of the 58 monitoring locations in Zone 2, 46 were tested at least once for pesticides between July 2004 and September 2006. The number and identity of pesticides analyzed in any given sample varied, based on the monitoring plans and the “phase” of sampling.

Of the 46 sites tested for pesticides in Zone 2, 28 yielded samples with pesticide concentrations greater than a water quality trigger on at least one occasion. The total number of pesticide results exceeding these triggers at a given location ranged from zero to 42. Table Z2-9, Summary of Number of Pesticide Monitoring Results Above Trigger Levels, provides this information and Figure Z2-7, Pesticide Exceedances, identifies the site and quantifies the number of pesticides detected above trigger limits

There were no detections at any monitoring site for the following constituents: aldicarb, methiocarb, methamidophos, molinate, phorate, phosmet, cyfluthrin (total), and paraquat dichloride during any of the monitoring events.

The pesticides most frequently exceeding trigger levels (with six or greater detections over trigger levels), included chlorpyrifos, diazinon, DDE, disulfoton, malathion, simazine, methyl parathion, and diuron. Table Z2-3, Summary of Pesticide Detections, details this information.

Table Z2-3 Summary of Pesticide Detections

Pesticide	Narrative Objective ug/L	Numeric Objective ug/L	Number of Tests	No. Samples Greater Than Trigger Levels	Avg. Concentration ug/L	Min. Concentration ug/L	Max. Concentration ug/L
Chlorpyrifos		0.015	347	51	0.050	0.016	0.214
Diazinon		0.10	341	34	0.368	0.117	1.180
DDE(p,p')		0.00059	218	18	0.044	0.002	0.480
Disulfoton	0.05	None	212	16	0.172	0.051	0.418
Malathion		ND	212	11	0.107	0.033	0.560
Simazine	10	4.0	205	9	18.3	4.160	41.00
Methyl Parathion	0.08	ND	212	7	0.049	0.016	0.188
Diuron	14.0	None	165	6	87.2	15.000	160.000

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The chlorpyrifos water quality trigger of 0.015 ug/L was exceeded in 51 of 347 tests in Zone 2. Twelve of these were found at Pixley Slough at Eightmile Road with an average concentration of 0.038 ug/L, and ranging between 0.016 ug/L and 0.115 ug/L. These pesticide results coincided with dormant spraying during the 2005 storm season. The Pixley Slough passes through some of the City of Lodi's urban areas. There was no recorded water column toxicity on these same sample dates.

The diazinon water quality trigger is 0.10 ug/L, a level that was exceeded 34 times. Diazinon detections greater than the trigger ranged from 0.117 ug/L to 1.18 ug/L. One third of the detections over trigger levels also occurred at Pixley Slough at Eightmile Road, coinciding with dormant spraying during the 2005 storm season.

The legacy pesticide DDT is no longer registered or legally applied to crops, but it and its degradates DDE and DDD, continue to be found in Zone 2. The Basin Plan limitation for these banned pesticides established that any detection of these constituents in the receiving water is an exceedance of the water quality objective. One third of the detections in Zone 2 for DDT and its breakdown products DDE and DDD were found at the Drain to Grant Line Canal off Wing Levee Road.

Measurements for disulfoton were compared to 0.05 ug/L, which is an interpretation of the narrative Basin Plan objective for toxicity, and is the level considered protective of aquatic life, established by the California Department of Fish & Game. Disulfoton results were 16 times higher than the trigger, and ranged in concentrations from 0.051 ug/L to 0.418 ug/L, with an average of 0.172 ug/L.

Eleven of the 16 disulfoton measurements occurred at Drain to Grant Line Canal off Wing Levee Road between the periods July 2004 and February 2005. The detections ranged in concentrations from 0.062 ug/L to 0.418 ug/L, averaging 0.203 ug/L. Four occurred at Pixley Slough at Eightmile Road, and ranged in concentrations from 0.051 ug/L to 0.130 ug/L, averaging 0.095 ug/L. The remaining one occurred at Drain to North Canal at South Bonetti Road.

Dieldrin is a persistent organochlorine pesticide, and is no longer legally applied in California. The Sacramento San Joaquin Basin Plan regards any detection of dieldrin as an exceedance of the water quality objective. Results from four monitoring sites included the presence of dieldrin between the dates of August 2004 and June 2006. These ranged in concentration from 0.008 ug/L to 0.110 ug/L.

Diuron is a broad-spectrum herbicide commonly used for weed control and was detected 32 times, ranging in concentration from 0.0035 ug/L to 160.0 ug/L. The results were compared to the water quality trigger of 14.0 ug/L, which is the USEPA IRIS reference dose for drinking water. All six detections observed

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above the trigger were encountered at drainages to Lone Tree Creek. These detections coincided with the 2005 storm season. The Lone Tree Creek subwatershed includes a diverse crop pattern including grains, hay, pasture, deciduous fruit/nut, vineyard, field crops, feedlot/dairy, and rice, with little urban influence.

Table Z2-4, Summary of Sites with Multiple Pesticide Detections over Trigger Levels, identifies five monitoring sites, out of the 33 tested, for which more than ten pesticide results measurements exceeded trigger levels during the monitoring period.

Table Z2-4
Summary of Sites with Multiple Pesticide Detections over Trigger Levels

Site Number	Monitoring Site	Chlorpyrifos	Diazinon	Other	Total No. Above Trigger Levels	No. of Unique Pesticide Exceedances
2	Bear Creek at Alpine Rd	1	5	4	10	6
16	Drain to Grant Line Canal off Wing Levee Rd.	1	2	26	29	8
20	Drain to San Joaquin River off South Manthey Rd.	7	8	4	19	6
41	Pixley Slough at Eightmile Rd	12	14	16	42	6
47	Sand Creek at Highway 4 Bypass	2	1	10	13	9

As discussed in the section on Zone 2 Water and Sediment toxicity, the Bear Creek at Alpine Road monitoring site had one toxicity test on 27 July 2005 for which the concentration of chlorpyrifos was sufficient to account for the complete mortality in water flea. The Bear Creek site had ten different pesticide measurements greater than water quality triggers for the period January 2005 through July 2005, although there were no additional tests with significant toxicity, other than 27 July 2005.

Pesticide monitoring results at the Drain to Grant Line Canal off Wing Levee Road had 29 detected pesticide results above water quality triggers between July 2004 and February 2005. During that same period, two water flea toxicity tests and one sediment toxicity test resulted in significant mortality, although the specific causes of toxicity were not identified.

Pesticide monitoring at the Drain to San Joaquin River off South Manthey Road resulted in 19 pesticide measurements above water quality triggers between July 2004 and February 2005. Toxicity testing did not occur at this site between September 2004 and February 2005.

Pesticide monitoring results at Pixley Slough at Eightmile Road showed 42 pesticide detections between August 2004 and June 2005 that exceeded water quality triggers. Toxicity test results identified only a single toxic event to algae during this same period.

Table Z2- 5, Summary of Less than 10 Pesticide Detections Over Trigger Levels, identifies 28 monitoring sites, out of the 33, for which less than ten pesticide

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results measurements exceeded trigger levels from July 2004 through October 2006.

Table Z2-5
Summary of Less than 10 Pesticide Detections over Trigger Levels

Site Number	Monitoring Site	Chlorpyrifos	Diazinon	Other	Total No. Above Trigger levels	No. of Unique Pesticides
7	Calaveras River at Pezzi Rd	0	2	3	5	3
11	Drain 12 @ French Camp Rd Headwall/Southside of RR	0	0	5	5	2
12	Drain 14 @ Lone Tree Ck (Top of Bank)	0	1	7	8	4
15	Drain to Brack Dr at Woodbridge Rd	0	0	4	4	4
17	Drain to North Canal along Bonetti Drive	0	0	4	4	4
18	Drain to North Canal at South Bonetti Rd.	3	1	5	9	7
19	Drain to Pixley Slough at Davis Rd	0	0	2	2	2
21	Duck Creek at Highway 4	2	0	0	2	1
22	French Camp Slough @ Airport Way	4	0	2	6	3
23	Grant Line Canal @ Clifton Court Rd	1	0	3	4	4
24	Grant Line Canal near Calpack Rd	4	0	2	6	3
25	Kellogg Creek @ Hwy 4	1	0	1	2	2
26	Kellogg Creek along Hoffman Ln	0	0	3	3	3
28	Littlejohns Creek @ Jacktone Rd	2	0	0	2	1
29	Lone Tree Creek @ Bernnan Rd	1	0	0	1	1
30	Lone Tree Creek @ Jacktone Rd	2	0	2	4	3
32	Marsh Creek @ Balfour Ave	1	0	1	2	2
33	Marsh Creek @ Concord Ave	0	0	2	2	2
35	Mid Roberts Island Drain at Woodsbro Road	0	0	1	1	1
38	Mormon Slough at Jack Tone Road	1	0	0	1	1
39	Mormon Slough on Jack Tone Rd	3	0	3	6	2
42	Pixley Slough at Ham Ln	1	0	0	1	1
45	Roberts Island Drain along House Road	0	0	2	2	2
46	Roberts Island Drain at Holt Road	0	0	3	3	2
49	Sweet Lateral	0	0	2	2	1
52	Tom Paine Slough at Paradise Rd.	0	0	2	2	2
55	Unnamed Drain to Lone Tree Creek at Jack	2	0	1	3	2
56	Unnamed Slough at Wildwood Rd	0	0	4	4	4

Effective 1 January 1991, the Regional Board prohibited the discharge of irrigation return flows containing the pesticides carbofuran, malathion, thiobencarb, molinate, and methyl parathion, unless the discharger is following Board approved management practices. Water Board approved management practices are associated with the use of these pesticides on rice fields represented by the California Rice Commission in the Sacramento and San Joaquin River Basins. Discharges from any other irrigated lands are prohibited in Zone 2. No rice field applications of carbofuran (no longer a rice pesticide), malathion, or methyl parathion took place in Zone 2 from 2004-2006. However, carbofuran, malathion, thiobencarb and methyl parathion were detected in Zone 2 in multiple instances throughout the monitoring period. Thiobencarb detections did not exceed the 1.5 ug/L performance goal established by the Water Board for rice fields or the 1.0 ug/L secondary MCL.

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Table Z2-6, Summary of Tests & Detections of Pesticides under Basin Plan Prohibition, summarizes the number of tests and all prohibited pesticide detections in Zone 2 for the period between July 2004 and September 2006. The location and number of detected pesticides with prohibitions are shown on Figure Z2-8, Detections of Pesticides under a Basin Plan Prohibition of Discharge.

**Table Z2-6
Summary of Detections of Pesticides under Basin Plan Prohibition**

Site Number	Monitoring Site	Data	Carbofuran	Malathion	Methyl Parathion	Molinate	Thiobencarb	Total
2	Bear Creek at Alpine Rd	Number of tests	4	13	13	13	13	56
		Number of Detections	0	1	1	0	1	3
3	Bear Creek at Harney Ln.	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
6	Calaveras River at Clements Rd.	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
7	Calaveras River at Pezzi Rd	Number of tests	4	19	19	8	8	58
		Number of Detections	0	0	2	0	0	2
10	Drain 11 @ Walsal Slough (Top of Bank)	Number of tests	0	6	6	11	7	30
		Number of Detections	0	0	0	0	0	0
11	Drain 12 @ French Camp Rd Headwall/Southside of RR	Number of tests	0	5	5	9	7	26
		Number of Detections	0	0	0	0	0	0
12	Drain 14 @ Lone Tree Ck (Top of Bank)	Number of tests	0	6	6	12	8	32
		Number of Detections	0	1	0	0	0	1
16	Drain to Grant Line Canal off Wing Levee Rd.	Number of tests	4	12	12	6	6	40
		Number of Detections	1	0	0	0	0	1
18	Drain to North Canal at South Bonetti Rd.	Number of tests	4	12	12	6	6	40
		Number of Detections	1	0	1	0	0	2
20	Drain to San Joaquin River off South Manthey Rd.	Number of tests	5	13	13	7	7	45
		Number of Detections	1	0	0	0	0	1
21	Duck Creek at Highway 4	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
22	French Camp Slough @ Airport Way	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
23	Grant Line Canal @ Clifton Court Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
24	Grant Line Canal near Calpack Rd	Number of tests	5	5	5	5	5	25

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Site Number	Monitoring Site	Data	Carbofuran	Malathion	Methyl Parathion	Molinate	Thiobencarb	Total
		Number of Detections	0	0	0	0	0	0
26	Kellogg Creek along Hoffman Ln	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
28	Littlejohns Creek @ Jacktone Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
30	Lone Tree Creek @ Jacktone Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
33	Marsh Creek @ Concord Ave	Number of tests	2	2	2	2	2	10
		Number of Detections	0	0	0	0	0	0
35	Mid Roberts Island Drain at Woodsbro Road	Number of tests	2	2	2	2	2	10
		Number of Detections	0	0	0	0	0	0
36	Mokelumne River @ Bruella Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
38	Mormon Slough at Jack Tone Road	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
39	Mormon Slough on Jack Tone Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	3	0	1	4
40	Paddy Creek at Jack Tone Rd.	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
41	Pixley Slough at Eightmile Rd	Number of tests	9	23	23	23	23	101
		Number of Detections	0	9	0	0	1	10
42	Pixley Slough at Ham Ln	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
45	Roberts Island Drain along House Road	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
46	Roberts Island Drain at Holt Road	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
47	Sand Creek at Highway 4 Bypass	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
50	Terminus Tract Drain @ Hwy 12	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
53	Unnamed Canal at Howard Road	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
54	Unnamed canal at west end of Woodbridge Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
55	Unnamed Drain to Lone Tree Creek at Jack	Number of tests	4	4	4	4	4	20

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Site Number	Monitoring Site	Data	Carbofuran	Malathion	Methyl Parathion	Molinate	Thiobencarb	Total
		Number of Detections	0	0	0	0	1	1
	Total Number of tests		133	212	212	198	188	943
	Total Number of Detections		3	11	7	0	4	25

As previously noted, carbofuran, malathion and methyl parathion were not applied to rice fields during the monitoring period; therefore, the detections presented in Table Z2-6 are associated with non-rice fields. Molinate was not detected during the monitoring period. The four thiobencarb detections were less than the performance goal of 1.5 ug/L and secondary MCL of 1.0 ug/L and would represent a violation only if associated with non-rice field applications.

The sample site at Pixley Slough at Eightmile Road had the greatest frequency of these pesticide detections, accounting for 10 (40%) out of the 25 detections found in the region. Nine out of 10 of these detections were malathion and the other was thiobencarb.

Thiobencarb is typically applied only to rice, while carbofuran is not. Malathion and methyl-parathion are applied to rice or non-rice crops. Detections of thiobencarb occurred in four out of the 188 tests conducted and were all less than the rice performance goal (1.5 ug/L) and the secondary MCL (1.0 ug/L). Detectable amounts ranged from 0.035 ug/L to 0.498 ug/L, all of which are lower than the concentration allowed under the Rice Pesticide Program (Resolution No. R5-2007-0018).

Eleven detections of malathion occurred during storm season of 2005, and ranged in concentration from 0.033 ug/L to 0.56 ug/L. Nine of these detections occurred at Pixley Slough at Eightmile Road, while single detections were observed at sample points Bear Creek at Alpine Road and Drain 14 at Lone Tree Creek. Sources of these detections have not been determined, but are under evaluation.

Detections of carbofuran occurred in three out of 133 tests ranging in concentrations from 0.015 ug/L to 0.104 ug/L. A single detection was found at the following sample points: Drain to Grant Line Canal off Wing Levee Road, Drain to North Canal at South Bonetti Road, and Drain to San Joaquin River off South Manthey Road. Sources of these detections have not been determined and are under evaluation.

Detections of methyl-parathion occurred in seven out of the 212 tests conducted. Three detections were observed at Mormon Slough on Jacktane Road, two at Calaveras River at Pezzi Road, and one each at Bear Creek at Alpine Road and Drain to North Canal at South Bonetti Road.

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METALS. Metals analyzed in Zone 2 include: arsenic, boron, cadmium, copper, lead, nickel, selenium, and zinc. The lowest water quality triggers for some metals vary depending on the water hardness (CaCO_3) at the time of sample collection. Eleven of the 23 sites sampled did not have any results for metals that were detected above trigger levels, although concentrations below trigger levels were often detected. The metals that were detected above trigger levels, are summarized in Table Z2-7, Metal Detections Above Trigger Levels.

Table Z2-7
Metal Detections Above Trigger Levels

Site Number	Monitoring Site	Data	Arsenic	Boron	Cadmium	Copper	Lead	Nickel	Selenium	Zinc	Total
2	Bear Creek at Alpine Rd	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
3	Bear Creek at Harney Ln.	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
6	Calaveras River at Clements Rd.	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
7	Calaveras River at Pezzi Rd	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
16	Drain to Grant Line Canal off Wing Levee Rd.	Number of Tests	12	13	12	12	12	12	12	12	97
		Number of Exceedances	0	0	0	0	0	0	0	0	0
18	Drain to North Canal at South Bonetti Rd.	Number of Tests	12	13	12	12	12	12	12	12	97
		Number of Exceedances	6	7	0	0	0	0	0	0	13
20	Drain to San Joaquin River off South Manthey Rd.	Number of Tests	12	12	12	12	12	12	12	12	96
		Number of Exceedances	1	0	0	0	1	0	0	0	2
22	French Camp Slough @ Airport Way	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	4	2	0	0	0	6
23	Grant Line Canal @ Clifton Court Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	2	0	0	3	3	1	0	0	9
24	Grant Line Canal near Calpack Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	2	0	0	0	0	0	0	0	2
26	Kellogg Creek along Hoffman Ln	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	0	0	0	0	0	0
28	Littlejohns Creek @ Jacktone Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	1	0	0	0	0	1
30	Lone Tree Creek @ Jacktone Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	1	0	0	0	0	1
33	Marsh Creek @ Concord Ave	Number of Tests	2	2	2	2	2	2	2	2	16
		Number of Exceedances	0	2	0	1	0	0	0	0	3

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Site Number	Monitoring Site	Data	Arsenic	Boron	Cadmium	Copper	Lead	Nickel	Selenium	Zinc	Total
35	Mid Roberts Island Drain at Woodsbro Road	Number of Tests	2	2	2	2	2	2	2	2	16
		Number of Exceedances	0	0	0	0	0	0	0	0	0
36	Mokelumne River @ Bruella Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	0	0	0	0	0	0
39	Mormon Slough on Jack Tone Rd	Number of Tests	5	6	5	5	5	5	5	5	41
		Number of Exceedances	0	0	0	0	0	0	0	0	0
40	Paddy Creek at Jack Tone Rd.	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
41	Pixley Slough at Eightmile Rd	Number of Tests	23	23	23	23	23	23	23	23	184
		Number of Exceedances	0	0	0	8	20	0	0	4	32
42	Pixley Slough at Ham Ln	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	3	0	0	0	3
50	Terminus Tract Drain @ Hwy 12	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	1	0	0	0	0	0	0	0	1
53	Unnamed Canal at Howard Road	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
54	Unnamed canal at west end of Woodbridge Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	5	0	0	0	0	0	0	0	5
	Total Number of Tests		141	144	141	141	141	141	141	141	1131
	Total Number of Exceedances		17	9	0	18	29	1	0	4	78

There were 1,131 total test results for metals conducted in Zone 2. Of these results, 78 or 7% exceeded limits. There were 144 samples analyzed for boron during the monitoring period, and 141 samples analyzed for each of the other metals. There were no detections for either cadmium or selenium observed above trigger levels in any of the samples.

The metal that exceeded trigger levels most frequently was lead, with 37% of the detections above trigger levels. Following lead, the percentages of samples exceeding trigger levels for other metals were: copper (23%), arsenic (22%), boron (12%), zinc (5%), and nickel (1%). The sources of these metals concentrations are not identified.

Agricultural applications of copper, in the form of copper hydroxide or copper sulfate, are common in nut and stone fruit orchards, grape crops, tomato, rice, alfalfa, and onion fields to control mildew/fungi. These types of commodities are widespread in the French Camp Slough, Lone Tree Creek, Littlejohns Creek, Pixley Slough and Grant Line Canal areas. Copper detections above trigger levels may be in part the result of agricultural copper applications, as well as other sources.

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Pixley Slough at Eightmile Road, which had the highest number of pesticide detections over trigger levels, also had more metals detections above trigger levels (lead, copper, zinc) than any other site. Toxicity tests results identified a single toxicity test result with significant toxicity.

PATHOGENS. *E.coli* is an indicator pathogen, and results are compared to the USEPA Recommended Criteria of 235 MPN/100 mL in Zone 2. It is not yet clear what sources contribute to the *E.coli* in program samples. A special study is currently being conducted by UC Davis in order to help identify possible sources. The study is scheduled for completion this year.

Monitoring took place at 23 sites throughout Zone 2, varying from one to 16 tests per site. A total of 98 out of 195 tests showed levels above the 235 MPN/100 mL. It is worth noting that 39% of these 98 tests were at or above 1600 MPN/100 mL.

The water bodies with the least number *E.coli* above the trigger level were tested for at least a year or more. These include the following sites: Delta Drain-Terminus Tract off Guard Road, Kellogg Creek along Hoffman Lane, Littlejohns Creek @ Jacktone Road, and Mokelumne River @ Bruella Road. Table Z2-8, Summary of *E. coli* Test Results, provides information about the number of tests collected at each monitoring site and the number that exceeded the USEPA Recommended criteria of 235 MPN/100ml.

Table Z2-8
Summary of *E.coli* Test Results

Site No.	Monitoring Site ID	Total No. of Tests	No. of Tests Less than 235 MPN/100 ml	No. of Tests Greater than 235 MPN/100 ml
5	Calaveras River @ Belota Intake	2	2	0
8	Delta Drain- Terminus Tract off Glascock Rd	9	5	4
9	Delta Drain- Terminus Tract off Guard Rd	8	6	2
21	Duck Creek at Highway 4	7	5	2
22	French Camp Slough @ Airport Way	14	3	11
23	Grant Line Canal @ Clifton Court Rd	14	3	11
24	Grant Line Canal near Calpack Rd	14	4	10
25	Kellogg Creek @ Hwy 4	9	4	5
26	Kellogg Creek along Hoffman Ln	8	5	3
28	Littlejohns Creek @ Jacktone Rd	16	11	5
29	Lone Tree Creek @ Bernnan Rd	3	0	3
30	Lone Tree Creek @ Jacktone Rd	16	2	14
32	Marsh Creek @ Balfour Ave	9	1	8
33	Marsh Creek @ Concord Ave	5	1	4
36	Mokelumne River @ Bruella Rd	11	11	0
37	Mokelumne River @ Fish Hatchery	1	1	0

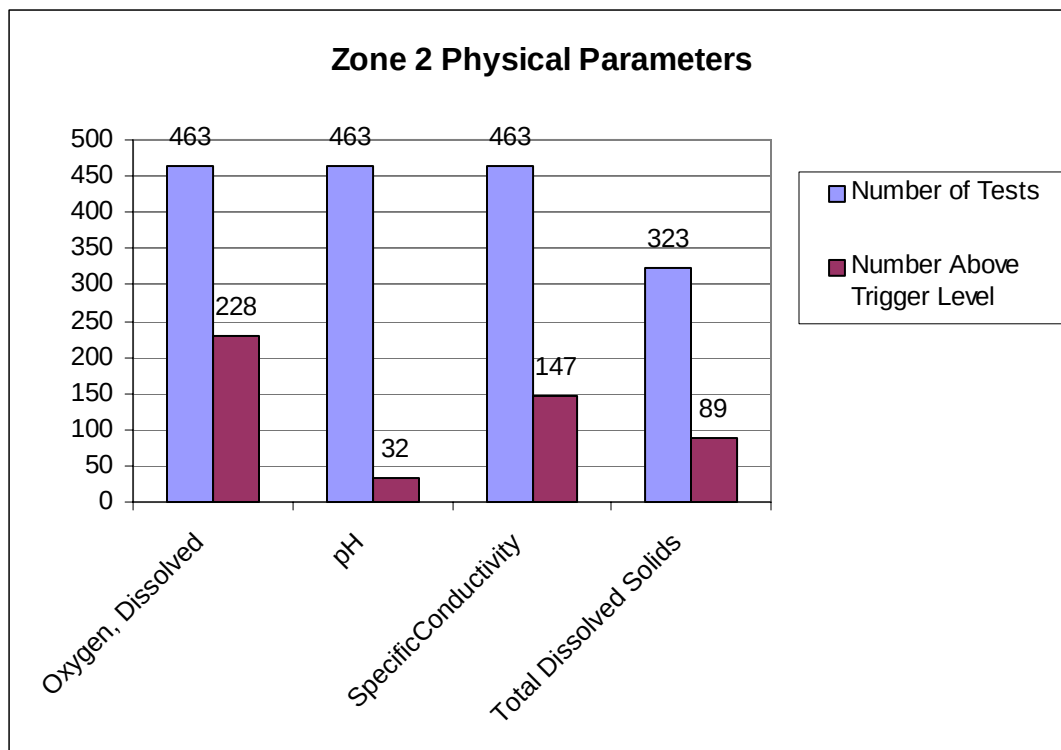
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38	Mormon Slough at Jack Tone Road	5	5	0
43	Potato Slough @ Hwy 12	11	11	0
45	Roberts Island Drain along House Road	5	1	4
46	Roberts Island Drain at Holt Road	5	4	1
47	Sand Creek at Highway 4 Bypass	5	0	5
50	Terminus Tract Drain @ Hwy 12	14	9	5
55	Unnamed Drain to Lone Tree Creek at Jack	4	3	1
Totals		195	97	98

Monitoring results from four sites had 10 or more results above 235 MPN/100 mL for the pathogen indicator. These sites were Lone Tree Creek at Jacktone Road, Grant Line Canal at Clifton Court, Grant Line Canal at Calpack Road, and French Camp Slough at Airport Way.

PHYSICAL PARAMETERS. Physical parameters discussed here include dissolved oxygen (DO), pH, electrical conductivity (EC), and total dissolved solids (TDS). Participants conducted an average of 31 tests across all physical parameters at 54 monitoring points. With the exception of TDS, testing occurred 463 times for each physical parameter. TDS testing occurred 323 times. Figure Z2-9, Zone 2 Physical Parameters summarizes this monitoring.

Figure Z2-9



Interpretation of DO and pH results is difficult because these parameters can change over short time frames due to variables such as ambient temperature, photosynthesis, flow/turbulence, and atmospheric conditions. Consequently,

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additional study and investigation is necessary to determine the cause and severity of the measurement outside water quality triggers.

Total dissolved solids (TDS) is a measurement of mineral salts dissolved in water. Identifying elevated TDS sources within Zone 2 is currently under evaluation and an EC/TDS study is currently under development.

Data Gaps

Baseline water quality conditions cannot be evaluated in Zone 2 sub-areas of the western Delta area, such as the Delta islands and tracts, due to lack of availability of monitoring data for this program.

Many sample points represent a large section of agricultural land, which cannot provide accurate information regarding waste concentrations from the upper reaches of the subwatersheds.

The effort to identify monitoring sites that are representative of agriculture is a challenge in Zone 2. For example, urban development has encroached near sample sites Marsh Creek at Balfour and Kellogg Creek at Highway 4. Consequently, these monitoring sites were moved from their original position to avoid urban influence. The Sand Creek at Highway 4 site is also being investigated for urban influence. Data obtained thus far are inconclusive because the origin of a drainage to Sand Creek from a nearby culvert is unknown at this time.

Zone 2 Summary

Some observations are made regarding water quality data collected in Zone 2, as follows:

The greatest percentage (33%) of toxicity events to the number of tests in Zone 2 occurs to the species *Hyalella azteca*, which serves as an indicator of sediment toxicity. Twelve of the 52 monitoring sites (23%) exhibited sediment toxicity at one time or another. In general, monitoring sites west of the San Joaquin River had the greatest toxicity to *Hyalella* located mostly in the lower reaches of the sub-watersheds.

Pimephales promelas (fathead minnow) had the least toxic frequency (3%) as a percentage to the number of tests in the Zone, although 17% of the individual monitoring sites in Zone 2 exhibited fathead minnow toxicity at one time or another. Observed minnow toxicity is mostly limited to the drains in the Delta with the exception of the Lone Tree Creek, Marsh Creek, and Sand Creek sub-watershed monitoring points.

Toxicity to *Ceriodaphnia dubia* (water flea) and *Selenastrum capricornutum* (algae) were almost equal at 8% and 9% comparing the number of toxic events vs. the number of tests. Twenty-three percent (15 out of 52) of the monitoring sites indicated toxicity to both species at least one time.

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The incidence of pesticides observed above the trigger level varies from constituent to constituent. The most common pesticides ranked in order as observed above the water quality triggers are: chlorpyrifos, diazinon, disulfoton, DDE, malathion, DDT, simazine, methyl parathion, dieldrin, and diuron.

The sample site No. 41 at Pixley Slough at Eightmile Road had the greatest frequency of prohibited pesticide detections, accounting for 10 (40%) out of the 25 detections found in the region. Nine out of 10 detections were malathion. Pixley Slough at Eightmile Road also had more detections above trigger levels for lead, copper and zinc than any other Zone 2 monitoring site.

Site No. 20 (Drain to San Joaquin River off South Manthey Road) experienced frequent chlorpyrifos and diazinon exceedances (7 and 8 times, respectively). All results were from the 2005 storm season. Detected concentrations of chlorpyrifos ranged from 0.018 ug/L to 0.072 ug/L, and detected concentrations of diazinon ranged from 0.226 ug/L to 0.728 ug/L. No toxicity samples were collected at the time the pesticide exceedances were observed.

Site No. 47 (Sand Creek at Highway 4 Bypass) experienced toxicity to water flea, fathead minnow and sediment toxicity a total of six times, with four of these results at 0% survival. The TIE tests conducted found that organophosphates were the source of toxicity to water flea and fathead minnow, suggesting that chlorpyrifos may have been the cause. Although two exceedances of chlorpyrifos were observed, it is notable that PURs have not documented any chlorpyrifos use in this subwatershed.

The frequency of salinity, in excess of water quality triggers measured as electrical conductivity, predominates in the Delta drain areas and in areas where receiving waters receive Delta water. Four of the 54 monitoring sites where specific conductance was tested exhibited 36% of all the occurrences above the trigger level. These monitoring points: Terminus Tract off Guard Road, Grant Line Canal near Calpack Road, Drain to Grant Line Canal off Wing Levee Road, and Drain to North Canal at South Bonetti Road occupy Delta drain areas.

Management plans are under development for Zone 2 to address water quality issues such as toxicity and pesticides, and future monitoring data reviews will attempt to evaluate the effectiveness of the Management Plans.

The tables below, Z2-9 through Z2-11 summarize the number of data results that were greater than water quality triggers.

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Table Z2-9

Summary of Pesticide Monitoring Results Above Trigger Levels

Site Number	Monitoring Site	Azinphos methyl	Bifenthrin	Carbaryl	Carbofuran	Chlorpyrifos	Cyhalothrin, lambda, total	Cypermethrin, total	DDD(p,p')	DDE(p,p')	DDT(p,p')	Diazinon	Dieldrin	Dimethoate	Disulfoton	Diuron	Endrin	Esfenvalerate/Fenvalerate, total	Linuron	Malathion	Methomyl	Methyl Parathion	Permethrin, total	Permethrin-1	Permethrin-2	Simazine	Total
1	8 Mile and Rio Blanco Rds.																										0
2	Bear Creek at Alpine Rd	1				1						5		1						1		1					10
3	Bear Creek at Harney Ln.																										0
4	Beaver Slough at Blossom Rd.																										0
5	Calaveras River @ Belota Intake																										0
6	Calaveras River at Clements Rd.																										0
7	Calaveras River at Pezzi Rd	1										2										2					5
8	Delta Drain-Terminus Tract off Glascock Rd																										0
9	Delta Drain-Terminus Tract off Guard Rd																										0
10	Drain 11 @ Walsal Slough (Top of Bank)																										0
11	Drain 12 @ French Camp Rd Headwall/Southside of RR															1										4	5
12	Drain 14 @ Lone Tree Ck (Top of Bank)											1				3				1						3	8
13	Drain at Bowman Rd.																										0
14	Drain at Wing Levee Road																										0
15	Drain to Brack Dr at Woodbridge Rd								1	1	1		1														4
16	Drain to Grant Line Canal off Wing Levee Rd.					1	1		1	9	2	2	2		11												29
17	Drain to North Canal along Bonetti Drive								1	1	1							1									4
18	Drain to North Canal at South Bonetti Rd.					1	3					1			1							1		1	1		9
19	Drain to Pixley Slough at Davis Rd									1	1																2
20	Drain to San Joaquin River off South Manthey Rd.					1	7			1		8												1	1		19
21	Duck Creek at Highway 4					2																					2
22	French Camp Slough @ Airport Way	1				4	1																				6
23	Grant Line Canal @ Clifton Court Rd					1				1				1				1									4
24	Grant Line Canal near Calpack Rd					4				1									1								6
25	Kellogg Creek @ Hwy 4					1																	1				2
26	Kellogg Creek along Hoffman Ln									1	1						1										3

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Site Number	Monitoring Site	Azinphos methyl	Bifenthrin	Carbaryl	Carbofuran	Chlorpyrifos	Cyhalothrin, lambda, total	Cypermethrin, total	DDD(p,p')	DDE(p,p')	DDT(p,p')	Diazinon	Dieldrin	Dimethoate	Disulfoton	Diuron	Endrin	Esfenvalerate/Fenvalerate, total	Linuron	Malathion	Methomyl	Methyl Parathion	Permethrin, total	Permethrin-1	Permethrin-2	Simazine	Total
27	Little John Creek at Newcastle Rd.																										0
28	Littlejohns Creek @ Jacktone Rd					2																					2
29	Lone Tree Creek @ Bernnan Rd					1																					1
30	Lone Tree Creek @ Jacktone Rd					2	1	1																			4
31	Lone Tree Creek at Newcastle Rd.																										0
32	Marsh Creek @ Balfour Ave					1																1					2
33	Marsh Creek @ Concord Ave								1	1																	2
34	Marsh Creek @ Marsh Creek Rd																										0
35	Mid Roberts Island Drain at Woodsbro Road													1													1
36	Mokelumne River @ Bruella Rd																										0
37	Mokelumne River @ Fish Hatchery																										0
38	Mormon Slough at Jack Tone Road					1																					1
39	Mormon Slough on Jack Tone Rd					3															3						6
40	Paddy Creek at Jack Tone Rd.																										0
41	Pixley Slough at Eightmile Rd		1		12						14			4					9						2		42
42	Pixley Slough at Ham Ln				1																						1
43	Potato Slough @ Hwy 12																										0
44	Return Irrigation Drain at MCD Rd.																										0
45	Roberts Island Drain along House Road					1			1																		2
46	Roberts Island Drain at Holt Road					2			1																		3
47	Sand Creek at Highway 4 Bypass	1			2	1			2	2	1	2				1				1							13
48	SJR Source Water to Canal at Holt and Nueger Roads																										0
49	Sweet Lateral														2												2
50	Terminus Tract Drain @ Hwy 12																										0
51	Tom Paine Slough at El Rancho Rd.																										0
52	Tom Paine Slough at Paradise Rd.								1	1																	2
53	Unnamed Canal at Howard Road																										0
54	Unnamed canal at west end of Woodbridge Rd																										0

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Site Number	Monitoring Site	Azinphos methyl	Bifenthrin	Carbaryl	Carbofuran	Chlorpyrifos	Cyhalothrin, lambda, total	Cypermethrin, total	DDD(p,p')	DDE(p,p')	DDT(p,p')	Diazinon	Dieldrin	Dimethoate	Disulfoton	Diuron	Endrin	Esfenvalerate/Fenvalerate, total	Linuron	Malathion	Methomyl	Methyl Parathion	Permethrin, total	Permethrin-1	Permethrin-2	Simazine	Total
55	Unnamed Drain to Lone Tree Creek at Jack				2				1																		3
56	Unnamed Slough at Wildwood Rd							1	1	1		1															4
57	Unnamed Slough at Woodsbro Rd. and Burns cutoff Levee																										0
58	Upstream Kellogg Creek @ Hoffman Ln																										0
	Grand Total	3	1	1	3	51	6	1	4	24	11	34	6	3	16	6	2	2	1	11	1	7	2	2	2	9	209

**Table Z2-10
Summary of Metals, Toxicity and Other Parameters with Monitoring Results
Above Trigger Levels**

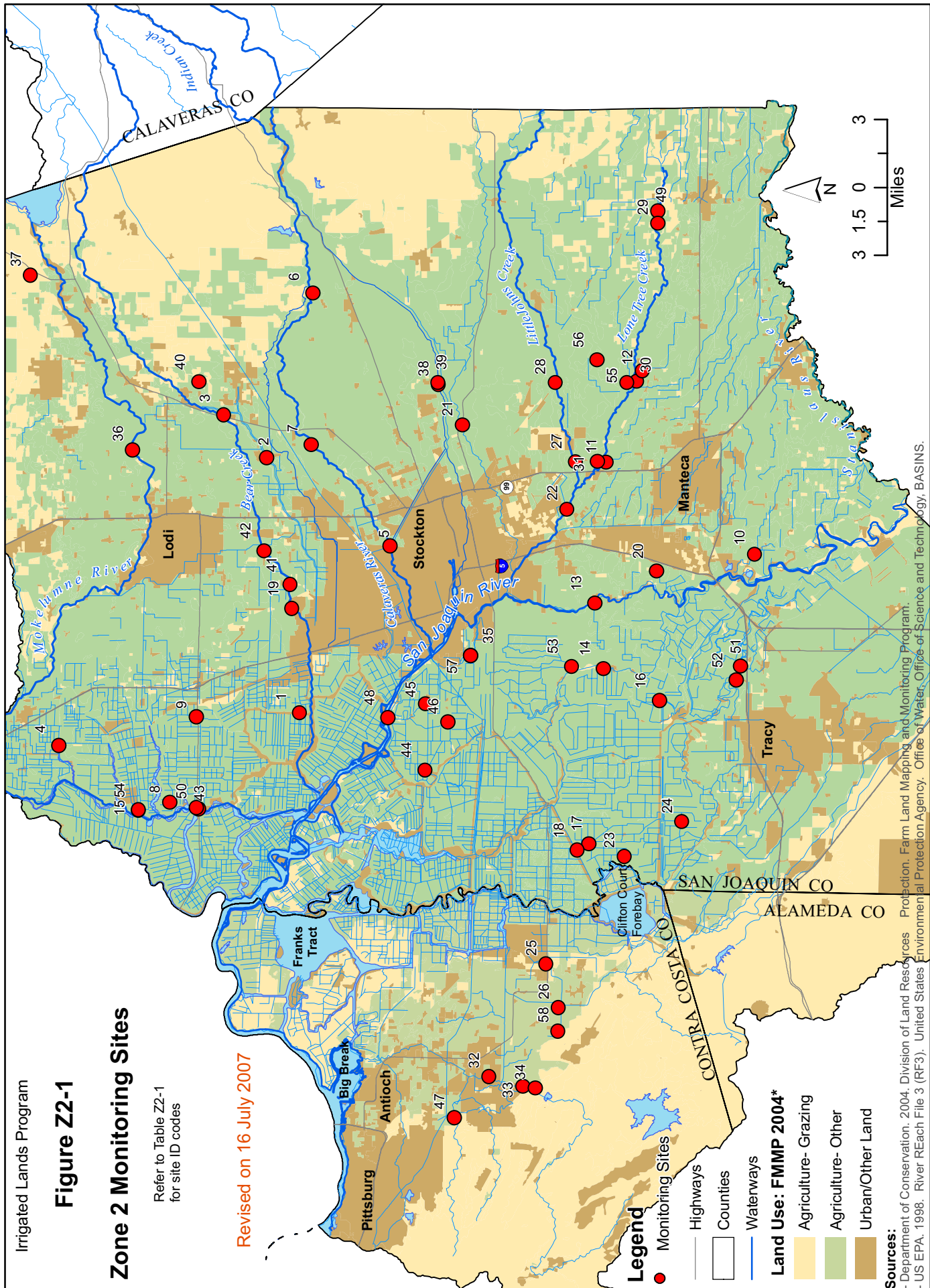
Site Number	Monitoring Site	E. coli	Total Dissolved Solids	Oxygen, Dissolved	pH	Specific Conductivity	Zinc, Total	Arsenic, Total	Boron, Total	Copper, Total	Lead, Total	Nickel, Total	Ceriodaphnia dubia	Pinophales promelas	Selenastrum capricornutum	Hyalella azteca	Total
		General Parameters				Metals					Toxicity						
1	8 Mile and Rio Blanco Rds.			3		1											4
2	Bear Creek at Alpine Rd			4									1				5
3	Bear Creek at Harney Ln.			3	2												5
4	Beaver Slough at Blossom Rd.			1													1
5	Calaveras River @ Belota Intake																0
6	Calaveras River at Clements Rd.			2													2
7	Calaveras River at Pezzi Rd			2	2								1		3	1	9
8	Delta Drain- Terminous Tract off Glascock Rd	4	4	8		4								1		2	23
9	Delta Drain- Terminous Tract off Guard Rd	2	7	7		10									1	1	28
10	Drain 11 @ Walsal Slough (Top of Bank)																0
11	Drain 12 @ French Camp Rd Headwall/Southside of RR																0
12	Drain 14 @ Lone Tree Ck (Top of Bank)																0
13	Drain at Bowman Rd.			3		4											7

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Site Number	Monitoring Site	E. coli	Total Dissolved Solids	Oxygen, Dissolved	pH	Specific Conductivity	Zinc, Total	Arsenic, Total	Boron, Total	Copper, Total	Lead, Total	Nickel, Total	Ceriodaphnia dubia	Pimephales promelas	Selenastrum capricornutum	Hyalella azteca	Total
		General Parameters				Metals						Toxicity					
14	Drain at Wing Levee Road			5		6											11
15	Drain to Brack Dr at Woodbridge Rd																0
16	Drain to Grant Line Canal off Wing Levee Rd.		12	11		14							2			1	40
17	Drain to North Canal along Bonetti Drive			1													1
18	Drain to North Canal at South Bonetti Rd.		12	11		13		6	7								49
19	Drain to Pixley Slough at Davis Rd			1													1
20	Drain to San Joaquin River off South Manthey Rd.		6	8		8		1			1						24
21	Duck Creek at Highway 4	2		3	2								1				8
22	French Camp Slough @ Airport Way	11		6	1					4	2		1		1	1	27
23	Grant Line Canal @ Clifton Court Rd	11	5	11	4	5		2		3	3	1				2	47
24	Grant Line Canal near Calpack Rd	10	10	15		16		2					3		1	4	61
25	Kellogg Creek @ Hwy 4	5	5	3	1	8							1	2	1	2	28
26	Kellogg Creek along Hoffman Ln	3	2	3	1	3							1				13
27	Little John Creek at Newcastle Rd.			2	1	1							1				5
28	Littlejohns Creek @ Jacktone Rd	5		6	2					1				1	2		17
29	Lone Tree Creek @ Bernnan Rd	3	1	2		1							1	1	3		12
30	Lone Tree Creek @ Jacktone Rd	14		11	2					1				1	2	2	33
31	Lone Tree Creek at Newcastle Rd.			5	1								1				7
32	Marsh Creek @ Balfour Ave	8	5	3	1	7							2			4	30
33	Marsh Creek @ Concord Ave	4	2		2	3			2	1				1			15
34	Marsh Creek @ Marsh Creek Rd																0
35	Mid Roberts Island Drain at Woodsbro Road		2	3	1	2											8
36	Mokelumne River @ Bruella Rd			4	2								5		3		14
37	Mokelumne River @ Fish Hatchery			1													1
38	Mormon Slough at Jack Tone Road			3													3
39	Mormon Slough on Jack Tone Rd				1										5		6
40	Paddy Creek at Jack Tone Rd.			4													4
41	Pixley Slough at Eightmile Rd			11			4			8	20				1		44

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Site Number	Monitoring Site	E. coli	Total Dissolved Solids	Oxygen, Dissolved	pH	Specific Conductivity	Zinc, Total	Arsenic, Total	Boron, Total	Copper, Total	Lead, Total	Nickel, Total	Ceriodaphnia dubia	Pimephales promelas	Selenastrum capricornutum	Hyalella azteca	Total
		General Parameters					Metals					Toxicity					
42	Pixley Slough at Ham Ln			1						3							4
43	Potato Slough @ Hwy 12			1	1	1							3				6
44	Return Irrigation Drain at MCD Rd.			3	1	5											9
45	Roberts Island Drain along House Road	4	4	5	3	2											18
46	Roberts Island Drain at Holt Road	1	1	5		3										2	12
47	Sand Creek at Highway 4 Bypass	5	4	7		6							3	1		2	28
48	SJR Source Water to Canal at Holt and Nueger Roads			7										2			9
49	Sweet Lateral			4	1												5
50	Terminus Tract Drain @ Hwy 12	5	5	10		7		1						1	2		31
51	Tom Paine Slough at El Rancho Rd.			4		4											8
52	Tom Paine Slough at Paradise Rd.																0
53	Unnamed Canal at Howard Road			2													2
54	Unnamed canal at west end of Woodbridge Rd		2	4		3		5									14
55	Unnamed Drain to Lone Tree Creek at Jack	1		2													3
56	Unnamed Slough at Wildwood Rd																0
57	Unnamed Slough at Woodsbro Rd. and Burns cutoff Levee			7		9											16
58	Upstream Kellogg Creek @ Hoffman Ln					1											1
	Total	98	89	228	32	147	4	17	9	18	29	1	27	11	25	24	759



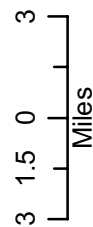


Figure Z2-4 Toxicity to *Ceriodaphnia dubia*

Revised on 16 July 2007

Legend

of Toxic Water Flea Tests

Ratio = Toxic / Total tests

○ 0 Toxic Samples

● 1 Toxic Sample

● 2 - 3 Toxic Samples

● 4 - 5 Toxic Samples

● 6 - 10 Toxic Samples

● 11 - 20 Toxic Samples

● 21 - 30 Toxic Samples

● 31 - 40 Toxic Samples

● 41 - 50 Toxic Samples

● 51 - 60 Toxic Samples

● 61 - 70 Toxic Samples

● 71 - 80 Toxic Samples

● 81 - 90 Toxic Samples

● 91 - 100 Toxic Samples

● 101 - 110 Toxic Samples

● 111 - 120 Toxic Samples

● 121 - 130 Toxic Samples

● 131 - 140 Toxic Samples

● 141 - 150 Toxic Samples

● 151 - 160 Toxic Samples

● 161 - 170 Toxic Samples

● 171 - 180 Toxic Samples

● 181 - 190 Toxic Samples

● 191 - 200 Toxic Samples

● 201 - 210 Toxic Samples

● 211 - 220 Toxic Samples

● 221 - 230 Toxic Samples

● 231 - 240 Toxic Samples

● 241 - 250 Toxic Samples

● 251 - 260 Toxic Samples

● 261 - 270 Toxic Samples

● 271 - 280 Toxic Samples

● 281 - 290 Toxic Samples

● 291 - 300 Toxic Samples

● 301 - 310 Toxic Samples

● 311 - 320 Toxic Samples

● 321 - 330 Toxic Samples

● 331 - 340 Toxic Samples

● 341 - 350 Toxic Samples

● 351 - 360 Toxic Samples

● 361 - 370 Toxic Samples

● 371 - 380 Toxic Samples

● 381 - 390 Toxic Samples

● 391 - 400 Toxic Samples

● 401 - 410 Toxic Samples

● 411 - 420 Toxic Samples

● 421 - 430 Toxic Samples

● 431 - 440 Toxic Samples

● 441 - 450 Toxic Samples

● 451 - 460 Toxic Samples

● 461 - 470 Toxic Samples

● 471 - 480 Toxic Samples

● 481 - 490 Toxic Samples

● 491 - 500 Toxic Samples

● 501 - 510 Toxic Samples

● 511 - 520 Toxic Samples

● 521 - 530 Toxic Samples

● 531 - 540 Toxic Samples

● 541 - 550 Toxic Samples

● 551 - 560 Toxic Samples

● 561 - 570 Toxic Samples

● 571 - 580 Toxic Samples

● 581 - 590 Toxic Samples

● 591 - 600 Toxic Samples

● 601 - 610 Toxic Samples

● 611 - 620 Toxic Samples

● 621 - 630 Toxic Samples

● 631 - 640 Toxic Samples

● 641 - 650 Toxic Samples

● 651 - 660 Toxic Samples

● 661 - 670 Toxic Samples

● 671 - 680 Toxic Samples

● 681 - 690 Toxic Samples

● 691 - 700 Toxic Samples

● 701 - 710 Toxic Samples

● 711 - 720 Toxic Samples

● 721 - 730 Toxic Samples

● 731 - 740 Toxic Samples

● 741 - 750 Toxic Samples

● 751 - 760 Toxic Samples

● 761 - 770 Toxic Samples

● 771 - 780 Toxic Samples

● 781 - 790 Toxic Samples

● 791 - 800 Toxic Samples

● 801 - 810 Toxic Samples

● 811 - 820 Toxic Samples

● 821 - 830 Toxic Samples

● 831 - 840 Toxic Samples

● 841 - 850 Toxic Samples

● 851 - 860 Toxic Samples

● 861 - 870 Toxic Samples

● 871 - 880 Toxic Samples

● 881 - 890 Toxic Samples

● 891 - 900 Toxic Samples

● 901 - 910 Toxic Samples

● 911 - 920 Toxic Samples

● 921 - 930 Toxic Samples

● 931 - 940 Toxic Samples

● 941 - 950 Toxic Samples

● 951 - 960 Toxic Samples

● 961 - 970 Toxic Samples

● 971 - 980 Toxic Samples

● 981 - 990 Toxic Samples

● 991 - 1000 Toxic Samples

Land Use: FMMP 2004*

Agriculture- Grazing

Agriculture- Other

Urban/Other Land

Highways

Counties

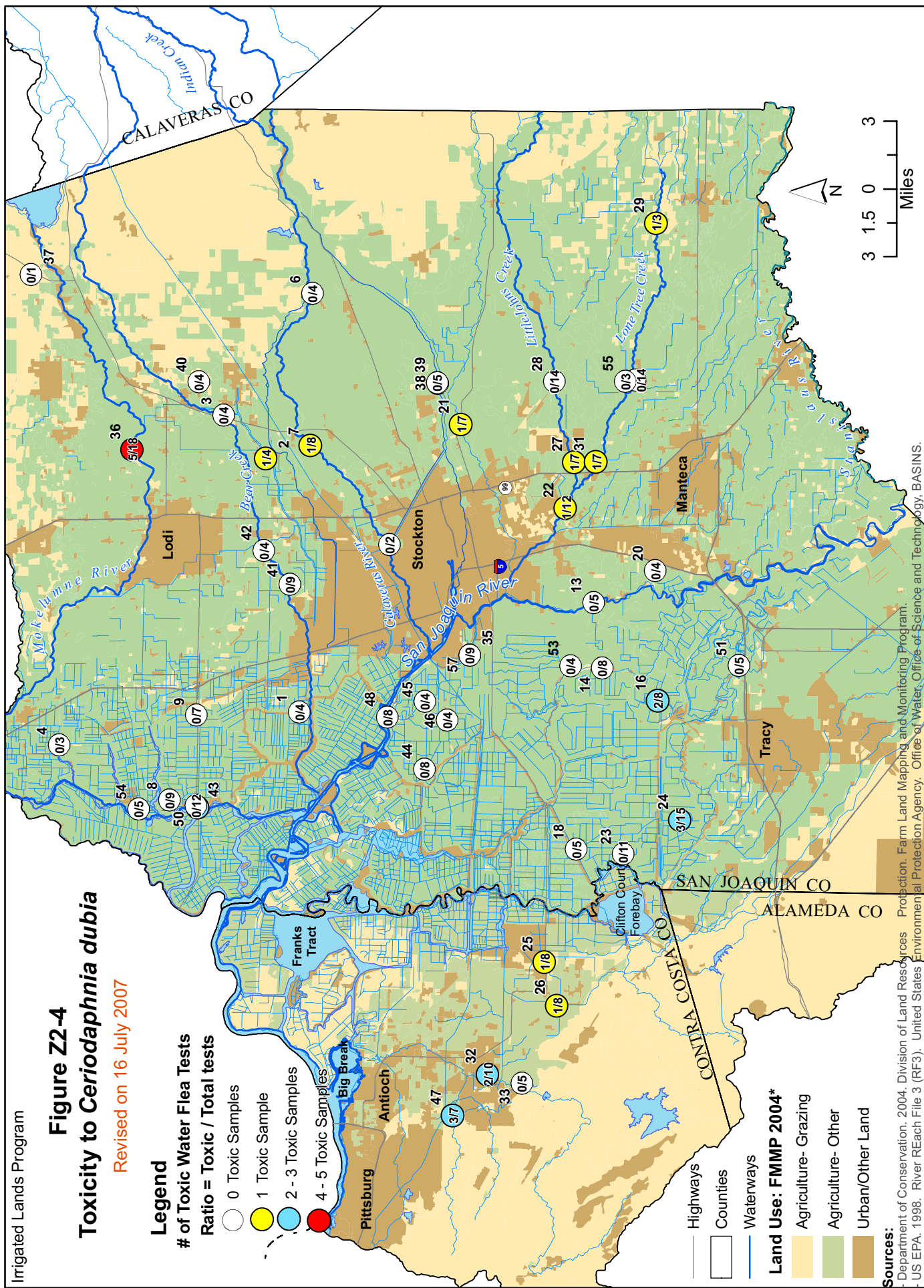
Waterways

Sources:

- Department of Conservation, 2004. Division of Land Resources

- US EPA, 1998. River Reach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

3 1.5 0 3
Miles



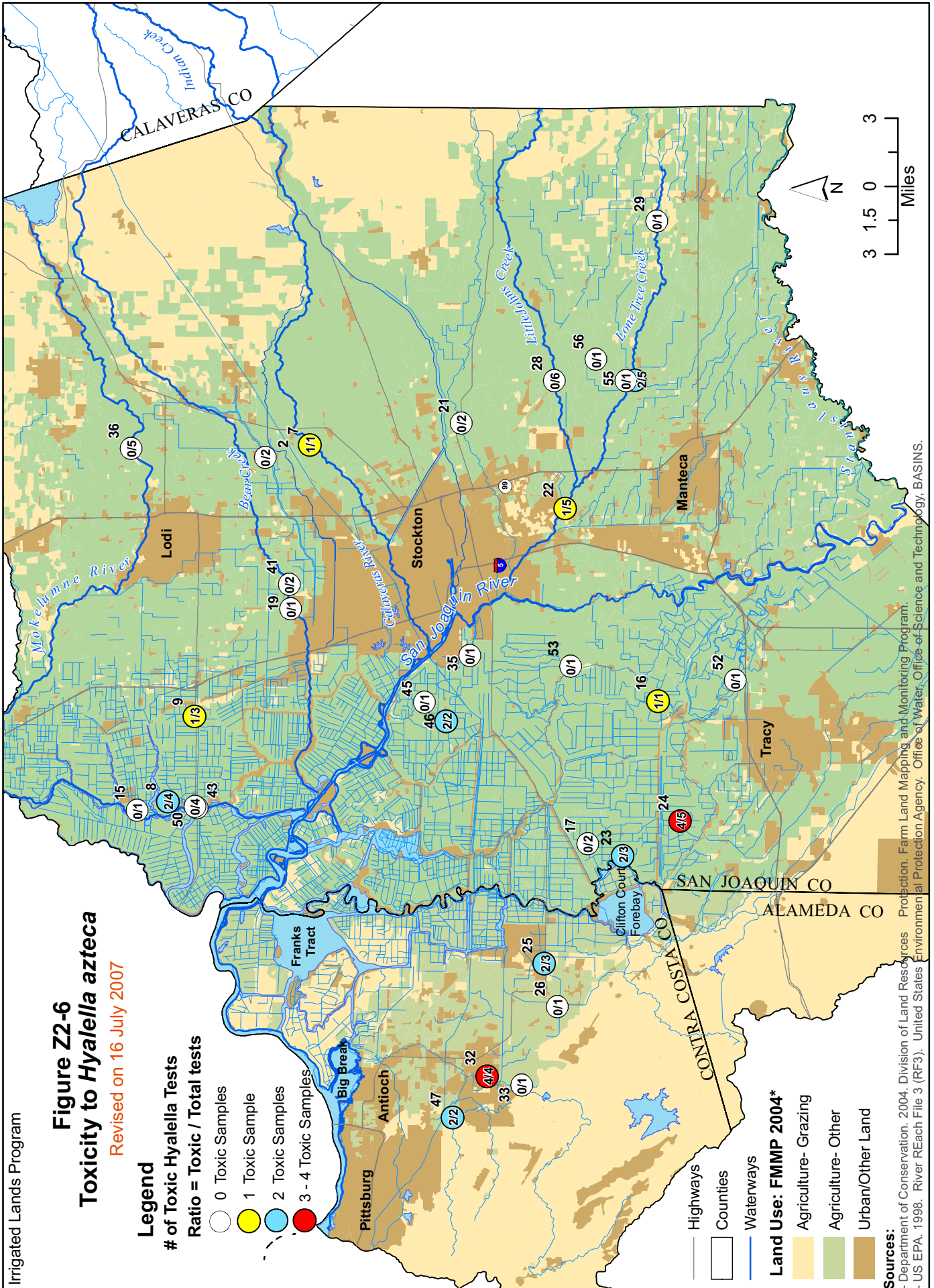
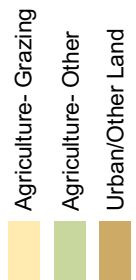
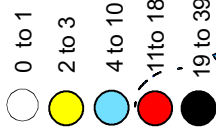


Figure Z2-7 Monitoring Results for Pesticides

Revised on 16 July 2007

Legend

Number of Pesticide Detects Over Trigger Limits
Ratio = Detects / Total Pesticide Tests



Sources:

- Department of Conservation, 2004. Division of Land Resources
- US EPA, 1998. River Reach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

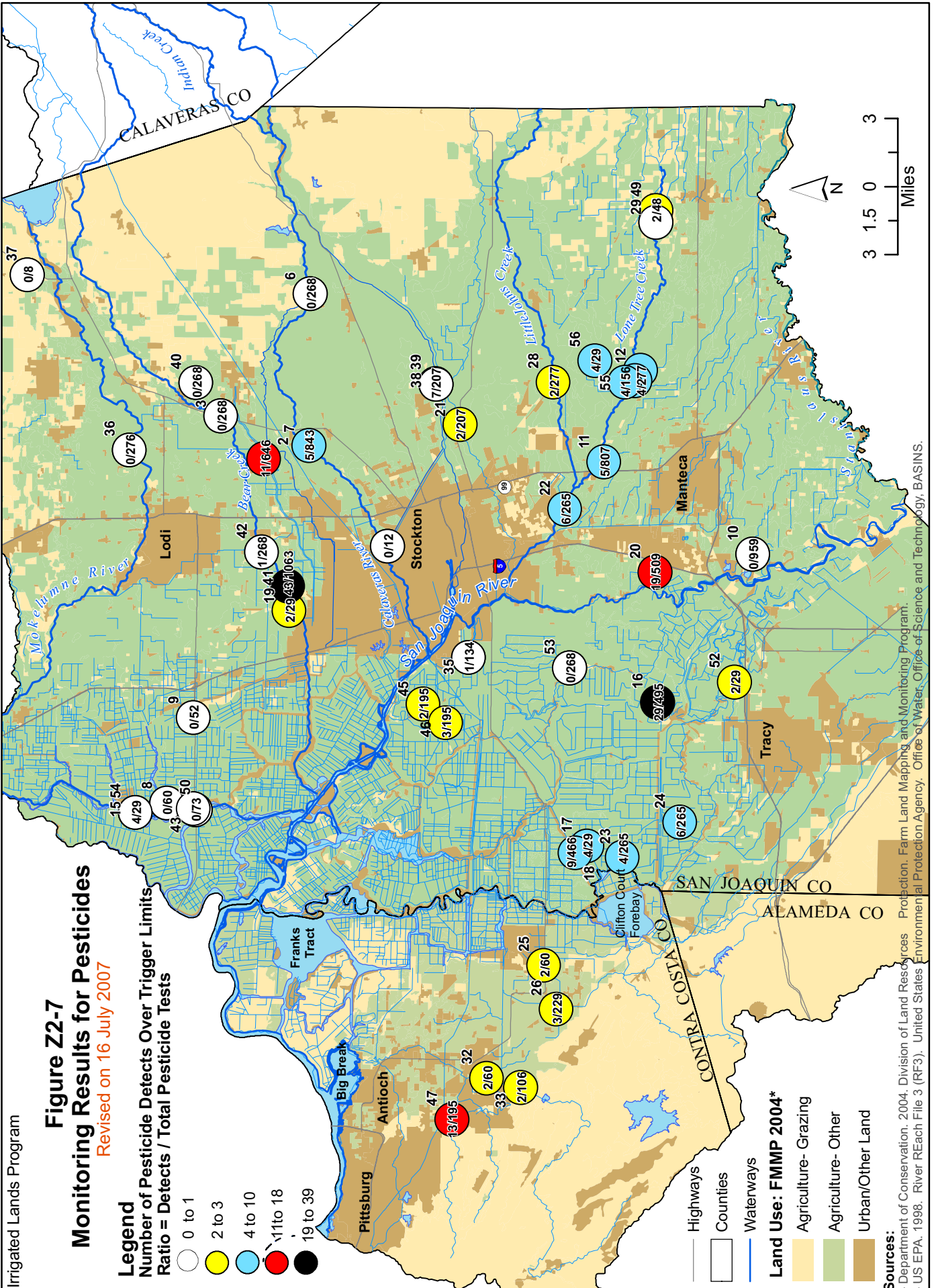


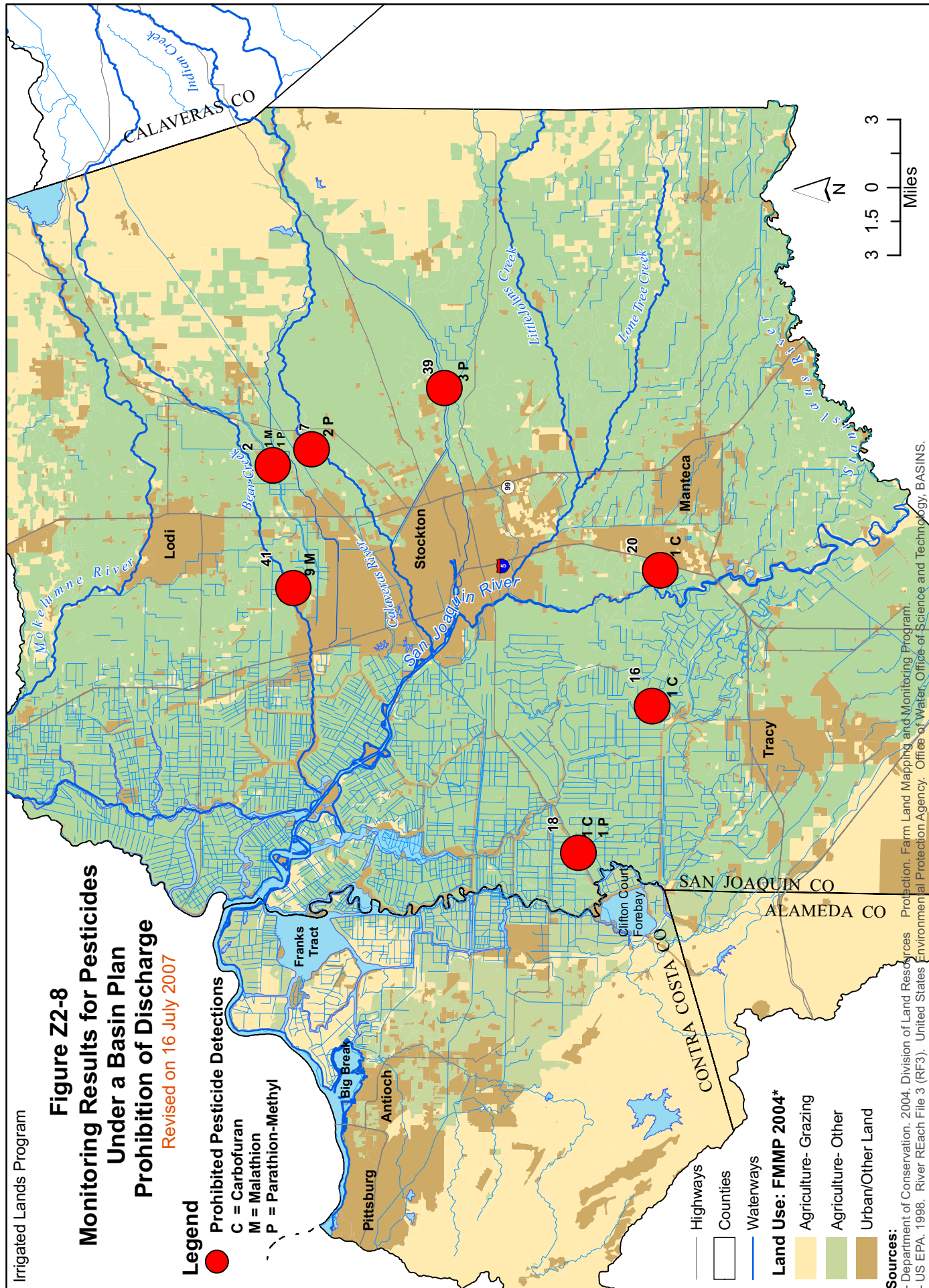
Figure Z2-8 **Monitoring Results for Pesticides** **Under a Basin Plan** **Prohibition of Discharge** Revised on 16 July 2007

Legend

- Prohibited Pesticide Detections
- C = Carbofuran
- M = Malathion
- P = Parathion-Methyl

- Highways
- Counties
- Waterways
- Land Use: FMMP 2004***
- Agriculture- Grazing
- Agriculture- Other
- Urban/Other Land

Sources:
 - Department of Conservation, 2004. Division of Land Resources
 - US EPA, 1998. River Reach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.



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ZONE 3

Zone 3 Description

Zone 3 is essentially the San Joaquin River Drainage. It includes the irrigated lands within the geographic areas represented by the East San Joaquin Water Quality Coalition, the Westside San Joaquin River Watershed Coalition, and the San Luis Water District Watershed Coalition.

Pesticide Use information for Zone 3 is summarized in Appendix B. The Appendix lists the primary crops by acreage that were grown in 2005 sorted by county. The Appendix also references a selection of the types and quantity of pesticides that are recorded as being used for these crops (Department of Pesticide Regulation for 2005).

The summary presented here includes data collected between March 2003 and September 2006. In all, data collected from 81 different sampling locations within Zone 3 are included in the summary. Approximate location of sampling sites are shown on Figure Z3-1, Zone 3 Monitoring Locations. Monitoring site identification and tests that were conducted at each site are provided in Table Z3-1, Monitoring Site Identification and Samples Collected.

Table Z3-1
Monitoring Site Identification and Samples Collected

Site ID	Site Name	Physical Parameters	Toxicity	Pesticides	Metals	Bacteria	Nutrients
1	Ash Slough at Ave 21	6/14/05 - 9/12/06	6/14/05 - 9/12/06	6/14/05 - 9/12/06	5/16/06 - 9/12/06	6/14/05 - 9/12/06	5/16/06 - 9/12/06
2	August Rd Drain u/s Crows Landing Bridge	7/31/04 - 9/29/04	7/31/04 - 9/29/04	7/31/04 - 9/29/04	None	7/31/04 - 9/29/04	None
3	Bear Ck at Kiby Rd	3/21/05 - 9/12/06	3/21/05 - 9/12/06	3/21/05 - 9/12/06	5/17/06 - 9/12/06	3/21/05 - 9/12/06	5/17/06 - 9/12/06
4	Berenda Slough at Dairyland Rd	5/16/06 - 9/21/06	5/16/06 - 9/21/06	5/16/06 - 9/12/06	None	5/16/06 - 9/12/06	None
5	Black Rascal Ck at Yosemite Rd	5/18/06 - 9/12/06	5/18/06 - 9/12/06	5/18/06 - 9/12/06	None	5/18/06 - 9/12/06	None
6	Cottonwood Ck at Rd 20	2/16/05 - 9/12/06	2/16/05 - 9/12/06	2/16/05 - 9/12/06	5/16/06 - 9/12/06	2/16/05 - 9/12/06	5/16/06 - 9/12/06
7	Deadman Ck at Hwy 59	5/17/06 - 9/12/06	5/17/06 - 9/12/06	5/17/06 - 9/12/06	None	5/17/06 - 9/12/06	None
8	Deadman Ck at Gurr Rd	7/31/04 - 9/12/06	7/31/04 - 9/12/06	7/31/04 - 9/12/06	5/17/06 - 9/12/06	7/31/04 - 9/12/06	5/17/06 - 9/12/06
9	Dry Ck at Wellsford Rd	2/15/05 - 9/21/06	2/15/05 - 9/21/06	2/15/05 - 9/14/06	5/18/06 - 9/14/06	2/15/05 - 9/14/06	5/18/06 - 9/14/06
10	Dry Ck at Rd 18	8/16/05 - 9/12/06	8/16/05 - 9/12/06	8/16/05 - 9/12/06	5/16/06 - 9/12/06	8/16/05 - 9/12/06	5/16/06 - 9/12/06
11	Duck Slough at Gurr Rd	7/31/04 - 9/13/06	7/31/04 - 9/13/06	7/31/04 - 9/13/06	5/17/06 - 9/13/06	7/31/04 - 9/13/06	5/17/06 - 9/13/06
12	Duck Slough at Hwy 99	2/16/05 - 9/13/06	2/16/05 - 9/13/06	2/16/05 - 9/13/06	5/17/06 - 9/13/06	2/16/05 - 9/13/06	5/17/06 - 9/13/06
13	Highline Canal at Hwy 99	5/10/05 - 9/21/06	5/10/05 - 9/21/06	5/10/05 - 9/13/06	5/17/06 - 9/13/06	5/10/05 - 9/13/06	5/17/06 - 9/13/06
14	Highline Canal at Lombardy Ave	2/15/05 - 9/21/06	2/15/05 - 9/21/06	2/15/05 - 9/13/06	5/17/06 - 9/13/06	2/15/05 - 9/13/06	5/17/06 - 9/13/06
15	Hilmar Drain at Central Ave	2/15/05 - 9/14/06	2/15/05 - 9/14/06	2/15/05 - 9/14/06	5/18/06 - 9/14/06	2/15/05 - 9/14/06	5/18/06 - 9/14/06
16	Jones Drain at Oakdale Rd	2/16/05 - 9/13/06	2/16/05 - 9/13/06	2/16/05 - 9/13/06	5/17/06 - 9/13/06	2/16/05 - 9/13/06	5/17/06 - 9/13/06
17	Lone Willow Slough at Madera Ave	2/16/05 - 9/12/05	2/16/05 - 7/12/05	2/16/05 - 7/12/05	None	2/16/05 - 7/12/05	None
18	Merced River at Sante Fe Ave	7/31/04 - 9/13/06	7/31/04 - 9/13/06	7/31/04 - 9/13/06	5/16/06 - 9/13/06	7/31/04 - 3/16/06	5/16/06 - 9/13/06
19	Mustang Ck at East Ave	5/18/06 - 9/14/06	5/18/06 - 8/10/06	5/18/06 - 8/10/06	None	5/18/06 - 8/10/06	None
20	Prairie Flower Drain at Crows Landing Rd	2/15/05 - 9/14/06	2/15/05 - 9/14/06	2/15/05 - 9/14/06	5/18/06 - 9/14/06	2/15/05 - 9/14/06	5/18/06 - 9/14/06
21	Silva Drain at Meadow	5/18/06 - 9/13/06	5/18/06 - 9/13/06	5/18/06 - 9/13/06	None	5/18/06 - 9/13/06	7/13/06

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Site ID	Site Name	Physical Parameters	Toxicity	Pesticides	Metals	Bacteria	Nutrients
	Dr						
22	South Slough at Quinley Rd	7/11/06 - 9/12/06	7/11/06 - 8/9/06	7/11/06 - 8/9/06	None	7/11/06 - 8/9/06	None
23	Hospital Ck at River Rd	7/6/04 - 10/10/06	7/6/04 - 9/11/06	7/6/04 - 8/8/06	7/11/06 - 10/10/06	7/6/04 - 10/10/06	7/11/06 - 10/10/06
24	Ingram Ck at River Rd	7/6/04 - 10/10/06	7/6/04 - 9/11/06	7/6/04 - 8/8/06	7/11/06 - 10/10/06	7/6/04 - 10/10/06	7/11/06 - 10/10/06
25	Westley Wasteway nr Cox Rd	7/6/04 - 10/10/06	7/6/04 - 9/11/06	7/6/04 - 8/8/06	8/8/06 - 10/10/06	7/6/04 - 10/10/06	8/8/06 - 10/10/06
26	Del Puerto Ck nr Cox Rd	7/6/04 - 10/10/06	7/6/04 - 9/11/06	7/6/04 - 8/8/06	7/11/06 - 10/10/06	7/6/04 - 10/10/06	7/11/06 - 10/10/06
27	Del Puerto Ck at Hwy 33	7/6/04 - 10/10/06	7/6/04 - 9/11/06	7/6/04 - 8/8/06	7/11/06 - 10/10/06	7/6/04 - 10/10/06	7/11/06 - 10/10/06
28	Salado Ck nr Olive Ave	7/6/04 - 3/14/06	7/6/04 - 8/10/04	7/6/04 - 8/10/04	None	7/6/04 - 10/12/04	None
29	Ramona Lake nr Fig Ave	7/6/04 - 10/10/06	7/6/04 - 8/8/06	7/6/04 - 8/8/06	8/8/06 - 10/10/06	7/6/04 - 10/10/06	8/8/06 - 10/10/06
30	Marshall Rd Drain nr River Rd	7/6/04 - 10/10/06	7/6/04 - 8/8/06	6/13/06 - 8/8/06	7/11/06 - 10/10/06	7/6/04 - 10/10/06	7/11/06 - 10/10/06
31	Orestimba Ck at River Rd	7/6/04 - 10/10/06	7/6/04 - 9/11/06	7/6/04 - 8/9/06	7/11/06 - 10/10/06	7/6/04 - 10/10/06	7/11/06 - 10/10/06
32	Orestimba Ck at Hwy 33	7/6/04 - 10/10/06	7/6/04 - 9/11/06	7/6/04 - 8/9/06	7/11/06 - 10/10/06	7/6/04 - 10/10/06	7/11/06 - 10/10/06
33	Newman Wasteway nr Hills Ferry Rd	7/13/04 - 10/10/06	7/13/04 - 9/11/06	7/13/04 - 8/8/06	7/11/06 - 10/10/06	8/10/04 - 10/10/06	7/11/06 - 10/10/06
34	SJR at Sack Dam	7/13/04 - 10/10/06	None	7/13/04 - 2/15/05	None	None	None
35	SJR at Lander Ave	7/13/04 - 10/10/06	7/13/04 - 10/10/06	7/13/04 - 4/11/06	7/11/06 - 10/10/06	8/10/04 - 10/10/06	7/11/06 - 10/10/06
36	Mud Slough u/s of San Luis Drain	7/13/04 - 10/10/06	7/13/04 - 10/10/06	7/13/04 - 10/10/06	7/11/06 - 10/10/06	8/10/04 - 10/10/06	7/11/06 - 10/10/06
37	Salt Slough at Lander Ave	7/13/04 - 10/10/06	7/13/04 - 10/10/06	7/13/04 - 10/10/06	7/11/06 - 10/10/06	8/10/04 - 10/10/06	7/11/06 - 10/10/06
38	Salt Slough at Sand Dam	7/13/04 - 10/10/06	7/13/04 - 9/11/06	7/13/04 - 8/8/06	7/11/06 - 10/10/06	8/10/04 - 10/10/06	7/11/06 - 10/10/06
39	Los Banos Ck at Hwy 140	7/13/04 - 10/10/06	7/13/04 - 10/10/06	7/13/04 - 10/10/06	7/11/06 - 10/10/06	8/10/04 - 10/10/06	7/11/06 - 10/10/06
40	Los Banos Ck at China Camp Rd	7/13/04 - 9/11/06	9/13/04 - 3/13/06	12/29/04 - 4/11/06	None	11/9/04 - 1/11/05	None
41	Turner Slough nr Edminster Rd	7/13/04 - 10/10/06	9/13/04 - 9/11/06	3/8/05 - 4/11/06	7/11/06 - 10/10/06	11/9/04 - 10/10/06	7/11/06 - 10/10/06
42	Westley Wasteway at Refuge Ponds	8/9/05	8/9/05	8/9/05	None	8/9/05	None
43	SJR at WSID Pumps	8/9/05	8/9/05	8/9/05	None	8/9/05	None
44	Delta Mendota Canal at DPWD	8/9/05	8/9/05	8/9/05	None	8/9/05	None
45	Little Panoche Ck at Hwy 5	3/17/06	3/17/06	None	None	3/17/06	None
46	Russell Ave Drain at San Luis Canal	3/17/06	3/17/06	None	None	3/17/06	None
47	Boundary Drain at Henry Miller Ave	6/22/05 - 8/20/05	6/22/05 - 8/20/05	6/22/05 - 8/3/05	6/22/05 - 8/3/05	None	6/22/05 - 8/3/05
48	Hospital Ck at Hwy 33	8/27/04	8/27/04	8/27/04	None	None	None
49	Island Field Drain at Catrina Rd	8/27/04 - 8/20/05	8/27/04 - 8/20/05	8/27/04 - 8/3/05	6/22/05 - 8/3/05	None	6/22/05 - 8/3/05
50	Orestimba Ck at Kilburn Rd	7/15/04 - 4/12/05	7/15/04 - 4/12/05	7/15/04 - 9/9/04	7/15/04 - 9/9/04	None	7/15/04 - 9/9/04
51	Poso Drain at NE corner Turner Island & Palazzo Rd	7/15/04 - 9/9/04	7/15/04 - 9/9/04	7/15/04 - 9/9/04	7/15/04 - 9/9/04	None	7/15/04 - 9/9/04
52	Unnamed Drain at Pomelo Ave near Paradise Ave	3/26/03 - 9/23/03	3/26/03 - 9/23/03	None	None	None	None
53	Westport Drain at Jennings Rd.	3/26/03 - 9/23/03	3/26/03 - 9/23/03	None	None	None	None
54	Berenda Ck at Ave 17.5 west of Madera	1/27/05 - 8/20/05	1/27/05 - 8/20/05	1/27/05 - 8/3/05	6/22/05 - 8/3/05	None	1/27/05 - 8/3/05
55	Cottonwood Ck at Hwy 145	7/22/04 - 8/17/04	7/22/04 - 8/17/04	7/22/04 - 8/17/04	8/3/04 - 8/17/04	None	7/22/04 - 8/17/04
56	Dry Ck at J9	7/20/04 - 9/15/04	7/20/04 - 9/15/04	7/20/04 - 9/15/04	7/20/04 - 9/15/04	None	7/20/04 - 9/15/04

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Site ID	Site Name	Physical Parameters	Toxicity	Pesticides	Metals	Bacteria	Nutrients
57	Duck Slough at Arboleda Dr	7/20/04 - 4/12/05	7/20/04 - 4/12/05	7/20/04 - 2/4/05	7/20/04 - 2/4/05	None	7/20/04 - 2/4/05
58	Ingalsbe Slough at J17	7/20/04 - 9/15/04	7/20/04 - 9/15/04	7/20/04 - 9/15/04	7/20/04 - 9/15/04	None	7/20/04 - 9/15/04
59	Owens Ck at Gurr Rd	6/22/05 - 8/20/05	6/22/05 - 8/20/05	6/22/05 - 8/3/05	6/22/05 - 8/3/05	None	6/22/05 - 8/3/05
60	Sand Slough on Turner Island Rd w of Merced NWR	8/27/04	8/27/04	8/27/04	None	None	None
61	Stevinson Lower Lat at Faith Home Rd	7/15/04 - 9/9/04	7/15/04 - 9/9/04	7/15/04 - 7/29/04	7/15/04 - 9/9/04	None	7/15/04 - 9/9/04
62	Casebeer Lat Exten at Deadman Ck	7/14/04 - 10/25/05	None	7/14/04 - 10/25/05	7/14/04 - 10/5/04	None	7/14/04 - 10/25/05
63	El Nido Canal Spill to Chowchilla Slough	7/15/04 - 3/2/06	None	7/15/04 - 3/2/06	None	None	7/15/04 - 3/2/06
64	El Nido Dam on Mariposa Ck	7/14/04 - 3/2/06	None	7/14/04 - 3/2/06	None	None	7/14/04 - 3/2/06
65	Fancher Lat at Head	7/15/04 - 10/25/05	None	7/15/04 - 10/25/05	None	None	7/15/04 - 10/25/05
66	Livingston Canal Spill to Merced R	10/5/04 - 3/2/06	None	10/5/04 - 3/2/06	10/5/04	None	10/5/04 - 3/2/06
67	Livingston Drain	7/12/04 - 10/25/05	None	7/12/04 - 10/25/05	7/12/04 - 10/5/04	None	7/12/04 - 10/25/05
68	North Side Canal at Spill to Merced R	7/12/04 - 3/2/06	None	7/12/04 - 3/2/06	7/12/04 - 10/5/04	None	7/12/04 - 3/2/06
69	Puglizevich Dam on Miles and Owen Cks	7/14/04 - 3/2/06	None	7/14/04 - 3/2/06	None	None	7/14/04 - 3/2/06
70	Jacobson Drain	7/6/04 - 3/2/06	None	7/6/04 - 3/2/06	None	None	7/6/04 - 3/2/06
71	Lat 1 Spill	7/6/04 - 3/2/06	None	7/6/04 - 3/2/06	None	None	7/6/04 - 3/2/06
72	Lat 5 Spill	7/6/04 - 3/2/06	None	7/6/04 - 3/2/06	None	None	7/6/04 - 3/2/06
73	Lat 6 Spill	7/6/04 - 3/2/06	None	7/6/04 - 3/2/06	None	None	7/6/04 - 3/2/06
74	Main Drain Spill	7/6/04 - 3/2/06	None	7/6/04 - 3/2/06	None	None	7/6/04 - 3/2/06
75	Spenker Spill	1/8/05 - 3/2/06	None	1/8/05 - 3/2/06	None	None	1/8/05 - 3/2/06
76	Waterford LM Spill	7/6/04 - 3/2/06	None	7/6/04 - 3/2/06	None	None	7/6/04 - 3/2/06
77	Coulter Pond	6/23/04 - 1/22/06	None	6/23/04 - 1/22/06	None	None	6/23/04 - 1/22/06
78	Langworth Pipeline	6/23/04 - 1/22/06	None	6/23/04 - 1/22/06	None	None	6/23/04 - 1/22/06
79	Highline Spill	7/14/04 - 9/28/05	None	7/14/04 - 9/28/05	None	None	7/14/04 - 9/28/05
80	Lat 5 1/2 Drop 23 (Lower Spill)	1/13/05 - 2/27/06	None	1/13/05 - 2/27/06	None	None	1/13/05 - 2/27/06
81	Lower Lat 2 1/2 Spill	7/14/04 - 3/2/06	None	7/14/04 - 3/2/06	None	None	7/14/04 - 3/2/06
82	Poso Slough at Hudson	3/25/05 - 11/20/05	3/25/05 - 11/20/05	None	None	None	None
83	Holland Drain at Hudson	3/25/05 - 8/20/05	3/25/05 - 8/20/05	None	None	None	None

Monitoring Data. Data summaries for the identified general categories are described below. Each section includes a discussion of the frequency of detection and the magnitude of detected constituent measurements, along with notable trends or characteristics pertaining to the results. The summaries include an evaluation of results that exceeded or may have exceeded numeric or narrative water quality objectives. The location or spatial distribution of particular types or ranges of results have been emphasized in some cases, where evaluation of this information is considered critical.

AQUATIC AND SEDIMENT TOXICITY. Information regarding the monitoring results of the three species water column toxicity tests and the one species sediment toxicity test is described below.

Pimephales promelas (Fathead Minnow). Based on the number of toxicity tests conducted within the reference period, toxicity to fathead minnow is relatively infrequent

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in Zone 3. Out of 588 samples analyzed for minnow toxicity only 2.2% (or 13 tests) resulted in reduced survival in the 96-hour test. However, the number of individual monitoring sites that exhibited fathead minnow toxicity at least one time during the three year period was 11 sites, which is 18.9% of the total number of monitoring sites in Zone 3.

A review of chemistry results generally supports these toxicity data. The highest observed concentration of chlorpyrifos in a Zone 3 sample was 2.2 ug/L, which is 22 times the level expected to be toxic to *Ceriodaphnia*, but approximately 1/50th the concentration expected to be toxic to minnows. Other constituents, such as ammonia, were likewise generally below concentrations that would be expected to cause significant mortality to minnows (in non-toxic samples).

It should be noted that only two of the 13 minnow-toxic samples caused more than 50% mortality. For those two samples, mortality reached 60% at Los Banos Creek at China Camp Road, and 92% at Prairie Flower Drain at Crows Landing Road. The sample that exhibited 92% mortality also contained an ammonia concentration of 18 mg/L. All other ammonia measurements in Zone 3 were less than 3.6 mg/L, and many were below the detection limit of 0.04 mg/L. The LC50 (Lethal Concentration for 50% mortality) for ammonia to fathead minnows is in the range of 5.9 to 8.2 mg/L, indicating that ammonia was the likely cause of toxicity in the Prairie Flow Drain sample.

The toxicology lab which conducted these analyses made observations of the presence of fungal coronas on fish. This was described as an indicator that the mortality in some minnow-toxic samples was due to pathogens that may have originated in the sample water, or in control fish cultures. Pathogens to fish are a concern, as are pathogens to humans. There are many unknowns about these observations, including that the presence of any pathogen has not been verified. If a pathogen in the laboratory minnow contributed to minnow mortality, it is not known if the pathogen resulted from pollutants in the field samples, or if it was already present in the laboratory minnow. The minnow that were tested in the field sample water were compared to the minnow in the laboratory water, according to test requirements. Further studies need to be conducted to determine if the cause of mortality was caused by agriculture drainage waters.

Toxicity to fathead minnow in Zone 3 monitoring is typically mid-range in magnitude (generally 10 to 65% mortality). TIEs were not performed on samples with less than 50% mortality, which includes most samples that exhibited significant toxicity within Zone 3. One sample contained a toxic level of ammonia, and possible sources of ammonia include animal waste and fertilizers. No other correlations have been drawn between observed toxicity to fathead minnows and likely impacts from discharges from irrigated lands within Zone 3. This is due, in part, to the limited number of samples that exceeded 50% mortality. Figure Z3-2, Toxicity to *Pimephales promelas*, identifies the approximate location of minnow tests, both with toxicity and without.

Ceriodaphnia dubia (Water flea). Toxicity to water flea has been observed in 61 of 597 samples in Zone 3 (10.2%). Out of the 58 different monitoring sites, 34 exhibited toxicity to water flea at least one time, or 59% of the monitoring sites. Complete

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mortality of 100% was frequent (36 of the 61 toxic samples) and the magnitude of the observed toxicity was as high as 22 toxic units.

Toxicity Identification Evaluations were performed in most cases where mortality exceeded 50% in the field samples. For samples with less than 50% mortality, TIEs were not performed. TIEs that were conducted often indicated non-polar organics as contributing to (or as the only cause of) toxicity, and sometimes showed that metabolically activated substances were responsible. Most insecticides are non-polar organic compounds, and many organophosphate insecticides (e.g. chlorpyrifos, diazinon) are metabolically activated poisons. The TIE information that identified metabolically activated non-polar organics, combined with pesticide use information in Zone 3 strongly point to organophosphate insecticides as the cause of the toxicity. In samples where both toxicity and some pesticides were analyzed, the concentrations of detected pesticides were compared to the level of toxicity and the established lethal concentration of the detected pesticides, if such data were available in the literature.

Three organophosphate insecticide compounds (chlorpyrifos, diazinon and methyl parathion) were found to exceed concentrations expected to be toxic to *Ceriodaphnia* in a portion of the samples that exhibited *Ceriodaphnia* toxicity. Bailey, et al. (1997), determined *Ceriodaphnia* 48-hour LC50 concentrations for chlorpyrifos (ranging from 0.058 to 0.079 ug/L) and for diazinon (ranging from 0.26 to 0.58 ug/L), (*Joint Acute Toxicity of Diazinon and Chlorpyrifos to Ceriodaphnia dubia*, Bailey, H.C., Journal of Environmental and Toxicological Chemistry, 1997). The California Department of Fish & Game (2000) developed *Ceriodaphnia* genus mean acute values for chlorpyrifos (at 0.06 ug/L) and diazinon (at 0.44 ug/L), (*Water Quality Criteria for Diazinon and Chlorpyrifos*, California Department of Fish and Game, Office of Spill Prevention and Response, 2000). Using these references, conservative benchmarks of 0.1 ug/L for chlorpyrifos and 0.5 ug/L for diazinon were selected to compare to measured concentrations of these compounds (when available) in samples that were toxic to *Ceriodaphnia* and to determine their potential to have contributed to the observed toxicity. Forty-nine of the Zone 3 samples that were toxic to *Ceriodaphnia* were also analyzed for chlorpyrifos, and in 19 of those 49 (39%), chlorpyrifos was detected above 0.1 ug/L, indicating a likely cause and effect relationship. Additionally, diazinon exceeded 0.5 ug/L in 4 toxic samples, indicating that diazinon was a likely cause, or contributor to, toxicity in those samples. Similarly, a methyl parathion *Ceriodaphnia* 48-hour LC50 of 2.1 ug/L and a 7-day lowest observed effect concentration (LOEC) of 1.37 ug/L were established by Norberg-King et al. (*Application of Toxicity Identification Evaluation Procedures to the Ambient Waters of the Colusa Basin Drain, California*, Norberg-King, T.J., Journal of Environmental and Toxicological Chemistry, 1991). Methyl parathion exceeded 1 ug/L in two *Ceriodaphnia*-toxic samples, indicating that methyl parathion was likely to have contributed to toxicity in those two samples.

Other pesticides that were detected at least once in *Ceriodaphnia*-toxic Zone 3 samples included: the insecticides dimethoate, dicofol, disulfoton, malathion, methomyl, DDT, DDE, dieldrin, and methidathion; and the herbicides atrazine, cyanazine, simazine, thiobencarb, pendamethalin (Prowl), and trifluralin. These compounds were not observed at levels above known LC50 concentrations for *Ceriodaphnia* (where such data exist), but it is possible that they may have contributed to observed toxicity through

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additive effects, especially in samples for which non-polar organics were determined to be the primary cause of toxicity.

Water bodies with two or more incidents of toxicity to *Ceriodaphnia* include the following: Bear Creek at Kibby Rd. (2 of 12 tests); Dry Creek at Wellsford Rd. (2 of 15 tests); Duck Slough at Gurr Rd. (3 of 18 tests); Highline Canal at Highway 99 (4 of 14 tests); Highline Canal at Lombardy Rd. (2 of 15 tests); Merced River at Santa Fe (3 of 18 tests); Hospital Creek at River Road (2 of 14 tests); Ramona Lake near Fig Ave. (2 of 10 tests); Orestimba Creek at River Road (3 of 19 tests); Orestimba Creek at Highway 33 (6 of 19 tests); Salt Slough at Lander Ave. (3 of 31 tests); Salt Slough at Sand Dam (3 of 19 tests); Los Banos Creek at Highway 140 (2 of 29 tests); Island Field Drain at Katrina Road (3 of 4 tests); and Berenda Creek at Ave. 17.5 (2 of 7 tests).

The measured concentrations of just three compounds (chlorpyrifos, diazinon, and methyl parathion) can potentially account for at least half of all the observed *Ceriodaphnia* toxicity, based on actual measured concentrations of the pesticides. These same pesticides may have caused additional toxicity in samples where these constituents were not analyzed. These insecticides are used on a variety of crops including alfalfa, orchards, and row crops. *Ceriodaphnia* toxicity was not limited to a specific area or watershed in Zone 3. The approximate locations of water flea toxicity tests with toxicity and without toxicity are presented in Figure Z3-3, Toxicity to *Ceriodaphnia dubia*.

Selenastrum capricornutum (Algal species). Toxicity to the algae test species was observed in a total of 8.5% of all samples (45 of 529) collected within Zone 3. The total number of monitoring sites that were tested for algae toxicity showed that 43% of the 56 sample sites showed algae toxicity on at least one occasion. The approximate locations of algae toxicity tests with toxicity and without toxicity are presented in Figure Z3-4, Toxicity to *Selenastrum capricornutum*.

TIEs for algae-toxic samples have indicated non-polar organics as the cause of (or contributor to) toxicity in some cases, but several TIEs conducted within Zone 3 have also shown that a treatment removing non-polar organics and a separate treatment to remove divalent cationic metals both improved algal growth in the same toxic sample. This indicates a possibility that in some cases, more than one toxicant, or an organo-metal compound is present.

Correlations between observed algae toxicity and detected (measured) metals and pesticides in algae-toxic samples have not been firmly established. Monitoring results suggest possible toxicity to algae from the herbicide simazine. During a December 2004 storm-sampling event, algae toxicity was determined to be present at four monitoring locations (Del Puerto Creek, Ingram Creek, Hospital Creek and Newman Wasteway). All four re-samples contained simazine. The concentrations of simazine in the toxic samples ranged from 2.2 to 7.7 ug/L. Simazine was also found to be present in other algae-toxic samples. However, no conclusions can be made until more information is available regarding the potential for simazine to inhibit algae growth.

An herbicide known to be toxic to *Selenastrum* that was detected in some algae-toxic samples is diuron. Various herbicides were often detected in algae-toxic samples,

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however non-toxic samples also frequently had herbicides detected. The role that excess nutrients play in the level of toxicity caused by metals or herbicides, as well as the additive or synergistic effects of multiple herbicides or herbicides and metals in combination, is not yet clear, and deserves further investigation.

Hyalella azteca (sediment toxicity). All sediment toxicity testing to date has been done using the test species *Hyalella azteca*. Toxicity to *Hyalella* generally seems to occur in about 25 to 35% of samples throughout various geographic locations in Zone 3, and for both MRP Plan monitoring and Supplemental Monitoring Programs. One notable exception to this higher trend for sediment toxicity found in the Patterson sub-watershed area, which is located in the northwest portion of Zone 3. The Patterson sub-area lies generally on the west side of the San Joaquin River, east of Interstate 5, from Highway 132 on the north to approximately the Newman Wasteway on the south. The frequency of *Hyalella* toxicity in the Patterson sub-watershed is 76% of all samples tested.

The mortality in toxic samples in the Patterson area is also generally higher than that observed in other locations, with 14 instances of 2% or less total survival in monitoring samples. Elsewhere within Zone 3, only three samples that were toxic to *Hyalella* had comparable magnitudes of toxicity -- less than 30% total survival.

Seven of eight monitoring locations within the Patterson area have yielded more than one toxic sediment sample. Three locations, Orestimba Creek at Highway 33, Del Puerto Creek at Highway 33, and Ingram Creek at River Road, have exhibited sediment toxicity each time they were tested (4, 4 and 5 times, respectively). Two other locations, Hospital Creek at River Road, and the Westley Wasteway near Cox Road, have exhibited toxicity on four of five sampling events. The Patterson sub-area is relatively narrow (approximately eight miles wide and 25 miles long), and nearly all drainage moves from west to east. The area has fine-grained soils, and have a large proportion of acres planted to furrow-irrigated row crops, which commonly discharge tail water. Drainage channels, including natural and modified creeks and constructed agricultural drains, are narrow and water typically moves rapidly. All of these characteristics promote the movement of fine sediments and soils off fields and into waterways.

On the east side of the river, five of 22 locations have exhibited sediment toxicity on two or more occasions. The location with the highest frequency of sediment toxicity on the east side was Duck Slough at Gurr Road, with four toxic samples out of six that were analyzed. Figure Z3-5, Toxicity to *Hyalella azteca*, presents the approximate locations of sediment toxicity tests, with mortality and without.

Studies that are being conducted by University of California for the Water Board in the San Joaquin River basin are showing strong correlations between the presence and magnitude of certain hydrophobic pesticides and observed sediment toxicity. The cause of toxicity in the majority of toxic sediment samples in the study has been clearly linked to several pyrethroid insecticides (bifenthrin, lambda-cyhalothrin, esfenvalerate, and permethrin), and/or the organophosphate insecticide chlorpyrifos, all of which are relatively hydrophobic insecticides and have a strong propensity to adhere to particulate matter. These compounds are also commonly used in Zone 3 and throughout the Central Valley to control agricultural pests on a variety of crops. Many toxic sediments

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from the study were shown to have concentrations of pyrethroids and/or chlorpyrifos which would account for all of the observed toxicity.

In the studies, 27% of all sediment samples (53 of 200 samples collected across all of Region 5) were toxic, and in 67% of those toxic samples the measured concentrations of pyrethroids and/or chlorpyrifos were sufficient to explain the toxicity. The comparison was performed using established LC50 concentrations for a group of measured pyrethroid and organochlorine insecticides, and chlorpyrifos (assuming additivity where multiple constituents were present), measured concentrations of those pesticides in the samples, and the presence and magnitude of toxicity in the same samples. Toxicity in the remaining 33% of the toxic samples in the study have not been linked to a cause or source. These study data strongly suggest that adequate control of the movement of a relatively small group of chemical products to prevent entry into waterways would significantly reduce the frequency and magnitude of sediment toxicity in agricultural drains and affected receiving waters. Efforts to control off-site movement of sediment would be likely to mitigate the detrimental effects of these chemicals, as well as other sediment-bound toxicants.

The Westside Coalition submitted several toxic sediment samples to the Water Board throughout the testing period, which were in turn submitted to a contractor to perform experimental TIE procedures on the sediment. There are no approved TIE procedures for sediment, and the techniques are still under development. The experimental TIEs generally indicated that non-polar organic compounds were the general class of compounds causing toxicity in all cases (which is consistent with insecticides being the primary cause of toxicity). In some instances, either pyrethroids or DDT and its degradates DDD and DDE were identified as possible toxicants. However, this information conflicts somewhat with the UC studies, which indicate that the concentrations of DDT/DDD/DDE were insufficient to be toxic to *Hyalella* in any field samples. In the UC studies pyrethroid concentrations could fully account for the majority of sediment toxicity.

The use of DDT has been banned in the United States for over 30 years, but the product is still used in other countries, and residues from past use are still present in the environment. DDT, DDD, and DDE are extremely persistent in the environment and are somewhat ubiquitous due to past use. The UC study also found measurable concentrations of DDT/DDD/DDE in over 90% of all sediment samples analyzed, in both toxic and non-toxic samples.

Table Z3-2, Frequency of Water Column and Sediment Toxicity, summarizes the water column and sediment toxicity frequency information for Zone 3, with the distribution for east of the San Joaquin and West San Joaquin.

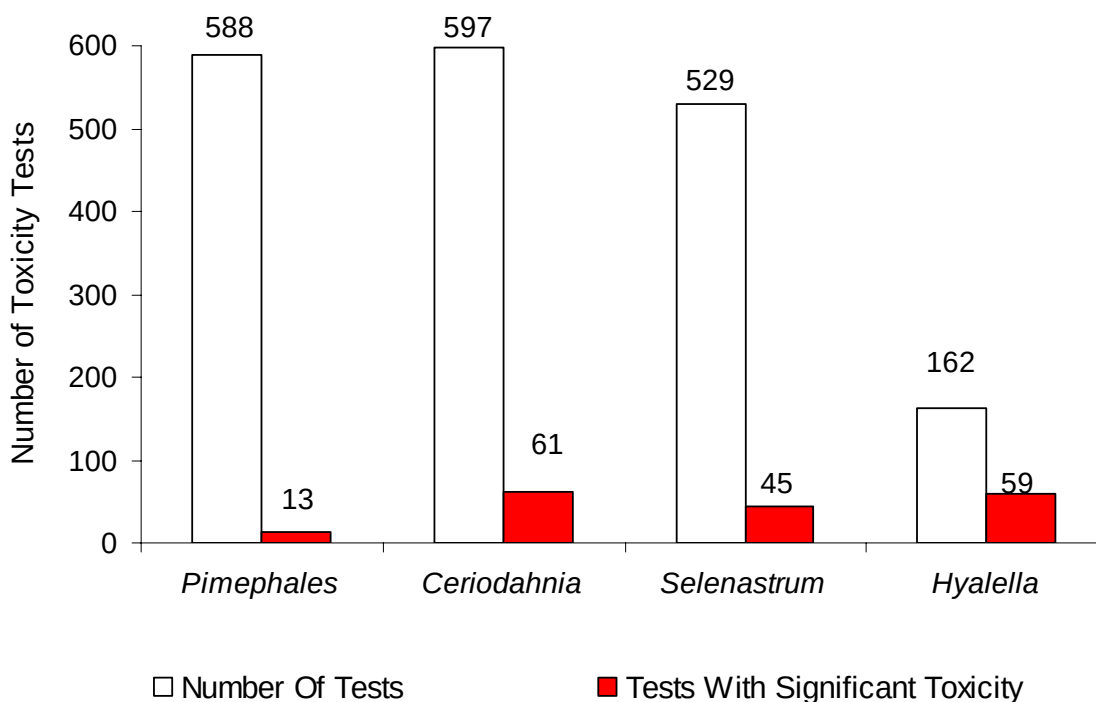
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TABLE Z3-2
Frequency of Water Column and Sediment Toxicity

	Minnow			Water Flea			Algae			Hyalella		
	# Toxic Tests	# Tests	% Toxic	# Toxic Tests	# Tests	% Toxic	# Toxic Tests	# Tests	%	# Toxic Tests	# Tests	% Toxic
East Side of San Joaquin River	5	267	1.9%	27	271	10%	28	228	12.3%	20	82	24%
West Side of San Joaquin River	8	321	2.5%	34	326	10.4%	17	301	5.6%	39	80	49%
TOTAL	13	588	2.2%	61	597	10.2%	45	529	8.5%	59	162	36%

Figure Z3-6 shows the same information compiled for Zone 1, which more graphically represents the number of toxic samples compared to the total number collected.

Figure Z3-6
Tests with Statistically Significant Toxicity



PESTICIDES. Pesticides have been evaluated and summarized from 712 samples collected at 75 locations. These analyses yielded a total of 18,435 individual pesticide results from the 712 samples analyzed for pesticides – an average of 26 pesticide results for each sample that was analyzed for a group of pesticides. The exact number and identity of the pesticides that were analyzed in any given sample was dependent on the monitoring plans. Different groups of pesticides were analyzed in different samples, depending on a number of factors including the “phase” of the monitoring being

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conducted, applicable CWA 303(d) listing monitoring requirements, site locations, irrigation district monitoring plans, and other factors. The frequency with which individual pesticides were detected in samples for which they were analyzed ranged from 0 to 100%.

Table Z3-3, List of Pesticide Detects, summarizes all pesticides that were detected in Zone 3 at least once during the monitoring period, along with applicable numeric objectives criteria, and numeric data that could be used to interpret the narrative objectives. While the primary effort in evaluating pesticide results is to identify where concentrations exceed numeric or narrative objectives, the results for several chemical pesticides within Zone 3 are noteworthy for various reasons and are summarized below.

Table Z3-3
List of Pesticide Detects

Pesticide	Zone 3 Detects/ No. of Tests	Percent Detects to No. of Tests	Range of Detected Results (ug/L)	Water Quality Trigger (ug/L)	Reference
2,4-D	3 of 6	50 %	0.3 to 0.45 ug/L	70 ug/L	Maximum Contaminant Level (MCL)
2,4-DB	2 of 6	33 %	0.41, 0.96 ug/L	None	N/A
Atrazine	11 of 235	5 %	0.035 to 0.13 ug/L	1 ug/L	MCL
				0.15 ug/L	CA Public Health Goal (PHG)
Biphenthrin	8 of 236	3 %	0.0088 to 0.037 ug/L	110 ug/L	USEPA Integrated Risk Information System (IRIS)
				0.0004 ug/L	1/10 LC50 for crustacea
Bromacil	1 of 10	10 %	1.8 ug/L	87.5 ug/L	National Academy of Sciences Suggested No Adverse Response Level (SNARL)
Carbaryl	2 of 184	1 %	0.25, 0.256 ug/L	700 ug/L	IRIS
				574 ug/L	SNARL
				2.53 ug/L	CA DFG Freshwater Aquatic Life Protection (fr aquatic life)
Carbofuran	1 of 184	0.5 %	0.32 ug/L	ND	Basin Plan Pesticide Discharge Prohibition
Chlorpyrifos	141 of 592	24 %	0.004 to 2.2 ug/L	0.015 ug/L	Basin Plan numeric water quality objective for segments of the San Joaquin River
Cyanazine	13 of 226	6 %	0.028 to 0.44 ug/L	1.0 ug/L	SNARL
DDE	29 of 208	14 %	0.003 to 0.29 ug/L	No detects (zero)	Basin Plan
				0.00059 ug/L	CTR
				0.00022 ug/L	USEPA human health protection
				0.001 ug/L	fr aquatic life
DDD	6 of 200	3 %	0.003 to 0.01 ug/L	No detects (zero)	Basin Plan

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Pesticide	Zone 3 Detects/ No. of Tests	Percent Detects to No. of Tests	Range of Detected Results (ug/L)	Water Quality Trigger (ug/L)	Reference
DDT	17 of 200	8 %	0.00097 to 0.13 ug/L	0.00083 ug/L	CTR
				0.00031 ug/L	USEPA human health protection
				No detects (zero)	Basin Plan
				0.00059 ug/L	CTR
				0.00022 ug/L	USEPA human health protection
Demeton	1 of 282	0.3 %	0.14 ug/L	0.001 ug/L	fr aquatic life
				0.1 ug/L	fr aquatic life
Diazinon	59 of 600	10 %	0.01 to 3.6 ug/L	0.3 ug/L	IRIS
Dichlorprop	1 of 6	17 %	0.34 ug/L	0.1 ug/L	Basin Plan numeric water quality objective for segments of the San Joaquin River
Dieldrin	7 of 200	3.5 %	0.0036 to 0.1 ug/L	None	N/A
				No detects (zero)	Basin Plan
				0.00014 ug/L	CTR
				0.000052 ug/L	USEPA human health protection
Dimethoate	95 of 489	19 %	0.04 to 2.5 ug/L	0.056 ug/L	fr aquatic life
				1.4 ug/L	IRIS
				1.0 ug/L	CA Notification Level, DHS
Dicofol	11 of 200	5.5 %	0.019 to 0.27 ug/L	0.2 ug/L	1/10 LC50 for <i>Cyclops strennus</i>
Diuron	26 of 184	14 %	0.003 to 1 ug/L	5.3 ug/L	1/10 LC50 for Cutthroat trout
				10 ug/L	SNARL
				14 ug/L	IRIS
EPN	3 of 276	1 %	0.09 to 0.34 ug/L	2.4 ug/L	EC50 for <i>Selenastrum</i>
EPTC	19 of 277	7 %	0.03 to 4.6 ug/L	None	N/A
Esfenvalerate	2 of 325	0.6 %	0.021, 0.05 ug/L	None	N/A
Ethoprop	3 of 276	1 %	0.035 to 0.081 ug/L	0.007 ug/L	1/10 LC50 for Rainbow trout
Fenamiphos	1 of 277	0.4 %	1.4 ug/L	None	N/A
Fensulfothion	1 of 276	0.4 %	0.26 ug/L	1.8 ug/L	IRIS
Glyphosate	2 of 134	1 %	6.5, 12 ug/L	None	N/A
Lambda- cyhalothrin	4 of 293	1 %	0.005 to 0.03 ug/L	700 ug/L	MCL
				35 ug/L	IRIS
Malathion	8 of 476	1.9 %	0.04 to 0.69 ug/L	0.00041 ug/L	1/10 LC50 for crustacea
Methyl Parathion	14 of 476	3 %	0.03 to 1.4 ug/L	ND	Basin Plan Pesticide Discharge Prohibition
				ND	Basin Plan Pesticide Discharge Prohibition

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Pesticide	Zone 3 Detects/ No. of Tests	Percent Detects to No. of Tests	Range of Detected Results (ug/L)	Water Quality Trigger (ug/L)	Reference
Methidathion	1 of 200	0.5 %	0.049 ug/L	0.7 ug/L	IRIS
				0.07 ug/L	1/10 LC50 for Opossum shrimp
Methomyl	19 of 184	10 %	0.08 to 2.25 ug/L	175 ug/L	SNARL
				0.52 ug/L	fr aquatic life
Metolachlor	15 of 25	60 %	0.03 to 1.2 ug/L	110 ug/L	IRIS
				70 ug/L	Health Advisory, USEPA OPP
				100 ug/L	fr aquatic life
Metribuzin	1 of 3	33 %	0.63 ug/L	170 ug/L	IRIS
				91 ug/L	Health Advisory, USEPA OPP
				100 ug/L	fr aquatic life
Molinate	3 of 206	1.5 %	0.035 to 0.042 ug/L	10.0 ug/L	Basin Plan Pesticide Discharge Prohibition
Oryzalin	1 of 1	100 %	0.2 ug/L	35 ug/L	IRIS
Paraquat	1 of 134	0.7 %	0.24 ug/L	3.2 ug/L	IRIS
Permethrin	1 of 320	0.3 %	0.23 ug/L	350 ug/L	IRIS
				0.03 ug/L	fr aquatic life
Prometryn	4 of 55	7 %	0.35 to 1.4 ug/L	28 ug/L	IRIS
Pendimethalin (Prowl)	54 of 298	18 %	0.03 to 3.1 ug/L	280 ug/L	IRIS
				5 to 30 ug/L	EC50 for <i>Selenastrum</i>
Simazine	38 of 240	16 %	0.035 to 7.7 ug/L	4 ug/L	MCL
				3.5 ug/L	IRIS
				10 ug/L	Fr aquatic life
				2 ug/L	EC50 for <i>Selenastrum</i>
Thiobencarb	1 of 206	3 %	0.035 to 5.8 ug/L	1.0 ug/L	Secondary MCL
Trifluralin	87 of 292	30 %	0.016 to 1.5 ug/L	5 ug/L	USEPA SNARL

Results listed in Table Z3-3 with results that were higher than an identified water quality trigger are summarized in Table Z3-4, Number of Pesticides Exceeding Trigger Levels, with chlorpyrifos, in particular, identified.

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Table Z3-4
Number of Pesticides Exceeding Trigger Levels

	PESTICIDES			CHLORPYRIFOS			
	No. Individual Pesticide Analyses	No. Detects over Trigger Limits	No. of Sample Events	No. of Chlorpyrifos Analyses	Chlorpyrifos detections	No. over Levels	Chlorpyrifos Percent over Trigger Levels
East Side of SJR	7449	76	374	262	64	47	18
West Side of SJR	10986	170	338	330	77	67	20
TOTAL	18435	246	712	592	141	114	19

SJR = San Joaquin River

Chlorpyrifos was detected in more Zone 3 samples than any other pesticide. It was detected in 141 of 592 samples analyzed (24%, or nearly one out of every four samples). Zone 3 chlorpyrifos samples were collected 592 times, with 114 detected measurements exceeding 0.015 ug/L (Basin Plan numeric objective for portions of the San Joaquin River). Locations of the chlorpyrifos measurements are identified in Figure Z3-7, Monitoring results for Chlorpyrifos.

Chlorpyrifos is an organophosphate pesticide that was frequently associated with samples that were toxic to *Ceriodaphnia dubia*. It is also the only pesticide that was strongly indicated as a cause of toxicity to more than one of the toxicity test species in Zone 3 (*Ceriodaphnia* and *Hyalella*). Chlorpyrifos was detected above the *Ceriodaphnia* LC50 in over one-third of the toxic samples analyzed for both *Ceriodaphnia* toxicity and chlorpyrifos. Chlorpyrifos accounts for 50% of the pesticide measurements that were higher than trigger levels. Similarly, 19% (115 of 592) of samples analyzed in Zone 3 were determined to have chlorpyrifos levels greater than 0.015 ug/L. Table Z3-3, List of Pesticide Detects, identifies the pesticide trigger limits used in this Review.

Diazinon, another organophosphate pesticide, had measured results that were significant with regard to both the frequency of detection and its potential impairments on water quality. Diazinon was detected 59 times in 600 analyses, or about 10% of the time. Eleven measurements were above the 0.10 ug/L basin plan numeric objective set for specific segments of the San Joaquin and Sacramento Rivers, and four measurements were above the USEPA goal of 0.6, recommended for human health protection as a drinking water level. Diazinon was detected above its literature-based LC50 concentration (of approximately 0.5 ug/L) for *Ceriodaphnia* in four *Ceriodaphnia*-toxic samples in Zone 3 (*Joint Acute Toxicity of Diazinon and Chlorpyrifos to Ceriodaphnia dubia*, Bailey, H.C., Journal of Environmental Toxicology and Chemistry, 1997). The highest concentration of diazinon observed in Zone 3 was 3.6 ug/L.

DDT, DDE and DDD, and dieldrin are no longer applied legally in California, but are still present in Zone 3 as a result of historical applications. Applications of a legal product, dicofol, is also a potential source of DDT, because DDT is a trace contaminant in dicofol. These organochlorine insecticides are extremely persistent in the environment, with half-lives of up to 30 years or longer, and are bio-accumulative. They are also extremely hydrophobic, with very low solubility in water, and a very strong propensity to

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adhere to particulates. Most detections in surface water are likely due to residues that are present in the sample in the form of suspended particulates.

The CTR objectives are generally below the detection limits for the compounds that are available at commercial analytical laboratories, and additionally, the Basin Plan states that any laboratory detections of these compounds exceed the objective. Therefore, all detections of these compounds exceed numeric Basin Plan water quality objectives. The number of detections of these compounds in Zone 3 were as follows:

1. DDE – 14% (29 detections in 208 analyses);
2. DDT – 8% (17 detections in 200 analyses);
3. DDD – 3% (6 detections in 200 analyses);
4. Dieldrin – 4% (4 detects in 200 analyses).

Twenty-four of the 29 detections for DDE were from the Patterson sub-area, which is an area with typically high concentrations of suspended particulates. This is consistent with the concept that much of the organochlorine content measured in samples is likely to be adsorbed to particulate matter. Additionally, over 90% of sediment samples analyzed by UC Berkeley contained measurable amounts of DDT/DDD/DDE, although concentrations in those same samples did not reach levels known to be toxic to the sediment test species, *Hyalella*.

Effective 1 January 1991, the Regional Board prohibited the discharge of irrigation return flows containing the pesticides carbofuran, malathion, thiobencarb, molinate, and methyl parathion, unless the discharger is following Board approved management practices. Water Board approved management practices are associated with the use of these pesticides on rice fields represented by the California Rice Commission in the Sacramento and San Joaquin River Basins. Discharges from any other irrigated lands are prohibited in Zone 3. No rice field applications of carbofuran (no longer a rice pesticide), malathion, or methyl parathion took place in Zone 3 from 2004-2006. However, all five pesticides mentioned above were detected in Zone 3 in multiple instances throughout the monitoring period.

Table Z3-5, Frequency of Select Pesticide Detects, summarizes detections of these compounds and the frequency with which detected concentrations exceeded other numeric criteria. Malathion and methyl parathion were each detected at least once in samples that were toxic to *Ceriodaphnia*. Methyl parathion was detected in two *Ceriodaphnia*-toxic samples in concentrations that exceeded the literature-based LC50 for *Ceriodaphnia* (of approximately 1 ug/L), indicating that it was a contributing factor to toxicity in at least two samples.

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**Table Z3-5
Frequency of Select Pesticide Detects**

Pesticide	No. Samples Greater than Trigger Limit	No. Samples Analyzed for Pesticide	Percent Greater than Trigger Limit	East of SJR: No. Samples Greater than Trigger Limit Analyses	West of SJR: No. Samples Greater than Trigger Limit Analyses	Trigger Limit used (ug/L)	Reference
Pesticides Exceeding Numeric Water Quality Objectives							
Chlorpyrifos	114	592	19	47 of 262	67 of 330	0.015	Basin Plan
DDD	6	200	3	2 of 142	4 of 58	0.00083	CTR
DDE	29	208	14	0 of 142	29 of 66	0.00059	CTR
DDT	17	200	8	2 of 142	15 of 58	0.00059	CTR
Diazinon	11	600	1.8	4 of 262	7 of 338	0.1	Basin Plan
Dieldrin	7	200	3.5	0 of 142	7 of 58	0.00014	CTR
Simazine	2	258	0.8	0 of 158	2 of 100	4.0	MCL
Pesticides under a Basin Plan Prohibition of Discharge							
Carbofuran	1	184	0.5	1 of 126	0 of 58	ND	Basin Plan
Malathion	8	476	1.7	2 of 146	6 of 330	ND	Basin Plan
Methyl Parathion	14	476	2.9	0 of 146	14 of 330	ND	Basin Plan
Pesticides Used to Assess Compliance with Basin Plan Narrative Water Quality Objectives							
Biphenanthrin	8	236	3.4	4 of 178	2 of 58	0.0004 ug/L	1/10 LC50
	0		0	0 of 178	0 of 58	110 ug/L	IRIS
Demeton	1	282	0.3	0 of 4	1 of 278	0.14 ug/L	Freshwater Aq. Life protect.
Dimethoate	35	507	7.1	6 of 164	29 of 343	0.2 ug/L	1/10 LC50
	11		1.6	0 of 164	11 of 343	1.0 ug/L	Human health
Diuron	8	311	2.6	8 of 253	0 of 58	14 ug/L	IRIS
Lambda-Cyhalothrin	4	293	1.3	1 of 243	3 of 50	0.00041 ug/L	1/10 LC50
	0		0	0 of 243	0 of 50	35 ug/L	IRIS
Methomyl	5	184	2.7	0 of 126	5 of 58	0.52 ug/L	Freshwater Aq. Life

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Pesticide	No. Samples Greater than Trigger Limit	No. Samples Analyzed for Pesticide	Percent Greater than Trigger Limit	East of SJR: No. Samples Greater than Trigger Limit Analyses	West of SJR: No. Samples Greater than Trigger Limit Analyses	Trigger Limit used (ug/L)	Reference
							protect.
Oryzalin	3	89	3.4	3 of 88	0 of 1	35 ug/L	IRIS
Permethrin	1	320	0.3	1 of 262	0 of 58	0.03 ug/L	Freshwater Aq. Life protect.
Esfenvalerate	2	320	0.6	1 of 262	1 of 58	0.007 ug/L	1/10 LC50

Atrazine, cyanazine, simazine, diruon, metolachlor, pendimethalin (prowl), and Trifluralin are all herbicides that have been detected in Zone 3. Of these, only simazine can be compared to a numeric trigger level. However, all the herbicides together are a cause for concern due to their use rates and the frequency with which they were detected in surface water samples. It is also possible that these or other detected herbicides are cumulatively playing a role in observed toxicity to the algae test species. However, the reader needs to consider that additional study is needed to determine any potential connection between the presence and magnitude of these chemicals and observed toxicity to *Selenastrum*.

Detection rates for these herbicides were as follows:

1. Atrazine – 5% (11 detections in 235 analyses);
2. Cyanazine – 6% (13 detections in 226 analyses);
3. Simazine – 16% (38 detections in 240 analyses);
4. Diuron – 14% (26 detections in 184 analyses);
5. Pendamethalin --25% (54 detections in 218 analyses), and
6. Trifluralin –30% (87 detections in 292 analyses).

Two simazine samples exceeded the drinking water maximum contaminant level (MCL) of 4 ug/L. The California Department of Fish & Game has established a fresh water aquatic life goal of 10 ug/L for simazine. Several algae-toxic samples were found to contain Simazine at concentrations ranging from 0.94 to 7.7 ug/L.

Dimethoate is another organophosphate insecticide that is used widely for many crops, and was frequently detected in Zone 3. There were 95 detections in 489 analyses (19%). Eight detections were above 1 ug/L, which is the California DHS action level for drinking water. No freshwater criteria have been recommended by Fish & Game or by USEPA. Dimethoate was detected in some samples that were toxic to *Ceriodaphnia*, however, LC50 information for *Ceriodaphnia* has not been determined. The highest observed concentration of dimethoate in Zone 3 was 3 ug/L.

The pyrethroids, bifenthrin, lambda-cyhalothrin, esfenvalerate and permethrin are all hydrophobic pesticides with have a propensity to adhere to particulate matter. The compounds have been identified as having caused toxicity to *Hyalella* in many toxic sediment samples, however they are infrequently detected in the water column. They are of particular concern due to their association with sediment toxicity, moderate persistence in the environment, high level of toxicity to aquatic species in general, and

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the fact that their use rates are generally increasing. Because pyrethroids are more toxic in general than some other classes of chemical pesticides, they are used in somewhat smaller amounts compared to some alternatives.

Because pyrethroids in general are toxic to aquatic organisms at lower concentrations, however, numeric interpretations of the narrative toxicity objective to protect freshwater aquatic life beneficial uses are comparatively very low. Ambient water quality criteria for these pyrethroids have not been recommended by USEPA or by Dept of Fish & Game for these compounds, with the exception of permethrin. Using literature studies to establish protective numbers results in objectives below laboratory detection limits in most cases. This results in most detections falling below water quality goals for human health-based protection, but above goals that would be protective of aquatic species. Table Z3-3, List of Pesticide Detects, summarizes the ranges of detected results and numeric criteria that may be applied to these pyrethroid compounds.

METALS. A total of 182 samples from 41 locations were analyzed for metals during the sampling period. Analyzed metals included arsenic, boron, cadmium, copper, lead, nickel, selenium, and zinc. Concentrations were compared to protective levels established as MCLs for drinking water and the CTR and USEPA values for the protection of freshwater aquatic life. The CTR values are based on correction factors established by the hardness content of the sample. Using these criteria, total exceedances of the objectives were determined as follows: arsenic (3), boron (6), cadmium (9), copper (48), lead (63), nickel (4), selenium (4), and zinc (1).

The Water Code and Basin Plan state that where naturally occurring background levels for metals are above water quality goals, discharges shall not degrade water quality further. An evaluation of naturally occurring background levels would likely need to occur for metals where protective goals have been exceeded in order to determine effects of agricultural discharges.

The federal MCL for arsenic is 10 ug/L, which is generally used to compare for drinking water quality beneficial uses (MUN), even though the California State MCL remains at 50 ug/L. Other comparisons can be made using a public health goal based on cancer risk set at 0.004 ug/L, which is lower than available laboratory detection limits. If this value is used to evaluate threats to human health through contact recreation and municipal supply beneficial uses, then any of the detections for arsenic exceed the trigger limit. Background studies would still need to be undertaken for individual sites and water bodies, however program data suggest that typical arsenic levels in Central Valley surface waters may be between 0.9 and 10 ug/L.

Among the analyzed metals, only copper is applied in significantly high amounts in Zone 3, in the form of copper hydroxide and copper sulfates (primarily to control fungi). However, naturally occurring toxic metals such as selenium can be leached from soils and discharged to surface water by irrigation practices. There is, therefore, the potential for agricultural discharges to degrade water quality through the contribution of these metals.

PATHOGENS. Results for the pathogen indicator, *E. coli* of the 46 locations monitored by the coalitions in Zone 3. Forty-five locations were monitored at least once for *E. coli*, and some locations have been sampled and analyzed for *E. coli* as many as 30 times

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(generally at a monthly frequency). Forty-two of the 45 locations tested for *E. coli* had at least one measurement above the USEPA Recommended Criteria of 235 MPN/100mL. Thirty-six of the 45 locations monitored have shown multiple detections above 235 MPN/100ml, with as many as 23 exceedances at one location. The overall number of *E. coli* samples in excess of the trigger limit is 338 of 633 total samples, or 53%. Maximum values outside of the upper range of laboratory test detection, such as >1600 or >2400 MPN/100mL, are frequently reported. No strong trends regarding the frequency of exceedances or the magnitude of measurements in relation to sample location or watershed areas have yet been identified, however exceedances appear to be slightly more prevalent in the northwest portion of Zone 3. Based on this limited monitoring, the exceedances, as such, are generally wide-spread, unpredictable, frequent and of unidentified origin. Approximate locations of the *E. coli* measurements are identified on Figure Z3-8, *E.coli* Sample Results greater than 235 MPN/100 mls.

The current routine monitoring data does not provide information on the source of the *E. coli* – human, wildlife, domestic animal, etc. Coalitions in Zone 3 have undertaken studies in an effort to help determine the source animals of the observed fecal bacteria. More information regarding sources is needed in order to evaluate the effects of naturally occurring background bacteria (from wildlife), and to determine the appropriate level of effort and specific activities that may be needed to mitigate any contributions from agricultural activities.

Focused studies may be needed to further characterize *E. coli*, such as more DNA testing, or analysis of the magnitude of measurements along more intensely sampled sections of waterways to show spatial differences in the results with regard to the site location and the magnitude of measurements comparing closely located samples. Studies may reveal more information on sources.

DISSOLVED OXYGEN AND pH. Measurements for these parameters were compared to Basin Plan objectives. The Basin Plan minimum value for dissolved oxygen of 7.0 mg/L was compared to results from all locations, and the reader needs to consider this generalization in conducting independent evaluations of the data. This generalization was considered reasonable, as all water bodies sampled either had cold water aquatic life beneficial uses, spawning beneficial uses, or are tributary to the San Joaquin River (which has spawning beneficial uses).

From these measurements, 225 of 1,145 (20%) were below 7 mg/L. For some water bodies throughout Zone 3, the less stringent objective of 5 mg/L may apply, as the waters may require further characterization with regard to beneficial uses. For several monitoring locations on the west side of the river, there were numerous values measured below the threshold of 7 mg/L, but none below 5 mg/L, so the above percentage may represent an overly conservative number of potential exceedances.

The pH of waters is generally to be maintained between 6.5 and 8.5 pH units. This range was exceeded in 7.8% of Zone 3 samples (89 of 1,145 measurements). It is important to note that pH measurements are also affected by the daily flux of carbon dioxide and dissolved oxygen in surface water, which in turn are dependent on temperature, and the time of day. Additionally, pH is dependent on carbon dioxide

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levels, and thus also fluctuates on a daily cycle in most surface waters due to the photosynthetic activities of aquatic plants, including algae.

Waters with measurements outside of the trigger limits identified for pH or dissolved oxygen may require further study or evaluation to determine if agricultural discharges are having a significant effect on these parameters, and what, if any, appropriate mitigation measures are warranted.

SALINITY. Salinity was evaluated by comparing the results of electrical conductivity analyses against established thresholds that are protective of various beneficial uses. The goal of 700 umhos/cm³ is the most restrictive of these goals, and is protective of agricultural supply for salt-sensitive crops, as well as municipal supply and aquatic life beneficial uses. It has been noted that agricultural supply water coming from the Delta-Mendota Canal for portions of the Westside Coalition often exceeds the 700 umhos/cm³ goal.

A total of 26% of the conductivity measurements in Zone 3 exceeded 700 umhos/cm. The number of exceedances is far greater on the west side of the river, where water supplies are primarily obtained from water pumped from the Sacramento-San Joaquin Delta through state or federal water projects. Water supplies on the east side of the river originate primarily from snowmelt runoff from the Sierra Nevada, and this source water is generally much lower in salt content. Additionally, soils in the southwest portion of the San Joaquin basin are high in salt content, and drainage from the use of these lands for agriculture contributes greatly to the discharge of dissolved salts from this portion of the watershed into the San Joaquin River. Eleven percent of measurements on the east side of the river exceeded the conductivity goal, and 39% of the measurements on the west side of the river were above the goal. Additionally, of the 56 exceedances identified on the east side of the river, 32 (57%) came from two drains (Prairie Flower Drain and Hilmar Drain), indicating an anomalously high level of salt in these drains, when compared to other locations on the east side of the river. On the west side, 54% of the exceedances were obtained from Mud Slough, Salt Slough and Los Banos Creek, which drain the south-west portion of the watershed. Measurements above 700 umhos/cm³ were less common in the northern portion of the Westside area. A TMDL program for salt loads and salt management for the San Joaquin River is under development, and management of agricultural discharges is expected to play a significant role in the reduction of salt loads to the San Joaquin River in the future. For the purposes of management, the TMDL program has identified sub-basins within the San Joaquin watershed (based on historical measurements and load calculations), along with goals and timelines for salt management within these sub-basins.

Table Z3-6 summarizes the field measurements for conductivity, dissolved oxygen, pH and *E. coli*.

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Table Z3-6

Field and Pathogen Results for East and West Sides of San Joaquin River

	Specific Conductivity			Dissolved Oxygen			pH			E. coli		
	No. > Trigger Limit ¹	No. of Tests	%	No. > Trigger Limit ²	No. of Tests	%	No. > Trigger Limit ³	No. of Tests	%	No. > Trigger Limit ⁴	No. of Tests	%
East Side	56	524	11	85	524	16	46	524	8.8	100	210	48
West Side	243	621	39	140	621	23	43	621	6.9	238	423	56
Total	299	1145	26	225	1145	20	89	1145	7.8	338	633	53

¹ results >700 umhos/cm³

² results <7.0 mg/L

³ results < 6.5 or > 8.5

⁴ results > 235 MPN/100 mL

SUMMARY

Chlorpyrifos alone accounted for half of all identified pesticide exceedances, and measurements in 19% of samples (one of every five) were above the trigger limit of 0.015 ug/L and can account for approximately one-third of all *Ceriodaphnia* toxicity in Zone 3. Chlorpyrifos concentrations can also account for one fifth of all *Hyalella* toxicity region-wide, according to recent studies conducted by the University of California.

Based on an evaluation of all results, pesticide concentrations measured above water quality objectives occurred in 246 of the 18,435 total pesticide results (1.3%). At least one measured pesticide was found to exceed a trigger limit in 164 of the 712 samples analyzed (23%). This evaluation is presented in Table Z3-4, Pesticides Exceeding Trigger Levels.

The review of nutrient data is continuing and will be summarized in subsequent monitoring data reviews. Ammonia was identified as a potential toxicant to aquatic life on one occasion during the sampling period. Nitrates also pose a potential hazard to human health. Evaluation of the effects of nutrient compounds at bio-stimulatory levels will continue, especially with regard to the potential for excessive algal growth.

The Patterson sub-watershed area was found to exhibit both an elevated frequency and very high magnitude of sediment toxicity at multiple locations. The Patterson sub-watershed lies on the west side of the San Joaquin River, east of Interstate 5, between Highway 132 on the north and the Newman Wasteway on the south. The frequency of *Hyalella* toxicity in the Patterson sub-watershed during the testing period was 76% of all samples tested. Seven of 8 monitoring locations within the Patterson area have yielded more than 1 toxic sediment sample. Three locations in the Patterson area have exhibited sediment toxicity each time they were tested, and two other locations exhibited toxicity on four of five sampling events. A number of distinct characteristics in the area, including fine-grained soils, predominant furrow-irrigated row crops, and narrow drainage channels promote the movement of fine sediments and soils off fields and into waterways. The use of hydrophobic pesticides, especially pyrethroids and chlorpyrifos, and the movement of these insecticides bound to sediment into creeks, is the likely cause of the toxicity observed at the Patterson area sampling locations.

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Salinity, as measured through electrical conductivity analyses was compared against established thresholds that are protective of various beneficial uses. The levels of salinity are far greater on the west side of the river, where water supplies are primarily obtained from water pumped from the Sacramento-San Joaquin Delta through state or federal water projects. Water supplies on the east side of the river originate primarily from Sierra Nevada snowmelt, are much lower in salt content. Additionally, soils in the southwest portion of the San Joaquin basin are high in salt content, and drainage from the use of these lands for agriculture contributes greatly to the discharge of dissolved salts from this portion of the watershed into the San Joaquin River. Shallow confining layers in the soil in the southwest portion of the Zone (southwest portion of the San Joaquin drainage) promote the build-up of salts in the root zone of agricultural crops. These salts are frequently flushed out with excess irrigation water to allow adequate growing conditions, and these salts are drained into the major drainage channels in the area, including Salt Slough, Mud Slough, and Los Banos Creek. Of all conductivity exceedances in Zone 3, 54% were obtained from Mud Slough, Salt Slough and Los Banos Creek, which drain the south-west portion of the watershed.

Water quality problems identified in Zone 3, in particular with respect to toxicity to all water species and sediment are being addressed through management plans that are being developed.

Table Z3-7 Analytical Detects by Monitoring Site, identifies the locations and frequency of measurements that exceeded trigger limits within Zone 3.

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TABLE Z3-7
ANALYTICAL DETECTS BY MONITORING SITE:
East Side of San Joaquin River

Site Name	Aquatic Toxic Events	Minnow tests performed	Minnow Toxic Events	Flea tests performed	Flea Toxic Events	Algae tests performed	Algae of Toxic Events	Sediment tests performed	Sediment Toxic Events
Coalition Data, East Side of San Joaquin River									
(1) Ash Slough @ Ave 21	1	10	0	9	0	9	1	3	0
(2) August Road Drain upstream of Crows Landing Bridge (Hogin Rd)	0	3	0	3	0	3	0	1	0
(3) Bear Creek @ Kiby Rd	2	13	0	13	2	12	0	5	0
(4) Berenda Slough along Avenue 18 ½	1	5	0	5	1	4	0	1	0
(5) Black Rascal Creek @ Yosemite Road	0	5	0	4	0	5	0	1	0
(6) Cottonwood Creek @ Road 20	1	14	1	13	0	12	0	5	1
(7) Deadman Creek @ Highway 59	0	5	0	5	0	5	0	1	0
(8) Deadman Creek (Dutchman) @ Gurr Rd	1	8	1	7	0	7	0	2	0
(9) Dry Creek @ Wellsford Road, Sta Co	2	14	0	15	2	12	0	5	1
(10) Dry Creek at Road 18, Mad Co	1	7	0	8	1	7	0	3	1
(11) Duck Slough @ Gurr Rd	4	16	0	18	3	16	1	6	4
(12) Duck Slough @ Hwy 99	3	14	1	15	1	14	1	2	0
(13) Highline Canal @ Hwy 99	5	12	0	14	4	12	1	6	3
(14) Highline Canal @ Lombardy Rd	4	14	0	15	2	14	2	5	3
(15) Hilmar Drain @ Central Ave	2	14	0	15	1	12	1	5	2
(16) Jones Drain @ Oakdale Road	2	14	0	15	1	13	1	5	0
(17) Lone Willow Slough @ Madera Ave	2	5	0	5	1	4	1	2	1
(18) Merced River @ Sante Fe	4	17	0	18	3	13	1	6	0
(19) Mustang Creek @ East Ave	0	3	0	3	0	2	0	1	0
(20) Prairie Flower Drain @ Crows Landing Road	3	15	2	15	1	10	0	5	3
(21) Silva Drain @ Meadow Drive	1	5	0	4	1	5	0	2	1
(22) South Slough at Quinley Road	0	2	0	1	0	2	0	1	0
Totals	39	215	5	220	24	193	10	73	20

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TABLE Z3-7 CONT.
ANALYTICAL DETECTS BY MONITORING SITE:
West Side of San Joaquin River

Site Name	Aquatic Toxic Events	Minnow tests performed	Minnow Toxic Events	Flea tests performed	Flea Toxic Events	Algae tests performed	Algae of Toxic Events	Sediment tests performed	Sediment Toxic Events
Coalition Data, West Side of San Joaquin River									
(23) Hospital Creek at River Road	5	14	1	14	2	14	2	5	4
(24) Ingram Creek at River Road	4	16	1	16	0	16	3	5	5
(25) Westley Wasteway near Cox Road	0	11	0	11	0	11	0	5	4
(26) Del Puerto Creek near Cox Road	2	15	1	15	1	15	0	4	3
(27) Del Puerto Creek at Highway 33	2	17	0	17	1	16	1	4	4
(28) Salado Creek near Olive Ave.	1	2	0	3	1	2	0	0	0
(29) Ramona Lake near Fig Ave.	2	9	0	10	2	9	0	0	0
(30) Marshall Road Drain near River Road	3	13	0	14	1	12	2	0	0
(31) Orestimba Creek at River Road	4	17	1	19	3	16	0	5	1
(32) Orestimba Creek at Highway 33	6	17	0	19	6	16	0	4	4
(33) Newman Wasteway near Hills Ferry Road	2	17	1	15	0	14	1	5	3
(34) San Joaquin River at Sack Dam	0	0	0	0	0	0	0	0	0
(35) San Joaquin River at Lander Ave.	1	30	0	30	1	26	1	5	0
(36) Mud Slough upstream of San Luis Drain	2	30	0	29	1	27	1	5	1
(37) Salt Slough at Lander Ave	5	30	0	31	3	29	3	5	1
(38) Salt Slough at Sand Dam	6	17	0	19	3	17	2	5	0
(39) Los Banos Creek at Highway 140	2	30	0	29	2	27	0	5	1
(40) Los Banos Creek at China Camp Road	1	4	1	4	0	4	0	4	1
(41) Turner Slough near Edminster Road	3	9	2	8	0	7	0	5	1
(42) Westley Wasteway at Refuge Ponds	0	1	0	1	0	1	0	0	0
(43) SJR at WSID Pumps	0	1	0	1	0	1	0	0	0
(44) Delta Mendota Canal at DPWD	0	1	0	1	0	1	0	0	0
(45) Little Panoche Creek at Interstate 5	1	1	0	1	1	1	0	1	1
(46) Russell Avenue Drain at San Luis Canal	2	1	0	1	1	1	1	1	1
Totals	54	303	8	308	29	283	17	73	35
Total, All Coalition Data	93	518	13	528	53	476	27	146	55

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TABLE Z3-7 CONT.
ANALYTICAL DETECTS BY MONITORING SITE:
East Side of San Joaquin River

Site Name	individual pesticide analyses	individual Pesticide exceedances	Pesticide suites analyzed	Pesticide suites w/ 1 or more exceedances	Chlorpyrifos Exceedances	individual Metals analyses	individual Metals exceedances	Metal suites analyzed	Metal sets w/ 1 or more exceedances
Coalition Data, East Side of San Joaquin River									
(1) Ash Slough @ Ave 21	229	4	10	4	4	40	7	5	5
(2) August Road Drain upstream of Crows Landing Bridge (Hogin Rd)	46	1	3	1	1	0	0	0	0
(3) Bear Creek @ Kiby Rd	249	1	13	1	1	40	0	5	0
(4) Berenda Slough along Avenue 18 ½	195	2	5	2	2	0	0	0	0
(5) Black Rascal Creek @ Yosemite Road	195	1	5	1	1	0	0	0	0
(6) Cottonwood Creek @ Road 20	255	0	14	0	0	40	4	5	3
(7) Deadman Creak @ Highway 59	195	3	5	2	1	0	0	0	0
(8) Deadman Creek (Dutchman) @ Gurr Rd	241	2	8	2	1	40	0	5	0
(9) Dry Creek @ Wellsford Road, Sta Co	255	4	14	4	3	40	0	5	0
(10) Dry Creek at Road 18, Mad Co	209	1	7	1	1	40	8	5	5
(11) Duck Slough @ Gurr Rd	300	2	17	2	0	40	2	5	2
(12) Duck Slough @ Hwy 99	253	2	14	2	2	40	6	5	3
(13) Highline Canal @ Hwy 99	242	1	12	1	1	40	2	5	2
(14) Highline Canal @ Lombardy Rd	254	3	14	3	2	40	4	5	4
(15) Hilmar Drain @ Central Ave	254	2	14	2	1	40	1	5	1
(16) Jones Drain @ Oakdale Road	254	3	14	2	2	40	5	5	4
(17) Lone Willow Slough @ Madera Ave	29	2	5	2	2	0	0	0	0
(18) Merced River @ Sante Fe	300	0	17	0	0	39	2	5	1
(19) Mustang Creek @ East Ave	116	0	3	0	0	0	0	0	0
(20) Prairie Flower Drain @ Crows Landing Road	254	2	14	2	2	40	0	5	0
(21) Silva Drain @ Meadow Drive	195	1	5	1	1	0	0	0	0
(22) South Slough at Quinley Road	78	0	2	0	0	0	0	0	0
Totals	4598	37	215	35	28	559	41	70	30

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TABLE Z3-7 CONT.
ANALYTICAL DETECTS BY MONITORING SITE:
West Side of San Joaquin River

Site Name	individual pesticide analyses	individual Pesticide exceedances	Pesticide suites analyzed	Pesticide suites w/ 1 or more exceedances	Chlorpyrifos Exceedances	individual Metals analyses	individual Metals exceedances	Metal suites analyzed	Metal sets w/ 1 or more exceedances
Coalition Data, West Side of San Joaquin River									
(23) Hospital Creek at River Road	511	6	16	5	1	32	8	4	4
(24) Ingram Creek at River Road	570	16	18	7	5	32	11	4	4
(25) Westley Wasteway near Cox Road	340	6	11	4	3	24	4	3	2
(26) Del Puerto Creek near Cox Road	490	7	15	5	4	32	6	4	4
(27) Del Puerto Creek at Highway 33	579	7	18	5	0	24	1	3	1
(28) Salado Creek near Olive Ave.	116	6	2	2	1	0	0	0	0
(29) Ramona Lake near Fig Ave.	288	2	9	2	2	24	4	3	3
(30) Marshall Road Drain near River Road	180	10	15	6	5	32	10	4	4
(31) Orestimba Creek at River Road	556	21	17	11	7	32	5	4	3
(32) Orestimba Creek at Highway 33	558	22	17	11	6	32	4	4	3
(33) Newman Wasteway near Hills Ferry Road	581	2	18	2	1	32	5	4	4
(34) San Joaquin River at Sack Dam	120	0	4	0	0	0	0	0	0
(35) San Joaquin River at Lander Ave.	998	0	31	0	0	32	0	4	0
(36) Mud Slough upstream of San Luis Drain	998	2	31	2	1	32	2	4	2
(37) Salt Slough at Lander Ave	1009	9	31	8	8	32	1	4	1
(38) Salt Slough at Sand Dam	614	10	19	9	9	32	0	4	0
(39) Los Banos Creek at Highway 140	988	0	31	0	0	32	5	4	3
(40) Los Banos Creek at China Camp Road	161	0	5	0	0	0	0	0	0
(41) Turner Slough near Edminster Road	289	0	9	0	0	32	0	4	0
(42) Westley Wasteway at Refuge Ponds	30	0	1	0	0	0	0	0	0
(43) SJR at WSID Pumps	30	0	1	0	0	0	0	0	0
(44) Delta Mendota Canal at DPWD	30	0	1	0	0	0	0	0	0
(45) Little Panoche Creek at Interstate 5	0	0	0	0	0	0	0	0	0
(46) Russell Avenue Drain at San Luis Canal	0	0	0	0	0	0	0	0	0
Totals	10036	126	320	79	53	488	66	61	38
Total, All Coalition Data	14634	163	535	114	81	1047	107	131	68

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TABLE Z3-7 CONT.
ANALYTICAL DETECTS BY MONITORING SITE:
East Side of San Joaquin River

Site Name	Bacteria samples collected	Bacteria Exceedances	DO Exceedances	pH Exceedances	EC Exceedances	DO pH and EC samples collected
Coalition Data, East Side of San Joaquin River						
(1) Ash Slough @ Ave 21	10	3	0	0	0	15
(2) August Road Drain upstream of Crows Landing Bridge (Hogin Rd)	3	3	0	0	3	3
(3) Bear Creek @ Kiby Rd	13	3	1	0	0	19
(4) Berenda Slough along Avenue 18 ½	5	1	1	0	0	9
(5) Black Rascal Creek @ Yosemite Road	5	2	3	0	0	9
(6) Cottonwood Creek @ Road 20	14	4	7	0	0	19
(7) Deadman Creek @ Highway 59	5	0	2	0	0	9
(8) Deadman Creek (Dutchman) @ Gurr Rd	8	8	5	0	0	12
(9) Dry Creek @ Wellsford Road, Sta Co	14	8	4	3	0	19
(10) Dry Creek at Road 18, Mad Co	7	2	1	0	0	15
(11) Duck Slough @ Gurr Rd	17	10	2	0	1	24
(12) Duck Slough @ Hwy 99	14	6	1	0	0	20
(13) Highline Canal @ Hwy 99	12	1	1	1	0	20
(14) Highline Canal @ Lombardy Rd	14	2	0	2	0	21
(15) Hilmar Drain @ Central Ave	14	10	1	2	13	24
(16) Jones Drain @ Oakdale Road	14	11	5	1	0	20
(17) Lone Willow Slough @ Madera Ave	5	3	3	1	0	5
(18) Merced River @ Sante Fe	12	1	0	1	0	24
(19) Mustang Creek @ East Ave	3	3	1	0	0	6
(20) Prairie Flower Drain @ Crows Landing Road	14	13	6	2	19	23
(21) Silva Drain @ Meadow Drive	5	4	2	0	0	9
(22) South Slough at Quinley Road	2	2	0	0	0	6
Totals	210	100	46	13	36	331

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**TABLE Z3-7 CONT.
ANALYTICAL DETECTS BY MONITORING SITE:
West Side of San Joaquin River**

Site Name	Bacteria samples collected	Bacteria Exceedances	DO Exceedances	pH Exceedances	EC Exceedances	DO pH and EC samples collected
Coalition Data, West Side of San Joaquin River						
(23) Hospital Creek at River Road	21	17	2	2	3	33
(24) Ingram Creek at River Road	28	13	4	2	10	29
(25) Westley Wasteway near Cox Road	21	12	2	4	3	25
(26) Del Puerto Creek near Cox Road	25	15	4	4	10	31
(27) Del Puerto Creek at Highway 33	27	16	8	4	5	30
(28) Salado Creek near Olive Ave.	8	6	2	0	4	10
(29) Ramona Lake near Fig Ave.	12	9	6	0	13	21
(30) Marshall Road Drain near River Road	21	15	7	2	8	32
(31) Orestimba Creek at River Road	30	23	4	1	1	34
(32) Orestimba Creek at Highway 33	30	22	8	3	4	35
(33) Newman Wasteway near Hills Ferry Road	29	15	9	0	27	33
(34) San Joaquin River at Sack Dam	0	0	1	3	1	30
(35) San Joaquin River at Lander Ave.	24	8	2	2	13	35
(36) Mud Slough upstream of San Luis Drain	29	11	5	2	29	35
(37) Salt Slough at Lander Ave	29	10	11	0	36	37
(38) Salt Slough at Sand Dam	29	9	12	3	18	38
(39) Los Banos Creek at Highway 140	30	18	20	1	31	38
(40) Los Banos Creek at China Camp Road	8	3	9	2	10	31
(41) Turner Slough near Edminster Road	17	13	15	8	5	37
(42) Westley Wasteway at Refuge Ponds	1	1	0	0	0	1
(43) SJR at WSID Pumps	1	0	1	0	1	1
(44) Delta Mendota Canal at DPWD	1	0	1	0	0	1
(45) Little Panoche Creek at Interstate 5	1	1	0	0	0	1
(46) Russell Avenue Drain at San Luis Canal	1	1	0	0	0	1
Totals	423	238	133	43	232	599
Total, All Coalition Data	633	338	179	56	268	930

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TABLE Z3-7 CONT.
ANALYTICAL DETECTS BY MONITORING SITE:
West Side and East Side, UCD data

Site Name	Aquatic Toxic Events	Minnow tests performed	Minnow Toxic Events	Flea tests performed	Flea Toxic Events	Algae tests performed	Algae Toxic Events	Sediment tests performed	Sediment Toxic Events
West Side of San Joaquin River (Phase 2 Contract)									
(47) Boundary Drain at Henry Miller Ave.	1	4	0	4	1	4	0	1	1
(48) Hospital Creek at Highway 33	0	0	0	0	0	0	0	1	1
(49) Island Field Drain at Catrina Road	3	4	0	4	3	4	0	2	1
(50) Orestimba Creek at Kilburn Road	1	5	0	5	1	5	0	2	1
(51) Poso Drain at NE corner of Turner Island and Palazzo Rd	0	5	0	5	0	5	0	1	0
Totals	5	18	0	18	5	18	0	7	4
East Side of San Joaquin River (Phase 1 Contract)									
(52) Unnamed Drain at Pomelo Ave. near Paradise Ave.	0	8	0	7	0	0	0	0	0
(53) Westport Drain at Jennings Rd.	1	9	0	8	1	0	0	0	0
East Side of San Joaquin River (Phase 2 Contract)									
(54) Berenda Creek at Ave 17.5 west of Madera	3	6	0	7	2	6	1	2	0
(55) Cottonwood Creek at Hwy 145 in Madera County	3	3	0	3	0	3	3	1	0
(56) Dry Creek at J9	5	5	0	5	0	5	5	1	0
(57) Duck Slough at Arboleda Drive	4	7	0	7	0	7	4	2	0
(58) Ingalsbe Slough at J17	5	5	0	5	0	5	5	1	0
(59) Owens Creek at Gurr Rd	0	4	0	4	0	4	0	1	0
(60) Sand Slough on Turner Island Rd. W of Merced Natl. Wildlife Refuge	0	0	0	0	0	0	0	1	0
(61) Stevenson Lower Lateral at intersection of Faith Home Rd	0	5	0	5	0	5	0	0	0
Totals	21	52	0	51	3	35	18	9	0
Total, All UC Davis Contract Data	26	70	0	69	8	53	18	16	4

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TABLE Z3-7 CONT.
ANALYTICAL DETECTS BY MONITORING SITE:
West Side and East Side, UCD data

Site Name	individual pesticide analyses	individual Pesticide exceedances	Pesticide suites analyzed	Pesticide suites w/ 1 or more exceedances	Chlorpyrifos Exceedances	individual Metals analyses	individual Metals exceedances	Metal suites analyzed	Metal sets w/ 1 or more exceedances
West Side of San Joaquin River (Phase 2 Contract)									
(47) Boundary Drain at Henry Miller Ave.	268	3	4	3	3	32	2	4	2
(48) Hospital Creek at Highway 33	0	0	0	0	0	0	0	0	0
(49) Island Field Drain at Catrina Road	268	7	4	4	4	32	5	4	4
(50) Orestimba Creek at Kilburn Road	207	24	5	5	3	40	3	5	3
(51) Poso Drain at NE corner of Turner Island and Palazzo Rd	207	10	5	4	4	40	6	5	3
Totals	950	44	18	16	14	144	16	18	12
East Side of San Joaquin River (Phase 1 Contract)									
(52) Unnamed Drain at Pomelo Ave. near Paradise Ave.	0	0	0	0	0	0	0	0	0
(53) Westport Drain at Jennings Rd.	0	0	0	0	0	0	0	0	0
East Side of San Joaquin River (Phase 2 Contract)									
(54) Berenda Creek at Ave 17.5 west of Madera	856	18	18	15	15	32	4	4	4
(55) Cottonwood Creek at Hwy 145 in Madera County	125	0	3	0	0	25	1	3	1
(56) Dry Creek at J9	203	5	5	4	3	40	0	5	0
(57) Duck Slough at Arboleda Drive	277	2	7	2	1	60	10	7	5
(58) Ingalsbe Slough at J17	203	0	5	0	0	41	0	5	0
(59) Owens Creek at Gurr Rd	268	3	4	3	0	33	0	4	0
(60) Sand Slough on Turner Island Rd. W of Merced Natl. Wildlife Refuge	0	0	0	0	0	na	na	na	na
(61) Stevenson Lower Lateral at intersection of Faith Home Rd	207	0	5	0	0	40	0	5	0
Totals	2139	28	47	24	19	271	15	33	10
Total, All UC Davis Contract Data	3089	72	65	40	33	415	31	51	22

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TABLE Z3-7 CONT.
ANALYTICAL DETECTS BY MONITORING SITE:
West Side and East Side, UCD data

Site Name	DO Exceedances	pH Exceedances	EC Exceedances	DO pH and EC samples collected
West Side of San Joaquin River (Phase 2 Contract)				
(47) Boundary Drain at Henry Miller Ave.	2	0	5	5
(48) Hospital Creek at Highway 33	0	0	0	0
(49) Island Field Drain at Catrina Road	2	0	0	6
(50) Orestimba Creek at Kilburn Road	0	0	3	6
(51) Poso Drain at NE corner of Turner Island and Palazzo Rd	3	0	3	5
Totals	7	0	11	22
East Side of San Joaquin River (Phase 1 Contract)				
(52) Unnamed Drain at Pomelo Ave. near Paradise Ave.	1	0	9	9
(53) Westport Drain at Jennings Rd.	0	0	3	10
East Side of San Joaquin River (Phase 2 Contract)				
(54) Berenda Creek at Ave 17.5 west of Madera	2	1	0	20
(55) Cottonwood Creek at Hwy 145 in Madera County	1	0	0	3
(56) Dry Creek at J9	0	0	0	5
(57) Duck Slough at Arboleda Drive	2	1	0	12
(58) Ingalsbe Slough at J17	3	0	0	5
(59) Owens Creek at Gurr Rd	3	0	0	5
(60) Sand Slough on Turner Island Rd. W of Merced Natl. Wildlife Refuge	0	0	0	1
(61) Stevinson Lower Lateral at intersection of Faith Home Rd	1	1	1	5
Totals	13	3	13	75
Total, All UC Davis Contract Data	20	3	24	97

Figure Z3-1

Zone 3 Monitoring Sites

Not all sites were monitored for the same length of time. Refer to Table Z3-1 for specifics.

Revised on 16 July 2007

Legend

● Monitoring Sites

— Highways

□ Counties

— Waterways

Land Use: FMMP 2004*

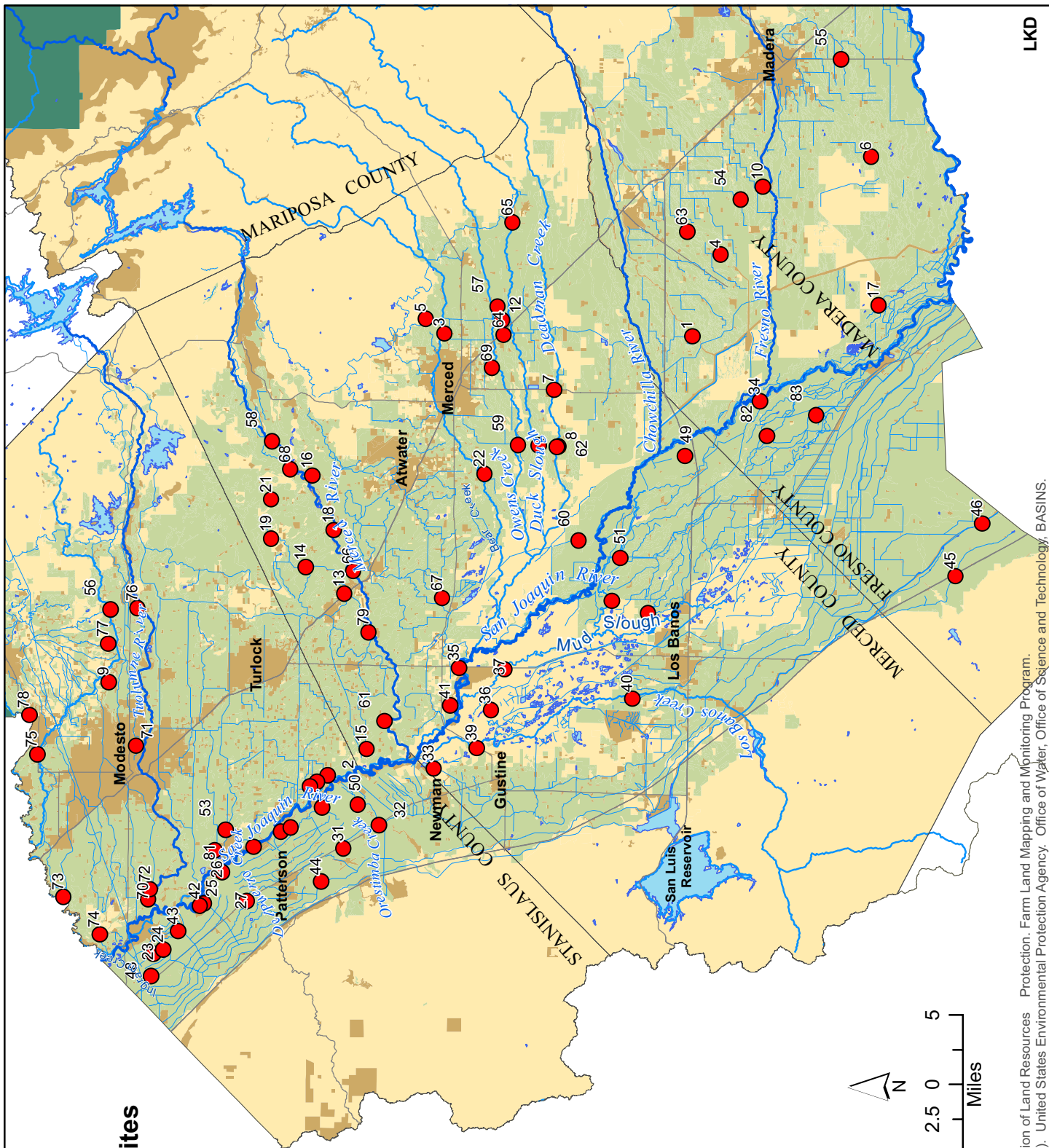
■ Agriculture- Grazing

■ Agriculture- Other

■ Urban/Other Land



5 2.5 0 5
Miles



Sources:

- Department of Conservation, 2004. Division of Land Resources Protection, Farm Land Mapping and Monitoring Program.

- US EPA, 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

LKD

Figure Z3-2

Toxicity to *Pimephales promelas*

Refer to Table Z3-1
for site-specific
monitoring
date ranges.

Revised on 16 July 2007

Legend

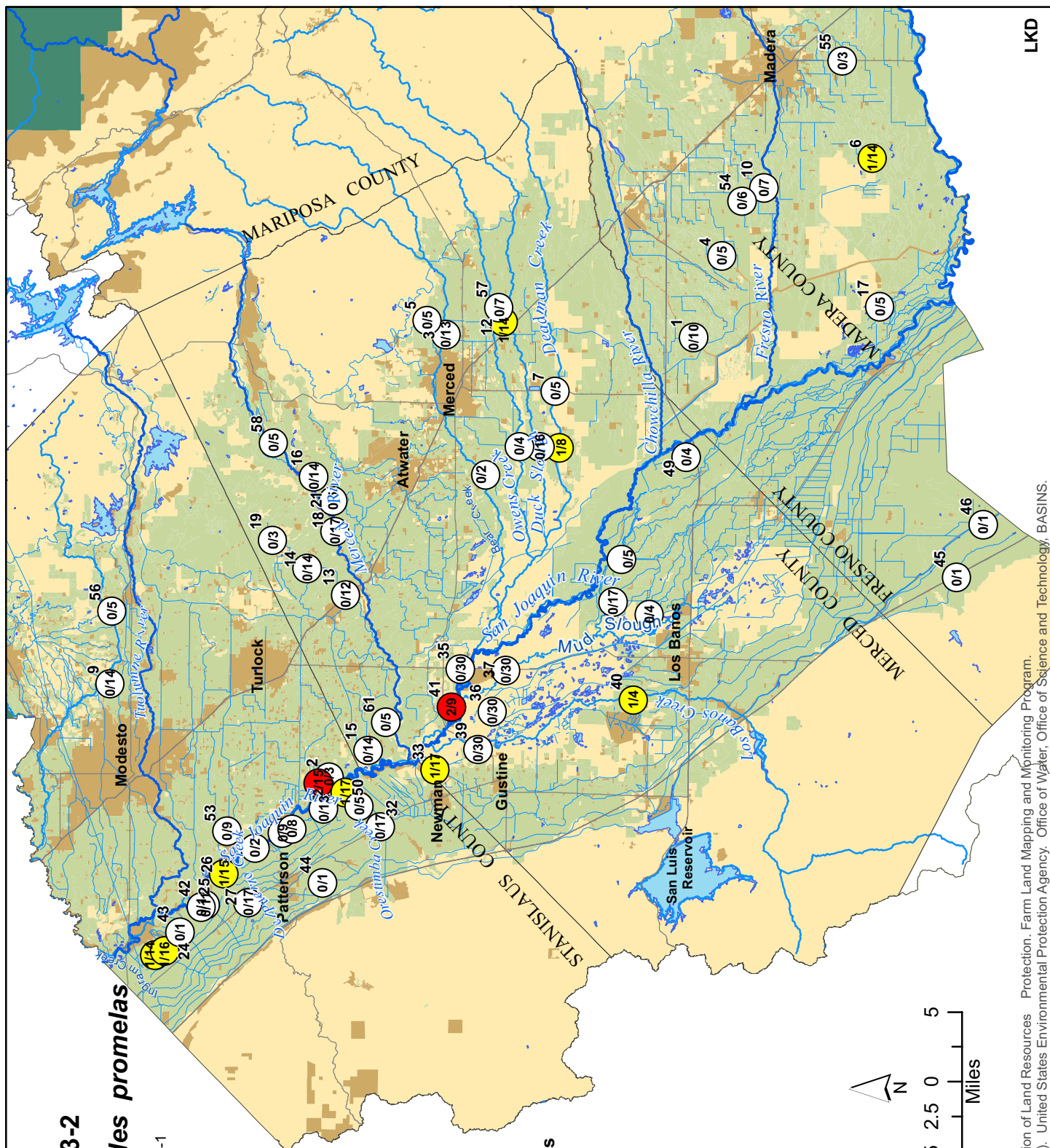
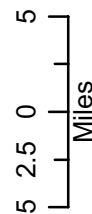
of Toxic Minnow Tests
Ratio = Toxic / Total Tests

- 0 Toxic Samples
- 1 Toxic Sample
- 2 Toxic Samples

- Highways
- Counties
- Waterways

Land Use: FMMP 2004*

- Agriculture- Grazing
- Agriculture- Other
- Urban/Other Land



Sources:

- Department of Conservation, 2004. Division of Land Resources - Protection, Farm Land Mapping and Monitoring Program.
- US EPA, 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

Figure Z3-3

Toxicity to *Ceriodaphnia dubia*

Refer to Table Z3-1
for site-specific
monitoring
date ranges.

Revised on 16 July 2007

Legend

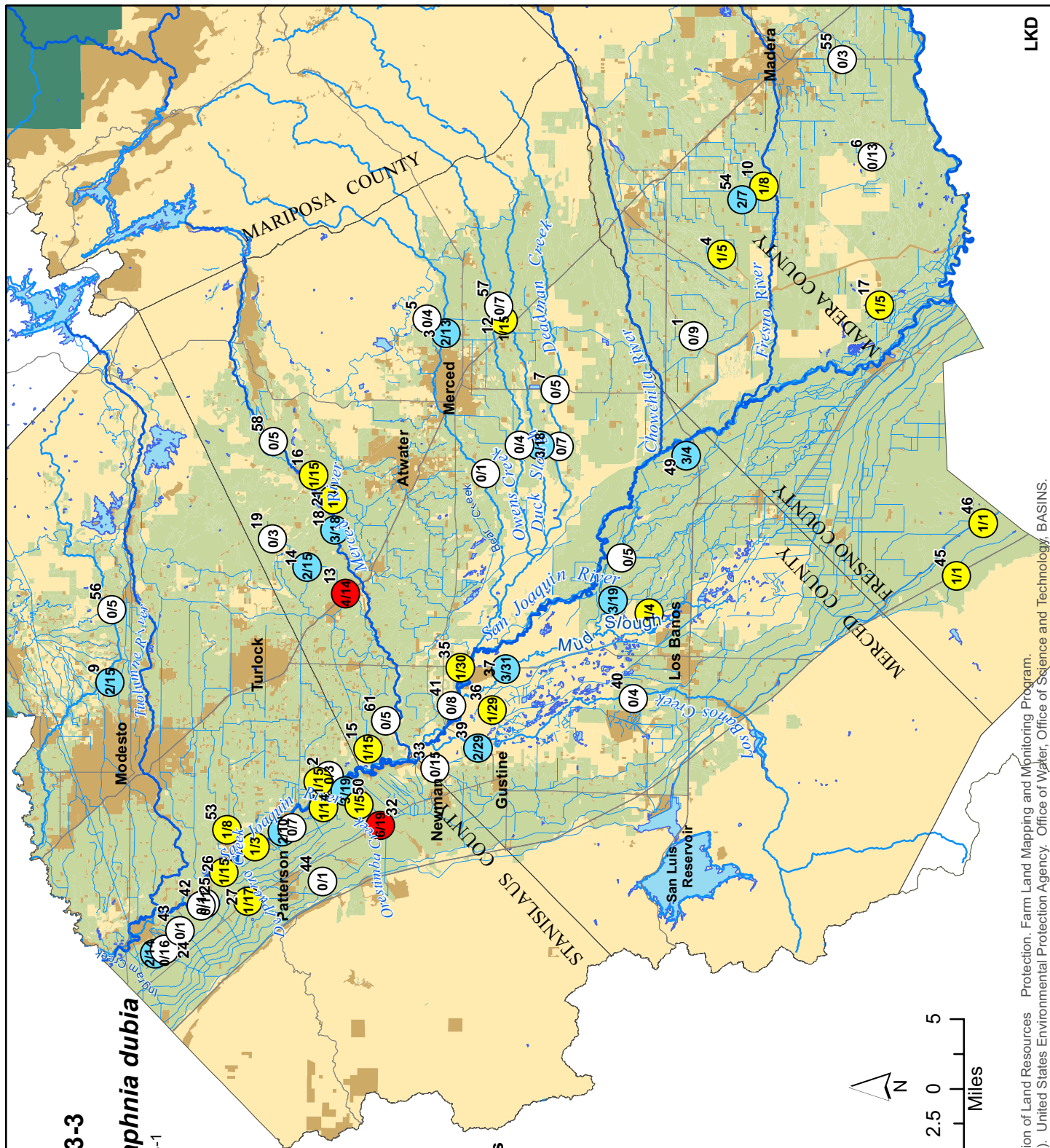
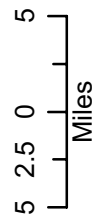
of Water Flea Tests
Ratio = Toxic / Total Tests

- 0 Toxic Samples
- 1 Toxic Sample
- 2 - 3 Toxic Samples
- 4 - 6 Toxic Samples

- Highways
- Counties
- Waterways

Land Use: FMMP 2004*

- Agriculture- Grazing
- Agriculture- Other
- Urban/Other Land



Sources:

- Department of Conservation, 2004. Division of Land Resources - Protection, Farm Land Mapping and Monitoring Program.
- US EPA, 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

Figure Z3-4

Toxicity to

Selenastrum capricornutum

Refer to Table Z3-1
for site-specific
monitoring
date ranges.

Revised on 16 July 2007

Legend

of Algae Tests

Ratio = Toxic / Total Tests

- 0 Toxic Samples
- 1 Toxic Sample
- 2 - 3 Toxic Samples
- 4 - 5 Toxic Samples

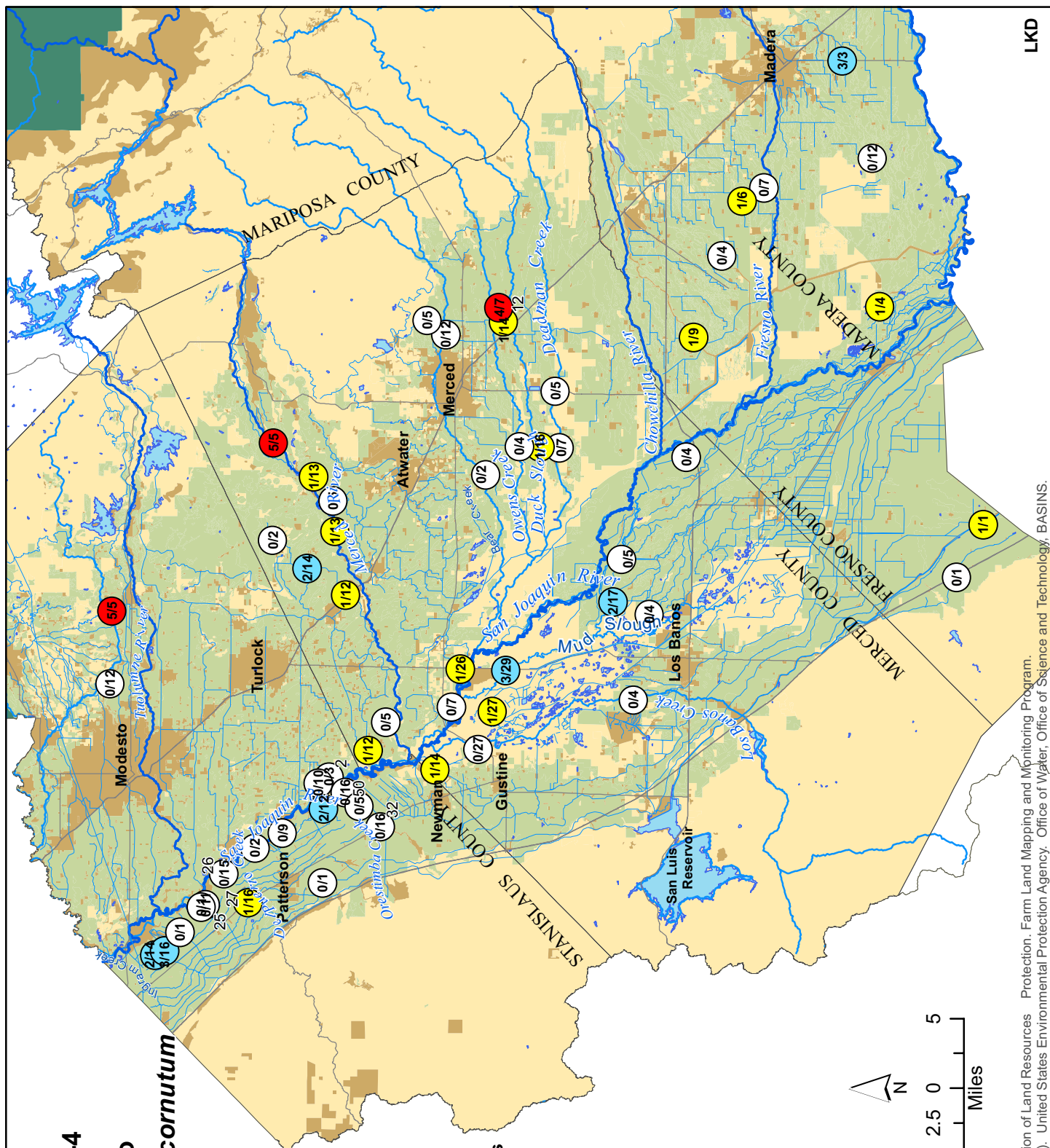
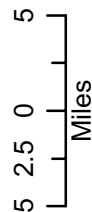
Highways

Counties

Waterways

Land Use: FMMP 2004*

- Agriculture- Grazing
- Agriculture- Other
- Urban/Other Land



Sources:

- Department of Conservation, 2004. Division of Land Resources Protection, Farm Land Mapping and Monitoring Program.
- US EPA, 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

Figure Z3-5

Toxicity to *Hyaella azteca*

Refer to Table Z3-1
for site-specific
monitoring
date ranges.

Revised on 16 July 2007

Legend

of Sediment Tests
Ratio = Toxic / Total Tests

- 0 Toxic Samples
- 1 Toxic Sample
- 2 - 3 Toxic Samples
- 4 - 5 Toxic Samples

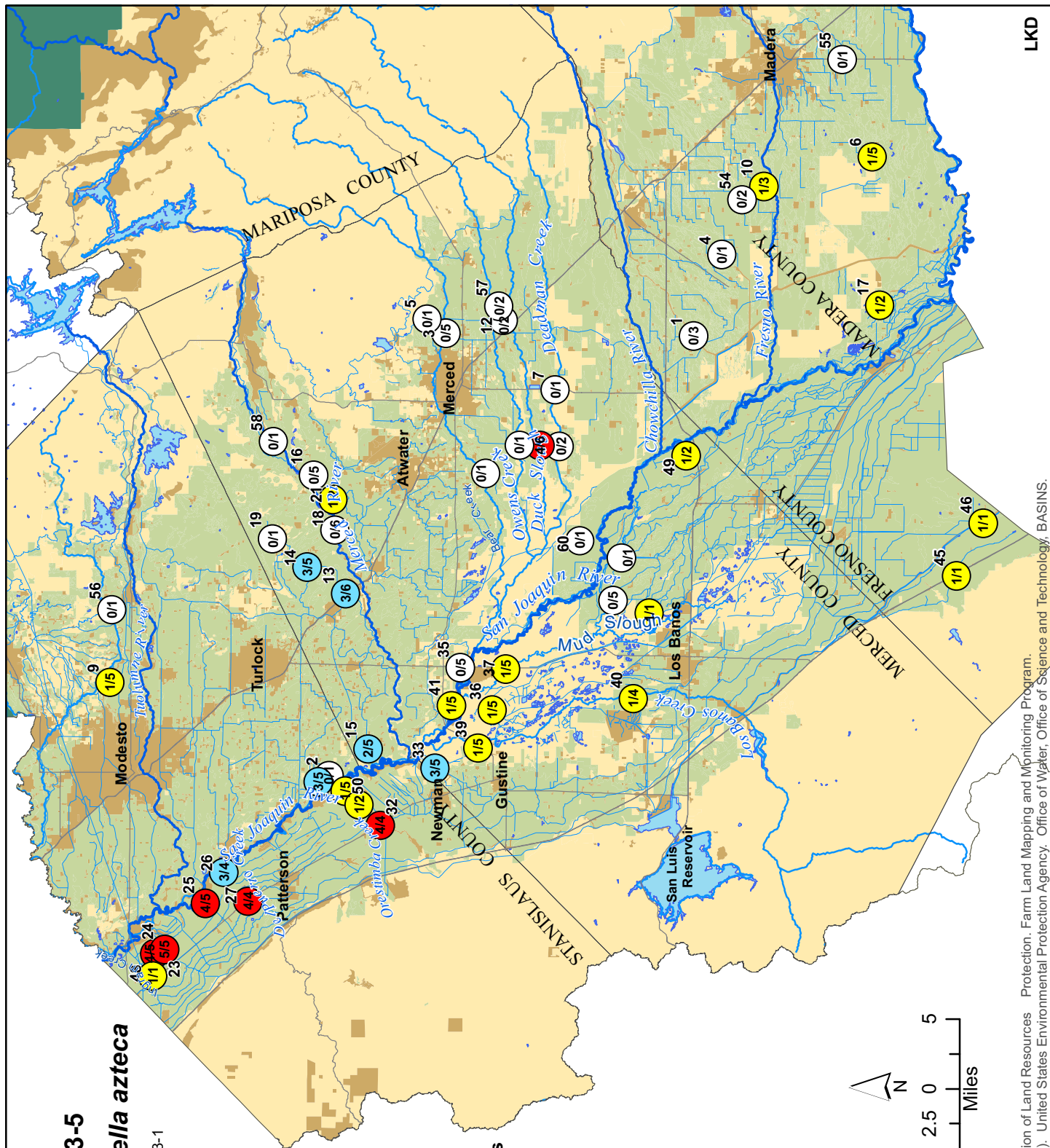
- Highways
- Counties
- Waterways

Land Use: FMMP 2004*

- Agriculture- Grazing
- Agriculture- Other
- Urban/Other Land



5 2.5 0 5
Miles



Sources:

- Department of Conservation, 2004. Division of Land Resources Protection, Farm Land Mapping and Monitoring Program.
- US EPA, 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

Figure Z3-7 Monitoring Results for Chlorpyrifos

Revised on 16 July 2007

*Note: There was only 1 Chlorpyrifos analysis conducted at several sites. Range of the number of analyses conducted per site is 1-31. Refer to Table Z3-1 for site-specific information.

Legend

of analyses >0.015 ug/L

- 0 - 1
- 2 - 5
- 7 - 9
- 15

Highways

Counties

Waterways

Land Use: FMMP 2004*

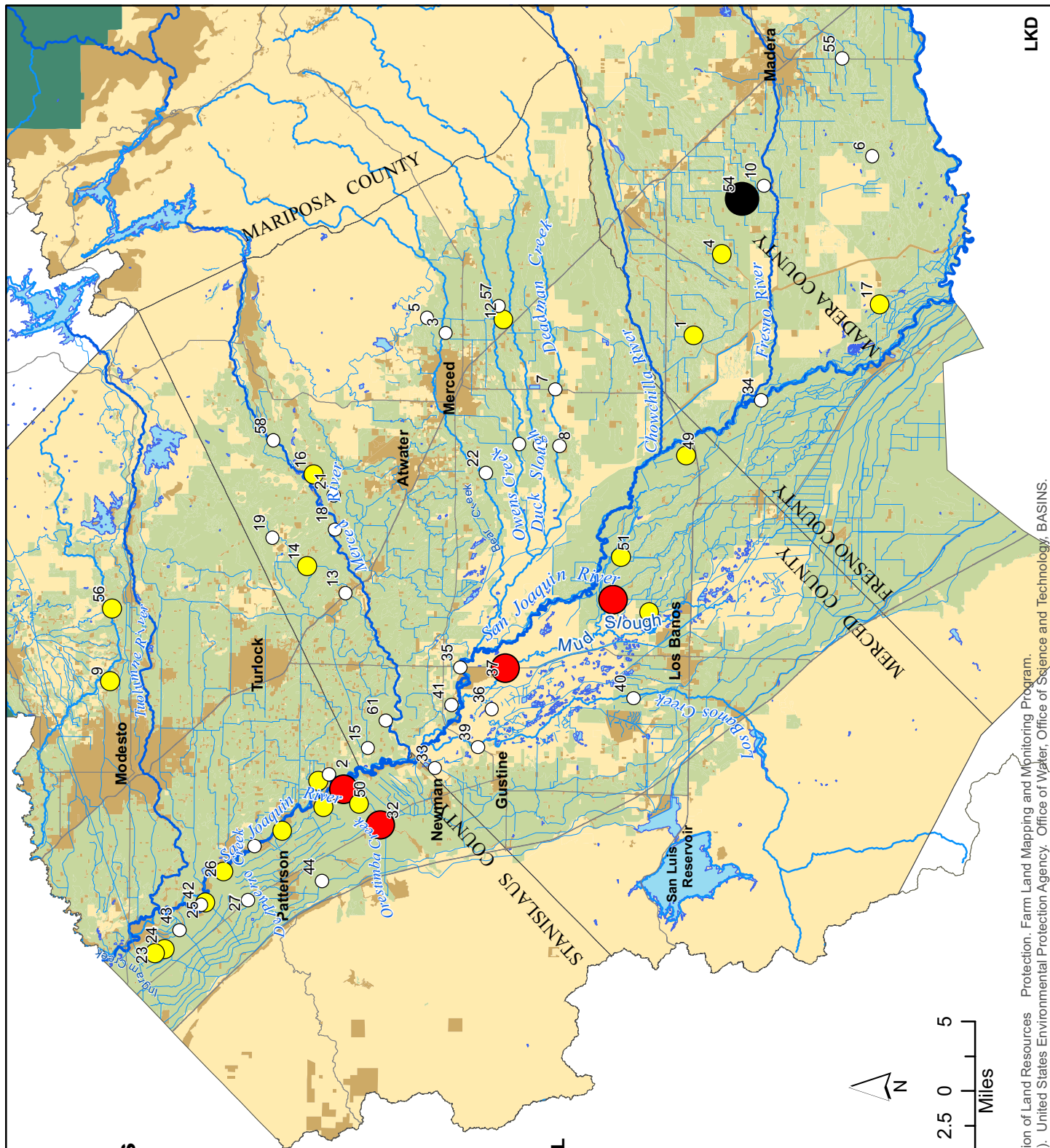
Agriculture-Grazing

Agriculture-Other

Urban/Other Land



5 2.5 0 5
Miles



Sources:

- Department of Conservation, 2004. Division of Land Resources Protection, Farm Land Mapping and Monitoring Program.
- US EPA, 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water, Office of Science and Technology, BASINS.

LKD

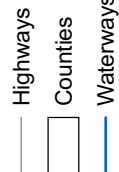
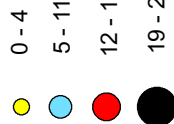
Figure Z3-8 Monitoring Results for *Escherichia coli*

Revised on 16 July 2007

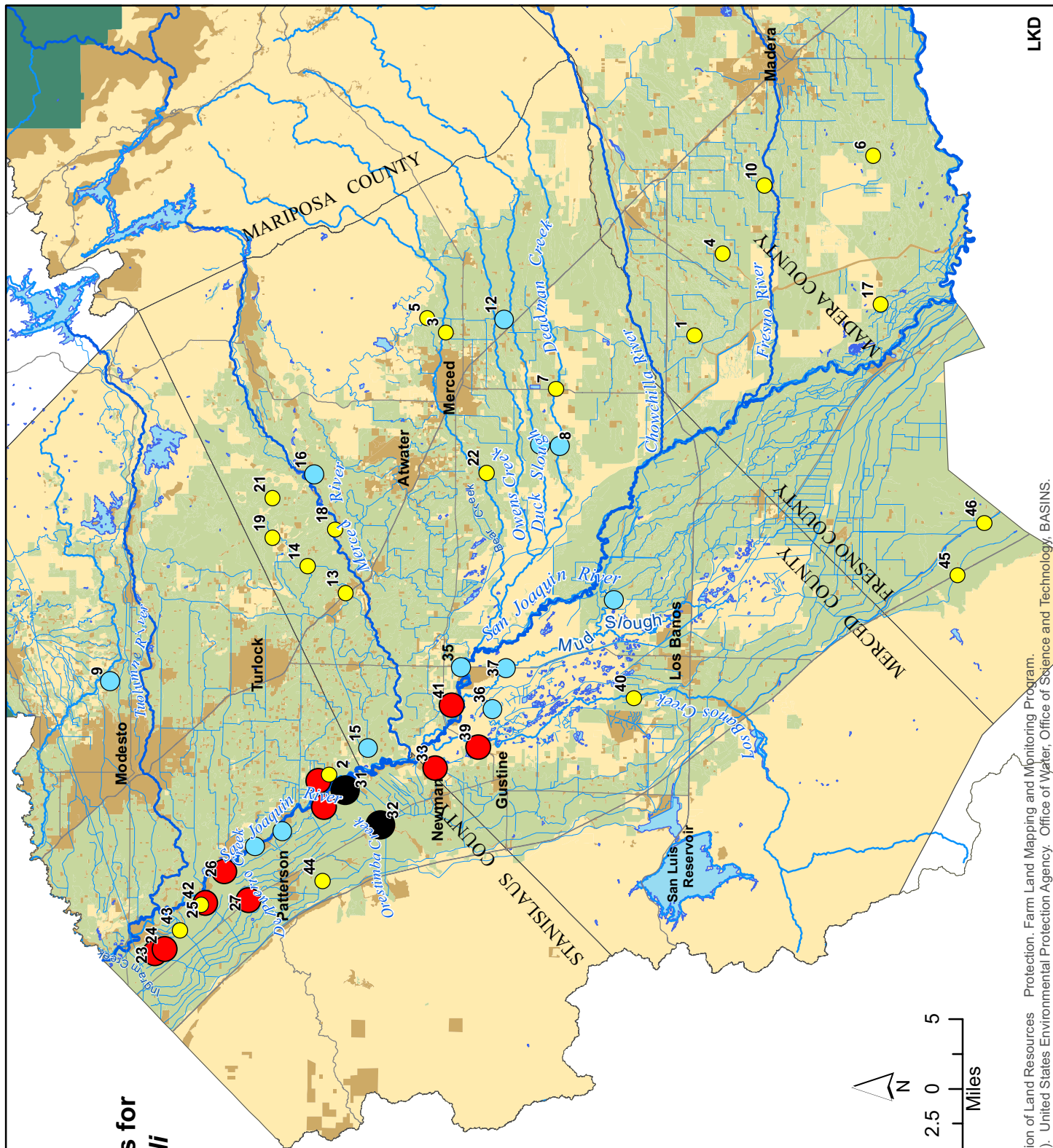
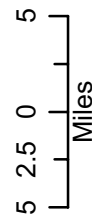
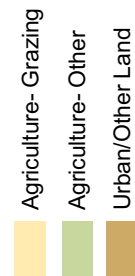
*Note: There was only
1 E. coli analysis
conducted at several sites.
Range of the number of analyses
conducted per site is 1-30.
Refer to Table Z3-1 for
site-specific information.

Legend

E. coli results
>235 MPN/100 mL



Land Use: FMMP 2004*



Sources:

- Department of Conservation, 2004. Division of Land Resources Protection, Farm Land Mapping and Monitoring Program.
- US EPA, 1998. River Reach File 3 (RF3). United States Environmental Protection Agency. Office of Science and Technology, BASINS.

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ZONE 4

Zone 4 Data Considerations

The review of data from Zone 4 varies from that of the other Zones for several reasons. The most significant of these is that water quality within Zone 4 is subject to water quality objectives and beneficial uses (standards) set forth in the Tulare Lake Basin Plan, not to those in the Sacramento and San Joaquin Rivers Basin Plan, which applies only to Zones 1, 2, and 3. Though some water quality objectives are the same in both basin plans (i.e., those determined by the designated beneficial use), standards unique to a specific water or specific basin plan apply only to that location.

Numeric objectives for electrical conductivity are a case in point. The Tulare Lake Basin Plan specifies numeric water quality objectives specific to very high quality reaches of the Kings, Kaweah, Tule and Kern Rivers. These objectives are as low as 100 $\mu\text{S}/\text{cm}$, which is much lower than the 900 $\mu\text{S}/\text{cm}$ of the recommended secondary maximum contaminant level (MCL) both basin plans incorporate by reference for all waters with the designated beneficial use of MUN. The specific numeric objectives are also much lower than the 700 $\mu\text{S}/\text{cm}$ agricultural recommended concentration cited in *Water Quality for Agriculture*, published by the Food and Agriculture Organization of the United Nations.

Where the Tulare Lake Basin Plan lacks a numeric objective for a particular waste constituent found in detectable concentrations in Zone 4, the Basin Plan's "Policy for Application of Water Quality Objectives" was utilized to evaluate exceedances to narrative water quality objectives. In this way, a comparison of waste constituent concentrations can be made with a screening value consistent with the appropriate narrative objective. For example, the Tulare Lake Basin Plan contains both numeric and narrative water quality objectives for pesticides. The narrative pesticide water quality objective, which does apply to chlorpyrifos state, in part: "Waters shall not contain pesticides in concentrations that adversely affect beneficial uses." In order to evaluate compliance with the narrative pesticide objective with respect to chlorpyrifos, the Policy for Application of Water Quality Objectives was utilized. To determine what the appropriate concentration is, the Policy requires a case-by-case consideration of, among other things, numerical criteria developed or published by other agencies for its relevance and appropriateness to the situation. In the case of chlorpyrifos, the Regional Water Board established a numeric standard in the Sacramento/San Joaquin Basin Plan following the full basin planning process, including peer review. Unless a particular situation within the Tulare Lake Basin can be determined to be substantially different from situations in the other basins, it is relevant and appropriate to use the numeric water quality objectives adopted by the Regional Water Board for water bodies in the Sacramento/San Joaquin Rivers Basin Plan to evaluate compliance with the narrative pesticide objective in the Tulare Lake Basin Plan.

Another reason for the different approach to a review and assessment for Zone 4 is due to the scarcity of monitoring data. There are several monitoring sites within Zone 4 for which fewer than 5 different sampling events took place within

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the three-year period. In many locations, sampling only occurred once or twice within the three-year period.

There can be a variety of reasons for this scarcity of monitoring data, including limitations caused by natural characteristics such as soil texture, low rainfall, and snowpack, as well as the different interpretations for monitoring programs utilized by Coalitions in Zone 4. The limited amount of data creates a limited ability to assess the water bodies and develop an understanding of baseline water quality conditions in Zone 4.

Monitoring data available for Zone 4 can be considered in conjunction with other information such as the identification of waterways, the amount of pesticide use, and field observations of potential return flows, to establish the need for additional scrutiny by both the Water Board and the Coalitions.

Zone 4 Description

The climate and soils of the Tulare Lake region contribute significantly to the tremendous agricultural production of the farmlands and to the diversity of crops grown. More than 250 varieties of crops and farm commodities are produced from approximately 3 million plus acres of irrigated agricultural lands within Zone 4. The generally arid climate (hot summers and mild winters with less than five inches of rainfall), coupled with fertile soils, allows for a variety of crops to be grown year round, or near year round in portions of Zone 4 (lettuce, potatoes, spinach, broccoli, carrots, sugar beets, cabbage, lemons, grapefruit, strawberries, and sod). Depending on rainfall events, irrigation of these crops also approaches year-round applications. This extended irrigation season coupled with the use of pre-planting irrigation (tomato, cotton, winter forage, and melons), post-harvest irrigation (nut crops, grapes, and various stone fruit), and application of water for frost protection (citrus), results in near year-round water use with a corresponding potential for agricultural runoff.

In 2005, the top ten commodities produced in Zone 4 based on dollar amounts (excluding livestock) were; grapes, almonds, citrus, cotton, pistachios, alfalfa, tomatoes, peaches, nectarines and corn silage. While cotton was the number one crop in many past years, grapes have recently outpaced cotton in terms of gross production receipts. More than ten percent of the irrigated acreage in California and about 12 percent of the three million irrigated acres in the region is planted in alfalfa. Alfalfa acreage in the region has been rising in recent years in response to the needs of the expanding dairy industry. Tulare County, in the heart of the region, is currently the nation's richest dairy county. In fact, the number one commodity for the entire zone based on dollar amounts was milk.

Table Z4-1, Pesticide Use in Zone 4, lists the primary crops by acreage that were grown in 2005 the four counties that comprise Zone 4. The table also references a selection of the types and quantity of pesticides that are recorded as being used for these crops (Department of Pesticide Regulation for 2005).

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**Table Z4-1
Pesticide Use in Zone 4***

FRESNO COUNTY			
CROP	ACREAGE	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Cotton	219,530	Bifenazate, Chlorpyrifos, Cyfluthrin, Ethephon, Endosulfan, Esfenvalerate, Docofol, Dimethoate, Diuron, Indoxacarb, Methamidophos, S-Metolachlor, Naled, Oxymyl, Oxyfluorfen, Pendimethalin, Prometryn, Propargite, S-Metolachlor, Thidazuron, Thiamethoxam, Trifluralin	1,014,144
2. Grapes	202,240	Buprofezin, Captan, Cryolite, Chlorpyrifos, Copper hydroxide, 2,4-D, Diazinon, Diuron, Ethephon, Fenamiphos, Glyphosate, Iprodione, Mancozeb, Myrothecium verruca, Oryzalin, Paraquat Dichloride, Phosmet, Propargite, Simazine, Sulfur, 1,3-Dichloropropene, Paraquat Dichloride, Methyl Bromide	9,940,440
3. Tomatoes	128,000	Chlorothalonil, Copper hydroxide, 1,3-Dichloropropene, Dimethoate, Endosulfan, Mancozeb, S-Metolachlor, Oxyfluorfen, Paraquat Dichloride, Sulfur	4,646,094
4. Almonds	88,400	Chlorpyrifos, Copper hydroxide, 2,4-D, Esfenvalerate, Flumioxazin, Iprodione, Maneb, Norflurazon, Oryzalin, Oxyfluorfen, Pendimethalin, Phosmet, Propargite, Simazine, Trifluralin, Ziram	461,497
5. Alfalfa	88,310	Benefin, chlorpyrifos, 1,3-Dichloropropene, Diuron, Endosulfan, Glyphosate, Hexazinone, Indoxacarb, Lambda-Cyhalothrin, Malathion, Methamidophos, Methomyl, Naled, Paraquat Dichloride, Pendimethalin, Trifluralin	186,137
6. Stone fruit	55,348	Chlorothalonil, Chloropicrin, Chlorpyrifos, Copper Hydroxide and Copper oxide, Diazinon, 1,3-Dichloropropene, 2,4-D, Glyphosate, Iprodione, Methidathion, Methyl Bromide, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Phosmet, Propargite, Ziram	527,262
7. Wheat	49,400	Bromozylin, 2,4-D, Dimethoate, Glyphosate, MCPA	
8. Corn/silage	38,260	Bifenthrin, Chlorpyrifos, Dimethoate, Glyphosate, Paraquat Dichloride, Propargite, S-Metolachlor	44,042
9. Melons	37,220	Carbaryl, Diazinon, 1,3-Dichloropropene, Endosulfan, glyphosate, Oxyfluorfen, Potassium N-Methyldithiocarbamate, Trifluralin	200,367
10. Citrus	35,660	Chlorpyrifos, Bromacil, Copper Hydroxide and Copper Oxide, 2,4-D, Diuron, Glyphosate, Simazine, Paraquat Dichloride, Thiabendazole, 1,3-Dichloropropene	392,201
FRESNO COUNTY TOTAL:			17,447,899
KINGS COUNTY			
CROP	ACREAGE	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Cotton	223,854	Ethephon, Endosulfan, Diuron, Thidiazuron, Thiamethoxam, Propargite, Esfenvalerate, S-metolachlor	225,167
2. Wheat (grain/silage)	83,584	Bromoxynil, 2,4-D, Dimethylamine Salt, Dimethoate, Glyphosate, MCPA	50,994
3. Corn/silage	65,502	Glyphosate, paraquat dichloride, dimethoate, bifenthrin, chlorpyrifos, propargite, S-metolachlor	109,503
4. Alfalfa	54,887	Chlorpyrifos, paraquat dichloride, glyphosate, pendimethalin, lambda-cyhalothrin, diuron, 1,3-Dichloropropene, malathion, trifluralin	103,807
5. Tomatoes	21,889	Chlorothalonil, Copper hydroxide, Dimethoate, Endosulfan, Mancozeb, S-Metolachlor, Oxyfluorfen, Paraquat Dichloride, Sulfur	906,638

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CROP	ACREAGE	CROP PESTICIDES	TOTAL POUNDS APPLIED
6. Stone Fruit	10,586	Ziram, Copper oxide, Methidathion, glyphosate, chlorothalonil, phosmet, methyl bromide, 2,4-D Dimethylamine salt, 1,3 Dichloropropene, Diazinon, Paraquat Dichloride, Propargite	98,098
7. Pistachios	9,690	Sulfur, oxyfluorfen, glyphosphate, oryzalin, copper hydroxide, thiophanate-methyl, permethrin	149,378
8. Almonds	9,275	Copper hydroxide, oryzalin, chlopyrifos, 2,4-D, Esfenvalerate, Oxyfluorfen, Simazine, Ziram	23,825
9. Walnuts	8,776	Methyl parathion, copper hydroxide, chlopyrifos, endosulfan, diflubenzuron, xylene	20,882
10. Oat Hay	6,695	MCPA, Dicamba	
TOTAL KINGS COUNTY:			1,690,591
TULARE COUNTY			
CROP	ACREAGE	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Corn/silage	147,300	Bifenthrin, Chlorpyrifos, Dimethoate, Glyphosate, Paraquat Dichloride, Propargite, S-Metolachlor	215,593
2. Citrus	109,533	Bromacil, Chlorpyrifos, Copper Hydroxide and Copper Oxide, 2,4-D, Diuron, Glyphosate, Simazine, Paraquat Dichloride, Thiabendazole, 1,3-Dichloropropene	1,190,416
3. Alfalfa	101,800	Chlorpyrifos, EPTC, diuron, indoxacarb, malathion, hexazinane, paraquat dichloride, methomyl, trifluralin	150,4289
4. Silage/small grains	95,200	Information not available	Not available
5. Grapes	65,035	Azoxystrobin, Cryolite, Chlorpyrifos, Copper Hydroxide, Cyprodinil, Copper Hydroxide, Diuron, 1,3-Dichloropropene, Ethephon, Fenamiphos, Mancozeb, Methomyl, Methyl Bromide, Oryzalin, Oxyfluorfen, Propargite, Paraquat Dichloride, Simazine, Sulfur	3,425,401
6. Cotton	50,665	Ethephon, Endosulfan, Diuron, Thidiazuron, Thiamethoxam, Dicofol, Propargite, Trifluralin	86,256
7. Stone fruit	41,702	Chloropicrin, Chlorpyrifos, Chlorothalonil, Copper Hydroxide & Copper Oxide, Diazinon, 1,3-Dichloropropene, 2,4-D, Glyphosate, Iprodione, Phosmet, Methyl Bromide, Methidathion, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Phosmet, Propargite, Simazine, Ziram	664,044
8. Wheat	34,500	2,4-D, Dicamba, Glyphosate, MCPA	23,601
9. Walnuts	30,670	Copper hydroxide, chlopyrifos, 1,3-Dichloroprene, Diflubenzuron, Diuron, Glyphosate, Nameb, Methyl Bromide, Methyl Parathion, Propargite, Xylene	264,804
10. Olives	14,616	Spinosad, copper hydroxide, simazine, diuron, glyphosate, Methidathion, Oxyfluorfen	48,740
TULARE COUNTY TOTAL:			6,069,283
KERN COUNTY			
CROP	ACREAGE	CROP PESTICIDES	POUNDS APPLIED
1. Alfalfa	155,000	Chlorpyrifos, paraquat dichloride, glyphosate, pendimethalin, lambda-cyhalothrin, diuron, molybdenum, 1,3Dichloropropene, Methamidophos	117,143
2. Cotton	134,585	Ethephon, Endosulfan, Diuron, Thidiazuron, Thiamethoxam, Propargite, Esfenvalerate, S-Metolachlor	114,553
3. Almonds	93,500	Copper hydroxide, oryzalin, chlopyrifos, 2,4-D, Esfenvalerate, Oryzalin, Oxyfluorfen, Simazine, Ziram	271,051
4. Wheat	85,000	Bromoxynil, 2,4-D, Dimethoate, Glyphosate, MCPA	15,901

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CROP	ACREAGE	CROP PESTICIDES	POUNDS APPLIED
5. Silage/forage	80,000	Glyphosate, paraquat dichloride, dimethoate, bifenthrin, chlorpyrifos, S-Metolachlor, Propargite	38,451
6. Grapes	72,000	Sulfur, cryolite, chlorpyrifos, Copper hydroxide, 2,4-D, Diazinon, Diuron, myrothecium verruca, Simazine1,3-dichloropropene, Paraquat Dichloride, Methyl Bromide	4,725,659
7. Pistachios	46,500	Sulfur, oxyfluorfen, glyphosphate, oryzalin, copper hydroxide, thiophanate-methyl, permethrin	787,322
8. Citrus	44,406	Chlorpyrifos, diuron, glyphosate, copper hydroxide, ximazine, buprofezin, bromacil	341,759
9. Grain	30,000	Information not available	Not available
10. Potatoes	23,390	Information not available	Not available
KERN COUNTY TOTAL:			64,411,839
Zone 4 Total: 89,619,612 lbs applied			

*Data from California Department of Pesticide Regulation, 2005 Pesticide Use Report

Monitoring Data

The data generated for Zone 4 is a combination of information obtained from the four subwatershed groups in the Southern San Joaquin Valley Water Quality Coalition, the Westlands Coalition sampling programs, monitoring for the Central Valley Water Board through the UC contract for the ILP, and SWAMP. The SWAMP monitoring sites were located in areas that represent agriculture. The UC Monitoring sites and SWAMP monitoring sites are heretofore referred to as Supplemental Monitoring sites.

Monitoring at most Coalition sites (MRP Plan sites) began during irrigation season of 2004, and most Supplemental Monitoring began in 2005. Overall, 74 different monitoring sites are identified as locations that represent agricultural land use for Zone 4. There are two additional monitoring sites (No. 7, ACOE Army Corps of Engineer Bridge and No. 18 Mill Creek) which were selected by the Kings River Subwatershed to represent background conditions on the Kings River. These monitoring locations are reportedly upstream of any influence by irrigated agriculture, and interpretations of the monitoring data from these sites are considered separately.

Sites No. 63 (Deer Creek), No. 67 (Kaweah River- Dam Outflow) and 74 (Tule River – Dam Outflow) were sampled by SWAMP. The Tule River and Kaweah River sites are located downstream of citrus and irrigated pasture for cattle. The Deer Creek site is located in the middle of a cattle-grazing operation that does not include irrigated pasture.

The data that is used in this 2007 Review includes only the monitoring data submitted in the Coalitions' Annual and Semi-Annual Monitoring Reports which included laboratory quality control information, and data generated through the University of California and SWAMP.

Table Z4-2, Summary of Monitoring Date Ranges, identifies the period of time from which monitoring data was collected at each site, as well as the number of samples collected for toxicity, pesticides or metals. The general locations of these monitoring sites are also identified on Figures Z4-1, MRP Plan Monitoring Sites, and Z4-2, Supplemental Monitoring Sites.

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Table Z4-2
Summary of Monitoring Date Ranges
2004 through 2006

Site ID	SiteName	Sub-watershed	Date Range	No. of Sediment Toxicity Tests	No. of Water Flea Tests	No. of Algae Tests	No. of Minnow Tests	No. of Pesticide Tests	No. of Metals Tests
1	Kaweah River	Kaweah River	07/22/2004 to 07/19/2006	2	8	8	8	5	4
2	St. Johns River	Kaweah River	07/22/2004 to 07/19/2006	2	8	8	8	6	5
3	Stone Corral I.D. Discharge	Kaweah River	07/22/2004 to 11/28/2005	2	6	6	6	4	3
4	Cross Creek at Highway 99 (Revised)	Kaweah River	10/26/2004 to 07/19/2006	2	7	7	7	6	5
5	Elk Bayou (New site for 2006)	Kaweah River	7/19/2006	0	1	1	1	1	1
6	Goshen Ditch (New site for 2006)	Kaweah River	7/19/2006	0	1	1	1	1	1
7	Army Corps of Eng. Bridge – BACKGROUND SAMPLE	Kings River	05/18/2006-10/03/2006	0	12	12	12	1*	1*
8	Deer Creek at Highway 99	Tule River		0	0	0	0	0	0
9	Deer Creek at Road 120	Tule River	08/16/2006 to 9/13/2006	1	2	2	2	2	2
10	Deer Creek at Road 176	Tule River	08/16/2006 to 9/13/2006	1	2	2	2	2	2
11	Deer Creek at Road 208	Tule River	3/28/2005	0	1	1	1	0	0
12	Kings River at Fresno Weir	Kings River	7/6/2004	0	1	1	1	0	0
13	Kings River at Jackson Avenue**	Kings River	07/06/2004 to 08/09/2004	0	0	0	0	0*	0*
14	Kings River at James Bypass	Kings River	05/17/2006 to 11/19/2006	2	4	4	4	0*	0*
15	Kings River at Lemoore Weir	Kings River	07/06/2004 to 10/19/2006	3	20	20	20	4*	4*
16	Kings River at Manning	Kings River	08/08/2004 to 10/19/2006	3	22	22	22	4*	4*
17	Main Drain Canal near Highway 46	Kern River	8/16/2004 to 8/30/2006	8	9	9	9	4	9
18	Mill Creek – BACKGROUND SAMPLE	Kings River	05/18/2006 to 06/21/2006	0	7	7	7	0	1*
19	Poso Creek at Highway 99	Kern River	NA	0	0	0	0	0	0
20	Tule River at McCarthy Check	Tule River	08/10/2004 to 1/17/2005	2	2	2	2	0	0
21	Tule River - North Fork - at 144	Tule River	08/16/2006 to 9/13/2006	1	2	2	2	2	2

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Site ID	SiteName	Sub-watershed	Date Range	No. of Sediment Toxicity Tests	No. of Water Flea Tests	No. of Algae Tests	No. of Minnow Tests	No. of Pesticide Tests	No. of Metals Tests
22	Tule River at Road 92	Tule River	08/16/2006 to 9/13/2006	1	2	2	2	2	2
23	Tule River at Woods-Central Ditch Diversion	Tule River	07/12/2004 to 1/17/2005	2	3	3	3	0	0
24	White River	Kern River	04/12/06	1	1	1	1	1	1
25	White River at Road 128	Kings River	NA	0	0	0	0	0	0
26	White River at Road 208	Kings River	NA	0	0	0	0	0	0
27	Gale Ave./San Luis Canal Intake	Westlands	03/27/2002 to 4/18/2002	1	1	1	1	0	0
28	Interstate 5/Arroyo Pasajero	Westlands	03/27/2002 to 4/18/2002	1	1	1	1	0	0
29	Interstate 5/Panoche Silver Cre	Westlands	3/14/2002 to 04/04/2002	2	2	2	2	0	1
30	Panoche-Silver Creek at Belmont Avenue	Westlands	4/4/2002	1	1	1	1	0	0
	SUBTOTALS		NA	38	126	126	126	45	48
31	Button Ditch on Ave 368 west of Alta Ave	Kings River	07/22/2004 to 8/19/2005	3	6	6	6	7	6
32	Calloway Canal at Hwy 46	Kern Tulare	07/20/2004 to 08/16/2004	1	3	3	3	3	3
33	Cantua Creek at South Stanislaus Ave.	Westlands	02/28/2006 to 03/01/2006	0	2	2	2	3	2
34	Deer Creek @ Alila Ave.	Tule River	3/24/2005	1	0	0	0	0	0
35	Ditch on S. side of Utica Ave.	Kings River	03/24/2005 to 03/4/2006	3	0	0	0	0	0
36	Drain to Fink Ditch at Central Ave	Kings River	06/20/2005 to 8/19/2005	1	4	4	4	4	0
37	Drain to Wooten Cr along Hill Rd at Wooten Cr	Kings River	07/20/2005 to 8/19/2005	1	1	1	1	4	0
38	Elbow Creek on Rd 112 N of Visalia	Kaweah River	01/27/2005 to 8/18/2005	2	2	2	2	6	0
39	Elk Bayou abv Tule R Channel at Road 96	Kaweah River	07/21/2005 to 8/18/2005	1	3	3	3	4	0
40	Farmer's Ditch @ Rt. 137 (Tulare Ave)	Kaweah River	3/24/2005 to 8/18/2005	2	0	0	0	0	0
41	Fresno Slough at Huntsman Ave.	Kings River	01/15/2006 to 03/01/2006	0	3	3	3	3	0
42	Kaweah River at Rd. 168	Kaweah River	NA	0	0	0	0	0	0
43	King Ditch @ Ave 368 & Rd. 60	Kings River	3/25/2005 to 8/19/2005	2	0	0	0	0	0
44	Kings River at Jackson Ave Bridge	Kings River	07/20/2004 to 08/16/2004	0	3	3	3	1	3
45	Kings River at Reed Ave	Kings River	NA	0	0	0	0	6	7
46	Knestirc Ditch @ Rt. 201 (Ave. 400)	Kings River	3/25/2005 to 8/19/2005	2	0	0	0	0	0
47	Los Gatos Creek at El Dorado Ave.	Westlands	NA	0	0	0	0	0	0
48	Melga Canal at Jersey Ave	Kaweah River	06/20/2005 to 08/01/2005	1	4	4	4	4	4

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Site ID	SiteName	Sub-watershed	Date Range	No. of Sediment Toxicity Tests	No. of Water Flea Tests	No. of Algae Tests	No. of Minnow Tests	No. of Pesticide Tests	No. of Metals Tests
49	Mill Creek at Road 168	Kaweah River	03/24/2005 to 08/18/2005	2	0	0	0	0	0
50	Murphy Slough @ Elm	Kings River	03/25/2005 to 8/18/2005	2	0	0	0	0	0
51	Near Kings River at Reed Ave	Kings River	3/25/2005	1	0	0	0	0	0
52	Peoples Ditch at Elder Ave	Kings River	06/20/2005 to 08/19/2005	1	4	4	4	4	4
53	St. Johns River at Road 108	Kaweah River	07/21/2005 to 8/01/2005	0	4	4	4	4	4
54	Stinson Ditch @ Kamm	Kings River	3/25/2005 to 3/4/2006	3	0	0	0	0	0
55	Tule River at Poplar Ave	Tule River	06/20/2004 to 8/16/2004	1	2	2	2	6	2
56	Turner Ditch @ Marks (aka 22nd Ave)	Kings River	03/25/2005 to 8/19/2005	2	0	0	0	0	0
57	Unnamed Drain along Utica Ave.	Kings River	NA	0	0	0	0	0	0
58	West Reedley Ditch at East Adams Ave	Kings River	07/22/2004 to 8/17/2004	1	2	2	2	3	2
59	Bates Slough	Kaweah River	08/30/2005 to 01/22/2007	0	6	6	6	0	2
60	Cross Creek	Kaweah River	6/27/2006 to 01/29/2007	0	3	3	3	0	0
61	Cross Creek_Houston Ave	Kaweah River	6/27/2006 to 01/29/2007	0	1	1	1	0	0
62	Cross Creek	Kaweah River	6/27/2006 to 01/29/2007	0	1	1	1	0	0
63	Deer Creek	Tule River	08/30/2005 to 01/22/2007	0	10	10	10	0	0
64	Deer Creek and Hwy 65	Tule River	08/30/2005 to 01/22/2007	0	4	4	4	0	0
65	Deer Creek; Road 192 and Ave. 96	Tule River	08/30/2005 to 01/22/2007	0	7	7	7	0	0
66	Deer Creek at Pixley wildlife refuge	Tule River	08/30/2005 to 01/22/2007	0	7	7	7	0	0
67	Kaweah River - Dam outflow	Kaweah River	06/27/2006 to 01/29/2007	0	4	5	4	0	0
68	Kaweah River at Rd. 196 North of Hwy 198	Kaweah River	06/27/2006 to 01/29/2007	0	4	5	4	0	0
69	N. Fork Tule River	Tule River	08/30/2005 to 01/22/2007	0	6	6	6	0	0
70	Outside Creek_west of Exeter	Kaweah River	06/27/2006 to 01/29/2007	0	3	3	3	0	0
71	Packwood Creek	Kaweah River	06/27/2006 to 01/29/2007	0	3	3	3	0	0
72	Porter Slough	Tule River	08/30/2005	0	2	2	2	0	0

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Site ID	SiteName	Sub-watershed	Date Range	No. of Sediment Toxicity Tests	No. of Water Flea Tests	No. of Algae Tests	No. of Minnow Tests	No. of Pesticide Tests	No. of Metals Tests
			to 10/23/2006						
73	St. John's River	Kaweah River	06/27/2006 to 01/29/2007	0	3	3	3	0	0
74	Tule River - Dam Outflow	Tule River	08/30/2005 to 01/22/2007	0	10	10	10	0	0
75	Elk Bayou	Kaweah River	08/30/2005 to 01/22/2007	0	5	5	5	0	0
76	Tule River	Tule River	08/30/2005 to 01/22/2007	0	6	8	6	0	0
	SUBTOTALS			33	128	132	128	62	39
	TOTALS			71	254	258	254	107	87

Shaded = Sample sites used in Coalition monitoring

* MRP pesticides and metals – site monitored more frequently for toxaphene and molybdenum only

** Jackson Avenue site monitored for flow, conductivity, toxaphene, and molybdenum only

AQUATIC AND SEDIMENT TOXICITY. As discussed in the Introduction to this 2007 Review, the three different water toxicity test species react differently to different types of stressors. In some cases, the same stressor will affect two species, but it will require different concentration levels for each. For example, chlorpyrifos concentrations can affect both the *Pimephales promelas* (fathead minnow) species as well as the *Ceriodaphnia* (water flea) species, although the concentrations that cause an effect are generally orders of magnitude higher for fathead minnow, as opposed to the water flea.

This difference in organism response to dose and contaminant means that the mortality to more than one species within the same sample indicates the presence of more than one contaminant of concern, or potentially a single stressor of sufficiently high concentration to affect the least sensitive of the species as well as the most sensitive. In Zone 4, significant toxicity in water column tests did occur in to up to three water column species (as well as sediment toxicity) at the monitoring locations identified in Table Z4-3, Toxicity Test Sites with Mortality in Multiple Species.

Table Z4-3
Toxicity Test Sites with Mortality in Multiple Species

Site ID	Site Name	Site ID	Site Name
3	Stone Corral (minnow, flea, algae, sediment)	63	Deer Creek (minnow & algae)
15	Kings River at Lemoore Weir	64	Deer Creek at 65 (minnow & algae)
16	Kings River at Manning (minnow & algae)	65	Deer Creek at 192 (minnow, & algae)
17	Main Drain Canal near Hwy 46 (algae and sediment)	67	Kaweah River – Dam outflow (minnow & algae)
20	Tule River at McCarthy Check (algae and sediment)	69	North Fork Tule River (minnow & algae)
31	Button Ditch at 368 (minnow, flea & algae)	73	St. John's River (minnow & algae)

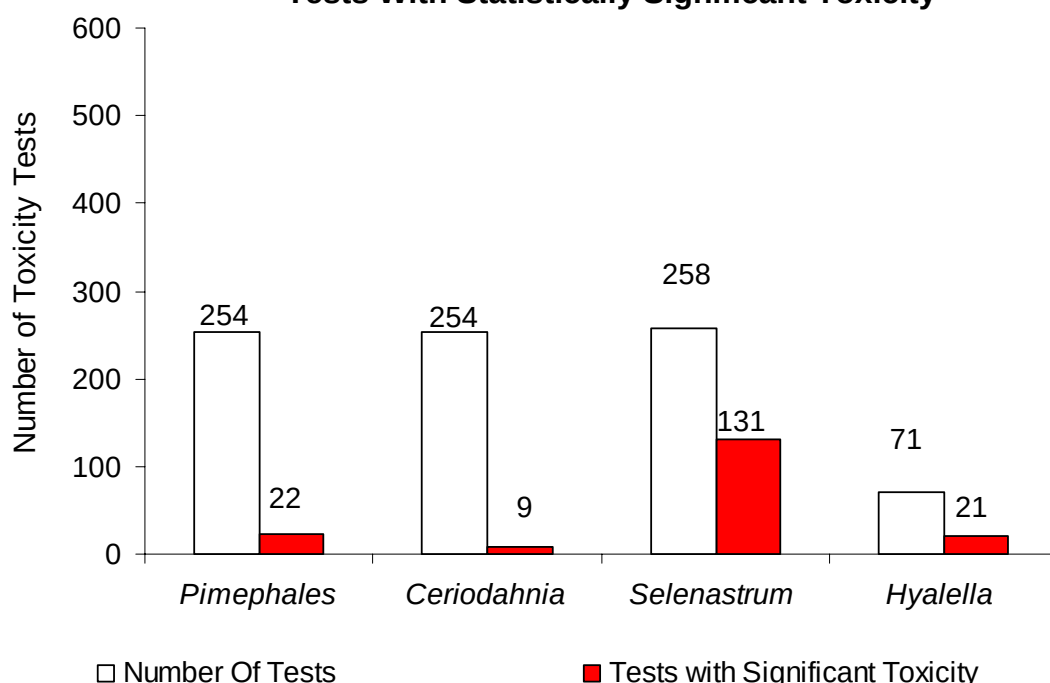
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Site ID	Site Name	Site ID	Site Name
39	Elk Bayou at 96 (minnow & flea)	74	Tule River – Dam outflow (minnow, algae)
41	Fresno Slough (flea & algae)	75	Elk Bayou (flea, algae)
59	Bates Slough (flea & algae)		

Shaded = Sample sites used in Coalition monitoring

Figure Z4-3 shows the number of tests with significant toxicity for all four species as compared to the total number of tests conducted. These tallies in Figure Z4-3 include the measurements taken at two monitoring sites that are considered 'Background Sites'. Sample Site #7 (ACOE) and Sample Site #18 (Mill Creek) are sites selected by the Coalition to represent water quality conditions without the influence of irrigated lands. The following sections discuss the results for each of the toxicity species, as well as possible causes for identified toxicity.

**Figure Z4-3
Tests With Statistically Significant Toxicity**



Pimephales promelas (fathead minnow). Mortality in fathead minnow is generally associated with sensitivity to ammonia, although high concentrations insecticides, or combinations of various insecticides at lower concentrations of insecticides will also result in fathead minnow mortality. Table Z4-4, Monitoring sites with *Pimephales promelas* Toxicity, identifies the monitoring sites where the fish toxicity was found, as well as the number of tests that exhibit different ranges of mortality, described as percent difference from laboratory control. The approximate locations of these sites are depicted in Figure Z4-4, Toxicity to *Pimephales promelas*

Overall, throughout Zone 4, about 9.4% of the number of samples (22 out of 235) tested for fathead minnow toxicity did demonstrate significant toxicity. Furthermore, toxicity to the fathead minnow was found in 31% of the sample sites from which fathead minnow toxicity tests were collected. These tallies

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exclude the fathead minnow tests conducted on the two background sample sites, No. 7 and No. 18. Mortality to fathead minnow was found in both of these Kings River background sample sites, one time each.

Table Z4-4
Monitoring Sites with Toxicity to *Pimephales promelas*

Site ID	Site Name	Sample Type	No. Samples (including non-toxic)	Sub-watershed	No. of Tests and Percent Reduction as Compared to Laboratory Control			
					Up to 20	20-50	> 50	Totals
1	Kaweah River	MRPPlan	8	Kaweah River	0	2	0	2
3	Stone Corral	MRPPlan	6	Kaweah River	0	0	1	1
5	Elk Bayou	MRPPlan	1	Kaweah River	0	0	1	1
7	ACOE – BACKGROUND SAMPLE	Coalition	12	Kings River	0	1	0	1
11	Deer Creek at Rd 208	MRPPlan	1	Tule River	0	0	1	1
15	Kings River at Lemoore Weir	MRPPlan	20	Kings River	1	0	0	1
16	Kings River at Manning Ave.	MRPPlan	22	Kings River	0	1	0	1
18	Mill Creek – BACKGROUND SAMPLE	Coalition	7	Kings River	1	0	0	1
21	Tule River at North Fork	MRPPlan	2	Tule River	0	1	0	1
31	Button Ditch	Supplemental	6	Kings River	1	0	0	1
39	Elk Bayou above channel	Supplemental	3	Kaweah River	1	0	0	1
63	Deer Creek	Supplemental	10	Tule River	0	1	0	1
64	Deer Creek & Hwy 65	Supplemental	4	Tule River	0	1	0	1
65	Deer Creek, Road 192	Supplemental	7	Tule River	0	1	0	1
75	Elk Bayou	Supplemental	5	Kaweah River	0	1	0	1
67	Kaweah River – dam outflow	Supplemental	4	Kaweah River	1	0	0	1
73	St. John's River	Supplemental	3	Kaweah River	1	0	0	1
69	N. Fork Tule River	Supplemental	6	Tule River	0	1	1	2
74	Tule River – Dam outflow	Supplemental	10	Tule River	1	1	0	2
		TOTALS:	137		7	11	4	22

Shaded = Sample sites used in Coalition monitoring

The magnitude of toxicity to fathead minnow was predominantly in the 20-50% mortality range, which does not generally result in a toxicity identification evaluation (TIE), but may have trigger follow-up monitoring to interpret the persistence of the toxicity in the environment. This report does not consider if the follow-up monitoring was conducted, and therefore does not evaluate the persistence factor. TIE information was not available for the two monitoring test results that had 50% or greater mortality.

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Both fathead minnow and the *Ceriodaphnia dubia* (water flea) species are sensitive to insecticides, although higher concentrations of pesticides are required to induce mortality with the fathead minnow than the flea. For this reason, it is interesting to note that there is a greater number of monitoring sites with demonstrated fathead minnow toxicity than to the water flea. This information indicates the presence of one or more stressors that would affect the fathead minnow to a greater extent than the water flea. One such stressor that might do this could be ammonia. More information, such as TIE analysis, is needed to verify this assumption, or to otherwise identify the cause of fathead minnow toxicity.

Ceriodaphnia dubia (water flea). The water flea species is generally used in water quality testing to indicate the presence of insecticides. Within the Central Valley, mortality of the water flea is associated with non-polar organic compounds, such as the organophosphate pesticides diazinon or chlorpyrifos. Water flea mortality could also result from use of other insecticides or insecticide combinations, including the pyrethroids, which are replacement pesticides for organophosphates.

Overall, throughout Zone 4, about 3.8% of the samples tested (9 out of 235) for water flea toxicity did demonstrate significant toxicity. Furthermore, toxicity to water flea was found in greater than 14.5% of the monitoring sites used in Zone 4. These tallies exclude the fathead minnow tests conducted on the two background sample sites, No. 7 and No. 18, although there was no toxicity found in either of the background sample sites.

Table Z4-5, Toxicity to *Ceriodaphnia dubia*, identifies the monitoring sites where toxicity to water flea was found, as well as the ranges of mortality described as percent difference from laboratory control.

Table Z4-5
Monitoring Sites with *Ceriodaphnia dubia* Toxicity

					No. of Tests with Percent Reduction - Compared to Laboratory Control			
Site ID	Site Name	Sample Type	No. Samples (including non-toxic)	Sub-watershed	Up to 20%	20-50%	> 50%	Total
3	Stone Corral	MRP Plan	6	Kaweah	0	0	1	1
16	Kings River @ Manning	MRP Plan	22	Kings	0	1	0	1
29	I-5 Panoche Silver Creek	MRP Plan	2	Westlands	0	0	1	1
31	Button Ditch	Supplemental	6	Kings	0	0	1	1
39	Elk Bayou	Supplemental	3	Kaweah	0	0	1	1
41	Fresno	Supplemental	3	Kings	0	0	1	1

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					No. of Tests with Percent Reduction - Compared to Laboratory Control			
Site ID	Site Name	Sample Type	No. Samples (including non-toxic)	Sub-watershed	Up to 20%	20-50%	> 50%	Total
	Slough							
59	Bates Slough	Supplemental	6	Kaweah	0	0	2	2
75	Elk Bayou	Supplemental	5	Kaweah	0	0	1	1
		Total:	53		0	1	8	9

Shaded = Sample site used in Coalition monitoring

Table Z4-5, Monitoring Sites with *Ceriodaphnia dubia* Toxicity indicates that where significant toxicity to water flea is found, it is generally of high in magnitude. Eight of the nine toxic samples resulted in mortality greater than 50%. Although there is a greater percentage of sites that are toxic to the fathead minnow, the magnitude of toxicity for water flea is in the higher range of mortality. This could be an indicator that some of the fathead minnow mortality can be attributed to ammonia, as opposed to insecticides and provide a clue to the source of the toxicity.

Three of the Supplemental monitoring sites listed in Table Z4-5, Monitoring Sites with *Ceriodaphnia dubia* Toxicity, resulted in complete mortality (100%) of all water flea. Toxicity identification evaluations (TIE) were conducted on each site. The summary of the TIE information is as follows:

1. Site #31 on 22 July 2004, Button Ditch (0% survival) TIE indicated non-polar organic, and pesticide detections for chlorpyrifos was 0.284 ug/L and dimethoate at 0.046 ug/L)
2. Site #39 on 1 August 2005, Elk Bayou (0% survival) TIE indicated nonpolar organics with chlorpyrifos at 0.27 ug/L and dimethoate at 0.046 ug/L)
3. Site #41 on 15 January 2006, Fresno Slough (0% survival), TIE indicated non-polar organics tied to organophosphate pesticides. There were also multiple pesticides detected in the sample including chlorpyrifos (0.138 ug/L), disulfoton (0.021 ug/L), diuron (0.012). Also detected in the TIE procedure was cyfluthrin at 0.021 ug/L and dioxathion at 0.13 ug/L)

Selenastrum capricornutum (algal species). Toxicity to this species can be caused by algaecides, and by metal compounds that are both naturally present, or applied for weed control. Herbicides, such as diuron, simazine, glyphosate, cyanazine, etc., as well as copper compounds, are periodically applied to canals and canal banks throughout the Central Valley to control algae. The correct application of these pesticides in irrigation canals is to be conducted under conditions specified by permit, with holding time considerations, and the water is to be discharged only when the herbicide is no longer present in toxic amounts.

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Overall, throughout Zone 4, about 50% of the samples tested (119 out of 239) for algae toxicity demonstrated significant toxicity. Furthermore, toxicity to algae toxicity was found in 56% of the monitoring sites used in Zone 4. These tallies exclude the fathead minnow tests conducted on the two background sample sites, No. 7 and No. 18. In fact, statistically significant algae toxicity was also found in both of these background sites, with 10 out of 12 samples toxic at site No. 7, and two out of seven toxic samples at site No. 18.

Table Z4-6, Monitoring Sites with *Selenastrum capricornutum* Toxicity, identifies the monitoring sites where these samples were collected, as well as the number of tests that exhibit different ranges of reduced growth, described as percent difference from laboratory control. The approximate locations of these monitoring sites are identified in Figure Z4-6, Toxicity to *Selenastrum capricornutum*.

Table Z4-6
Monitoring Sites with *Selenastrum capricornutum* Toxicity

Site ID	Site Name	Sample Type	No. Samples	Sub-watershed	No. of Tests with Percent Reduction as Compared to Laboratory Control			
					Up to 20%	20-50%	> 50%	Total
3	Stone Corral	MRPPlan	6	Kaweah	0	0	1	1
7	ACOE (Army Corps of Eng) Bridge – BACKGROUND SAMPLE	Coalition	12	Kings	2	8	0	10
12	Kings River at Fresno Weir	MRPPlan	1	Kings	0	1	0	1
14	Kings River At James Bypass	MRPPlan	4	Kings	0	4	0	4
15	Kings River at Lemoore	MRPPlan	20	Kings	5	12	0	17
16	Kings River at Manning	MRPPlan	22	Kings	6	8	0	14
17	Main Drain Canal	MRPPlan	9	Kern	1	1	0	2
18	Mill Creek – BACKGROUND SAMPLE	Coalition	7	Kings	1	1	0	2
20	Tule River at McCarthy Check	MRPPlan	2	Tule	1	0	0	1
31	Button Ditch	Supplemental	6	Kings	0	1	0	1
33	Cantua Creek at South Stanislaus Ave.	Supplemental	2	Westlands	0	1	0	1
38	Elbow Creek	Supplemental	2	Kaweah	1	0	0	1
41	Fresno Slough	Supplemental	3	Kings	0	0	2	2
44	Kings River at Jackson Ave Bridge	Supplemental	3	Kings	0	3	0	3
55	Tule River at Poplar	Supplemental	2	Tule	0	2	0	2
58	West Reedley Ditch	Supplemental	2	Kings	0	2	0	2
59	Bates Slough	Supplemental	6	Kaweah	4	0	1	5
60	Cross Creek	Supplemental	3	Kaweah	0	3	0	3
61	Cross Creek at Houston	Supplemental	1	Kaweah	0	1	0	1
63	Deer Creek	Supplemental	10	Tule	1	5	1	7
64	Deer Creek & Hwy 65	Supplemental	4	Tule	0	1	0	1
65	Deer Creek, Rd 192	Supplemental	7	Tule	0	5	1	6
66	Deer Creek @ Pixley Wildlife refuge	Supplemental	7	Tule	0	5	1	6
67	Kaweah River – Dam outflow	Supplemental	5	Kaweah	1	4	0	5
68	Kaweah River at 196	Supplemental	5	Kaweah	2	2	0	4
69	North Fork Tule River	Supplemental	6	Tule	0	5	2	7

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					No. of Tests with Percent Reduction as Compared to Laboratory Control			
Site ID	Site Name	Sample Type	No. Samples	Sub-watershed	Up to 20%	20-50%	> 50%	Total
70	Outside Creek – west of Exeter	Supplemental	3	Kaweah	0	3	0	3
71	Packwood Creek	Supplemental	3	Kaweah	0	4	0	4
72	Porter Slough	Supplemental	2	Tule	0	1	0	1
73	St. John's River	Supplemental	3	Kaweah	1	2	0	3
74	Tule River – Dam outflow	Supplemental	10	Tule	3	0	0	3
75	Elk Bayou	Supplemental	5	Kaweah	1	1	0	2
76	Tule River	Supplemental	8	Tule	0	6	0	6
		TOTALS:	191		30	92	9	131

Shaded = Sample site used in Coalition monitoring

The majority of the algae toxicity tests exhibited less than the fifty percent reduced growth, which would caused the laboratory to conduct a TIE. There is limited TIE information provided for Zone 4, although two TIE results from Supplemental Monitoring sites are available, as follows:

4. Site #41: on 28 February 2006, Fresno Slough (7 toxic units). TIE results indicated metals, or non-polar organics, or both. The sample results also had detections of diuron at 0.41 ug/L, simazine at 0.033 ug/L, atrazine at 0.02 ug/L, chlorpyrifos at 0.066 ug/L, and diazinon at 0.011 ug/L.
5. Site #41: on 1 March 2006, Fresno Slough (7 toxic units). TIE results indicated metals or non-polar organics or both. The sample results had diuron at 0.29 ug/L, simazine at 0.039 ug/L, chlorpyrifos at 0.061 ug/L, and diazinon at 0.007 ug/L.

The approximate locations of water column toxicity tests for all three species at all sites are identified in Figures Z4-2 through Z4-4. Sites that had more than one toxic event within the three-year period are also identified.

Hyalella azteca (sediment amphipod). The *Hyalella azteca*, is the only species that has been used thus far in the program to determine toxicity in sediment. Toxicity in the sediment can be linked to the presence of stressors with low water solubility, including certain pesticides such as chlorpyrifos, pyrethroids, and chlorinated pesticides. Toxicity in the sediment can be the result of irrigation runoff that contains pesticides that settle into the water body sediments, from overspray during aerial applications, or by erosion of contaminated sediment. Common stressors that are hydrophobic, and therefore are best detected through sediment toxicity tests include various pyrethroid insecticides, which are replacements for organophosphate pesticides, chlorpyrifos, and several chlorinated pesticides, such as DDT and its breakdown products.

Overall, throughout Zone 4, sediment toxicity was identified in 29.6% of the total number of individual sediment toxicity samples collected (21 out of 71). Sediment toxicity samples were collected at 39 different sites throughout Zone 4,

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from which 16 demonstrated statistically significant toxicity on at least one occasion. That is 41% of the sample sites in Zone 4 had significant toxicity. The majority of these samples with toxic results were high in magnitude, greater than 50% mortality.

Table Z4-7 Monitoring Sites with <i>Hyalella azteca</i> Toxicity								
					No. of Tests with Percent Reduction - Compared to Laboratory Control			
Site ID	Site Name	Sample Type	No. Samples	Sub-watershed	Up to 20%	20-50%	> 50%	Total
2	St. John's River	MRPPlan	2	Kaweah	0	1	1	2
3	Stone Corral Discharge	MRPPlan	2	Kaweah	0	0	1	1
4	Cross Creek at 99	MRPPlan	2	Kaweah	0	0	1	1
17	Main Drain Canal at 46	MRPPlan	8	Kern	0	2	1	3
20	Tule River at McCarthy	MRPPlan	2	Tule	0	0	1	1
23	Tule River at Woods	MRPPlan	2	Tule	0	0	1	1
29	I-5 @Panoche Silver Creek	MRPPlan	2	Westlands	1	0	0	1
30	Panoche-Silver @ Belmont	MRPPlan	1	Westlands	0	0	1	1
35	Ditch south of Utica Ave.	Supplemental	3	Kings	0	0	3	3
37	Drain to Wooten Creek	Supplemental	1	Kings	0	0	1	1
38	Elbow Creek @ 112	Supplemental	2	Kaweah	0	1	0	1
43	King Ditch at 368	Supplemental	2	Kings	0	0	1	1
46	Kinestirc Ditch at 201	Supplemental	2	Kings	0	0	1	1
50	Mill Creek at 168	Supplemental	2	Kaweah	0	0	1	1
54	Stinson Ditch @ Kamm	Supplemental	3	Kings	0	0	1	1
56	Turner Ditch @ Marks	Supplemental	2	Kings	0	0	1	1
		Other:	25					
		TOTALS:	63		1	4	16	21

Shaded = Sample site used in Coalition monitoring

Table Z4-7, Toxicity to *Hyalella azteca*, provides information about these sixteen monitoring sites, as well as the range of sediment toxicity for the results. Sediment toxicity could be explained through TIE analyses, although limited numbers of TIEs are being conducted.

Figure Z4-7, Toxicity to *Hyalella azteca*, provides the approximate locations of sediment toxicity monitoring, including those for which toxicity was not found.

PESTICIDES. Although some pesticide detections have been identified in the MRP Plan and Supplemental Monitoring in Zone 4, the frequency of pesticide monitoring information, and the spatial distribution of the data is not as great as in other Zones presented in this 2007 Review. Measurements for pesticides can provide information regarding toxic events to the water column or sediment samples that were collected, and some of this corroborative information has been discussed in the sections on toxicity results above. However, limited water and sediment monitoring data is available to identify the quantity, variety and impact to the environment from pesticides that are used in Zone 4.

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Table Z4-8, Pesticide Tests and Results Greater than Trigger Levels, the number of samples that were collected, as well as the pesticides that exceeded either Basin Plan numeric limits or other trigger levels used to characterize water quality conditions. Figure Z4-8, Monitoring Results for Pesticides, provides the approximate locations of all of the monitoring sites, including those locations where no sample results were provided, and those with no detections that exceeded trigger limits. The map also identifies monitoring sites with more than one sample result that exceeded a trigger limit within the three-year period.

**Table Z4-8
Pesticide Tests and Results Greater than Trigger Limits**

Site ID	Site Name	Sample Type	No. of Tests	Chlor-pyrifos ^b	Prohibited Pesticides ^b	DDT & Break-down products ^a	Other ^{a&b}	TOTAL
6	Goshen Ditch	MRPPlan	1	1	0	0	0	1
16	Kings River @ Manning	MRPPlan	4	0	1	0	0	1
31	Button Ditch	Supplemental	7	5	0	0	0	5
32	Calloway Canal	Supplemental	3	0	1	0	1	2
33	Cantua Creek	Supplemental	3	1	0	2	1	4
37	Drain to Wooten Creek	Supplemental	4	3	2	0	1	6
38	Elbow Creek	Supplemental	6	12	0	0	0	12
39	Elk Bayou	Supplemental	4	4	0	0	0	4
41	Fresno Slough	Supplemental	3	3	0	1	0	4
44	Kings River @ Jackson Ave	Supplemental	1	0	1	0	1	2
45	Kings River @ Reed	Supplemental	6	6	0	0	0	6
48	Melga Canal	Supplemental	4	0	0	0	1	1
55	Tule River @ Poplar Ave	Supplemental	6	0	1	0	0	1
		Totals:	52	35	6	3	5	49

Shaded = Sample site used in Coalition monitoring

Footnotes:

- a. Tulare Lake Basin Plan Numeric objective exceedances
- b. Detects above interpretation of Basin Plan Objectives

ELECTRICAL CONDUCTIVITY. One measure of salinity that is used in the Central Valley is that of electrical conductivity, measured in $\mu\text{S}/\text{cm}$. The Tulare Lake Basin also promulgates maximum electrical conductivity levels for certain reaches of the Kings, Kaweah, Tule and Kern Rivers in Zone 4. These specific numeric limits vary from 100 to 450 $\mu\text{S}/\text{cm}$, depending on the reach.

The measurements for conductivity that have been collected for the Program in Zone 4 have very few values that are greater than either the specific Tulare Lake Basin Plan objectives, or the trigger limit of 700 $\mu\text{S}/\text{cm}$ that is used to evaluate water quality for agricultural use.

Some of the reasons for the low frequency of conductivity measures that are greater than trigger levels as compared to Zones 2 and 3 may include the following:

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1. The relatively low number of monitoring events in Zone 4 as compared to other zones;
2. The type of water bodies that are generally monitored in Zone 4 (main stem water bodies, such as Kings, Kern, Tule and Kaweah);
3. Lower levels of salinity in water bodies within Zone.

**Table Z4-9
Electrical Conductivity Results that Exceed Trigger Limits**

Site ID	Site Name	Sub-watershed	Date	Result in $\mu\text{S/cm}$	Limit in $\mu\text{S/cm}$
12	Kings River at Fresno Weir	Kings	1/26/2005	107	100
17	Main Drain Canal near Highway 46	Kern	8/30/2006	1073	700
27	Gale Ave/San Luis Canal Intake	Westlands	4/19/2006	1642	1000
29	Interstate 5/Panoche Silver Creek	Westlands	3/15/2006	5709	700
29	Interstate 5/Panoche Silver Creek	Westlands	4/05/2006	1339	700
30	Panoche Silver Creek at Belmont Avenue	Westlands	4/5/2006	1633	700
31	Button Ditch on Ave 368 west of Alta Ave	Kings	3/25/2005	829	700
35	Ditch on S. side of Utica Ave.	Kings	3/24/2005	1820	700
35	Ditch on S. side of Utica Ave.	Kings	8/18/2005	990	700
41	Fresno Slough at Huntsman Ave.	Kings	2/28/2006	1640	700
41	Fresno Slough at Huntsman Ave.	Kings	3/1/2006	1666	700
45	Kings River at Reed Avenue	Kings	3/25/2006	202	200
54	Stinson Ditch @ Kamm	Kings	3/25/2005	1280	700

Shaded = Sample site used in Coalition monitoring

More information is necessary to adequately evaluate salinity in Zone 4.

Data Gaps

The quantity of pesticides that are applied in Zone 4 (89,619,612 pounds in 2005), particularly in Fresno County, raises the need to conduct sufficient toxicity and pesticide monitoring to be able to understand whether or not pesticide use is appropriately protective, or if more effective management practice implementation should occur. The toxicity data that is available is certainly indicative of an impact from pesticide use.

The low frequency of monitoring data per monitoring site does severely limit the ability to evaluate the information with respect to seasons, land-use, pesticide application, or source identification. Identification of monitoring sites that have toxic results, however, does provide information to direct continued monitoring and to investigate management practice implementation.

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The locations of most MRP Plan monitoring comes from four main water bodies, Kings River, Kern River, Kaweah River and Tule River. Very little information about the smaller sloughs, irrigation supply canals and waterbodies that drain from irrigated lands in the area. Similarly, there is no monitoring data provided to this Program for the San Joaquin River, although field inspections have identified the fact that there are direct discharges from irrigation districts and runoff from irrigated lands to the San Joaquin River. There are currently no ongoing monitoring sites located on these discharges to the San Joaquin.

Depending on rainfall events, irrigation of crops in Zone 4 approaches year-round applications. This extended irrigation season coupled with the use of pre-planting irrigation (tomato, cotton, winter forage, and melons), post-harvest irrigation (nut crops, grapes, and various stone fruit), and application of water for frost protection (citrus), results in near year-round water use with a corresponding potential for agricultural runoff. In spite of this fact, monitoring information is available for only a very limited number of monitoring events, depending on the subwatershed.

Zone 4 Summary

Even considering the relatively limited monitoring that has been conducted in Zone 4, some observations can be made, as follows:

The greatest frequency of toxicity in Zone 4 occurs to the species, *Selenastrum* (algal toxicity) which is an indicator of herbicide or metal toxicity. There is limited toxicity identification information, but the few results available also indicate the presence of pesticides. Two monitoring sites that have been referred to as 'background sites' also have significant algae toxicity, and further investigation into the cause of this toxicity through TIE or other procedures is warranted.

Toxicity from hydrophobic stressors, as demonstrated in the sediment toxicity tests is also very high, with 41% of the monitoring sites showing sediment toxicity. Studies conducted by University of California have implicated pyrethroids for this type of toxicity, although the possible presence of other hydrophobic contaminants should be investigated.

Toxicity to *Pimphales promelas* (fathead minnow) is demonstrated at 31% of the sites that have been tested in Zone 4. This, coupled with the lower percent of sites that have demonstrated toxicity to water flea (10%) does imply that ammonia could be the cause of minnow toxicity in some instances.

Other information that should be considered for Zone 4 includes the magnitude of certain exceedances, including toxicity. Prioritization of actions to address source identification and management practice implementation could be made using magnitude criteria. For example, Monitoring Site No. 35 (Ditch South of Utica Avenue) had only three samples reported for *Hyalella* testing, and all three of the samples resulted in mortality to the species at magnitudes greater than 50%.

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The incidence of salinity in excess of trigger limits, measured as electrical conductivity, is relatively low in Zone 4.

Throughout Zone 4, there are multiple monitoring sites, both MRP Plan sites and Supplemental Sites, which have demonstrated toxicity at a sufficient frequency and magnitude to warrant further investigation and management practice implementation. Some of these sites also show toxicity to more than one species, which could require a variety of approaches to reducing contaminant loads. Some of these sites include the following:

- Site No. 1, Kaweah River
- Site No. 3, Stone Corral
- Site No. 14, RAJB Bypass
- Sites No. 15-16, and 44 Kings River
- Site No. 16, Kings River at Manning
- Site No. 31, Button Ditch at 368
- Site No. 41, Fresno Slough
- Site No. 55, Tule River at Poplar
- Site No. 58, West Reedly Ditch
- Site No. 59, Bates Slough
- Site No. 60, Cross Creek
- Sites 63-66, Deer Creek
- Site No. 67-68, Kaweah River
- Site No. 69, North Fork Tule
- Site No. 70, Outside Creek, west of Exeter
- Site No. 71, Packwood Creek
- Site No. 73, St. John's River
- Site No. 75, Elk Bayou



Figure Z4-1
MRP Plan Monitoring Sites
 (Sites 1 through 30)

Revised on 18 June 2007

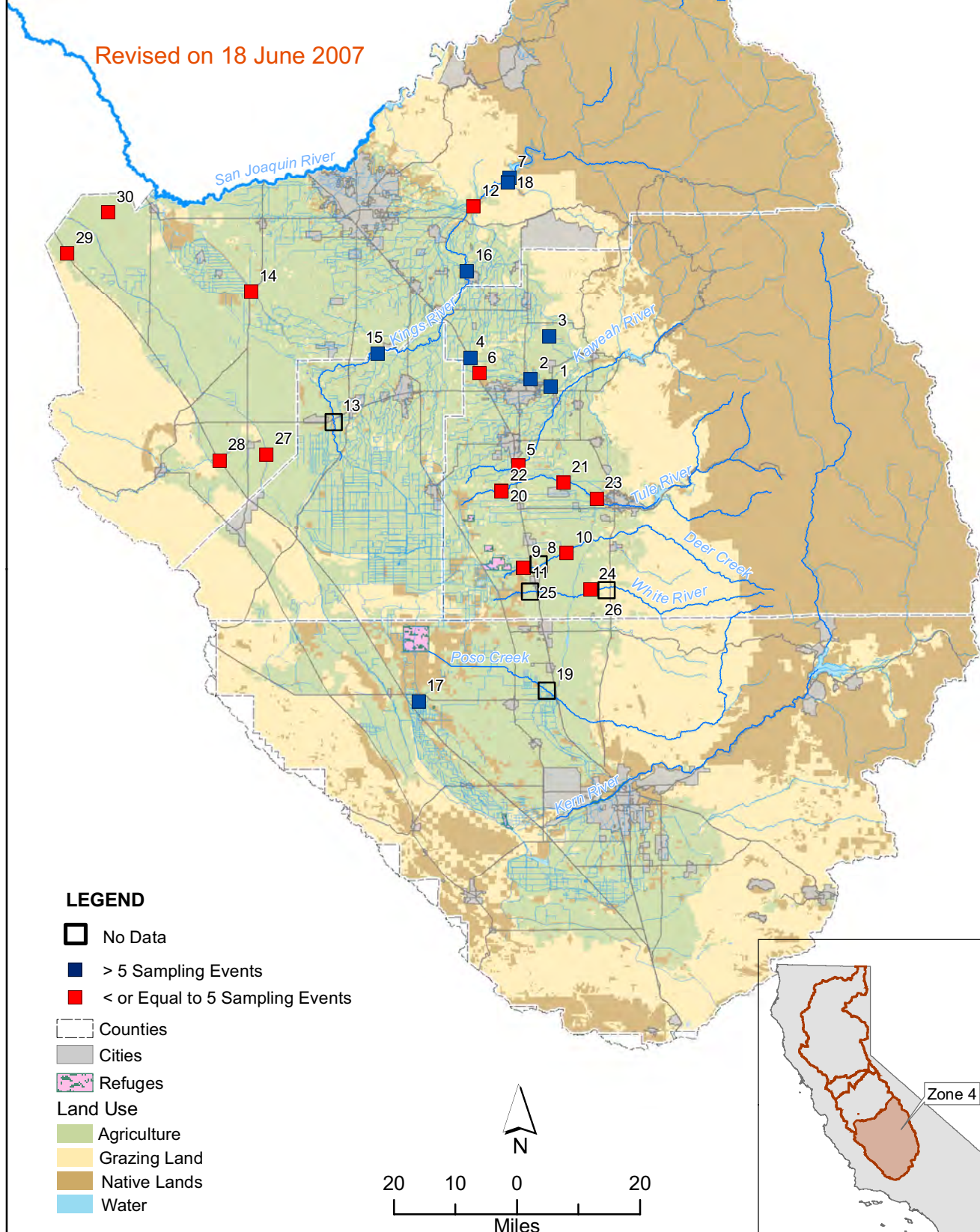
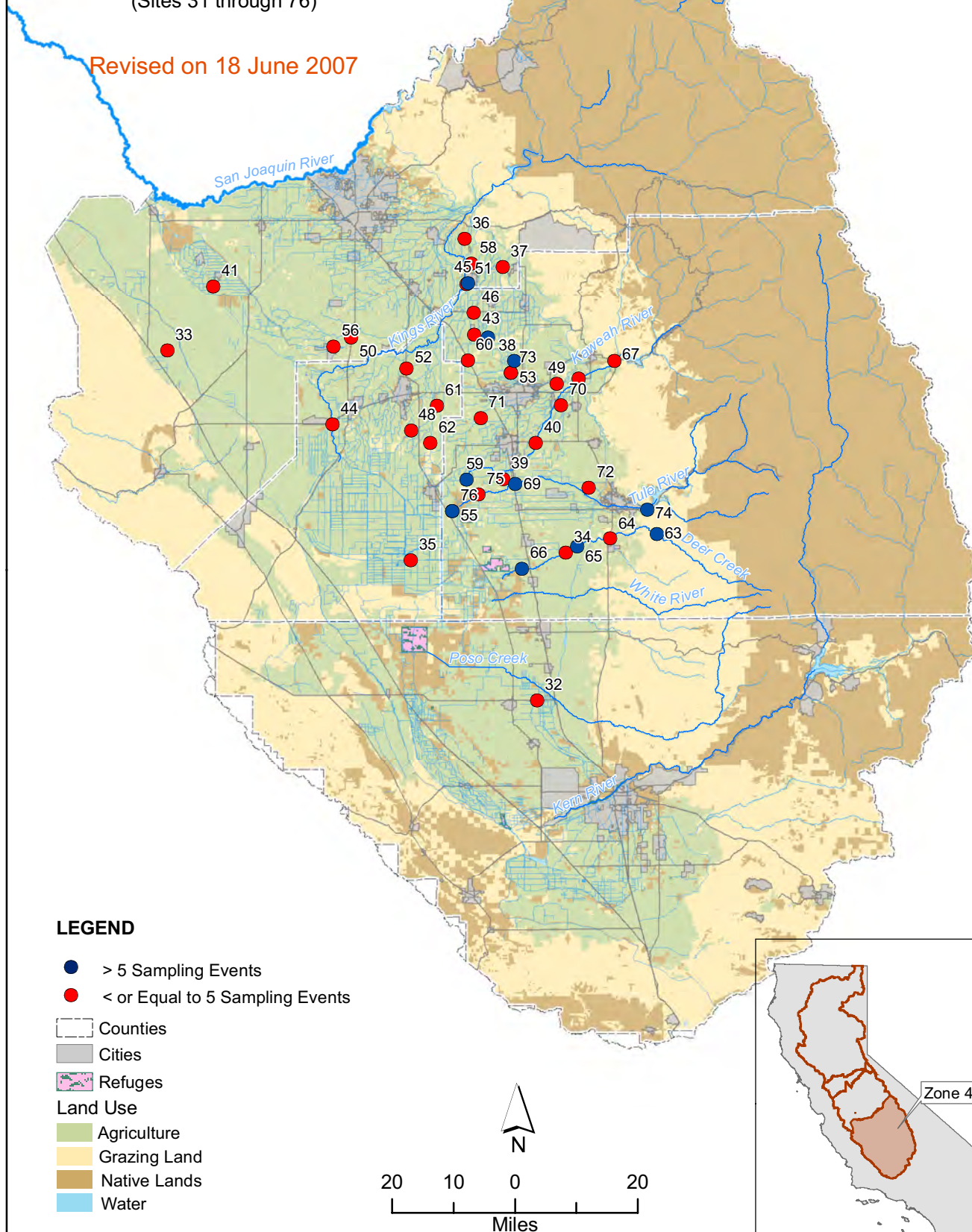




Figure Z4-2
Supplemental Monitoring Sites
 (Sites 31 through 76)

Revised on 18 June 2007



Sources:

- Department of Conservation. 2004. Division of Land Resources. Protection, Farm Land Mapping and Monitoring Program.
 - US EPA. 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water. Office of Science and Technology. BASINS.

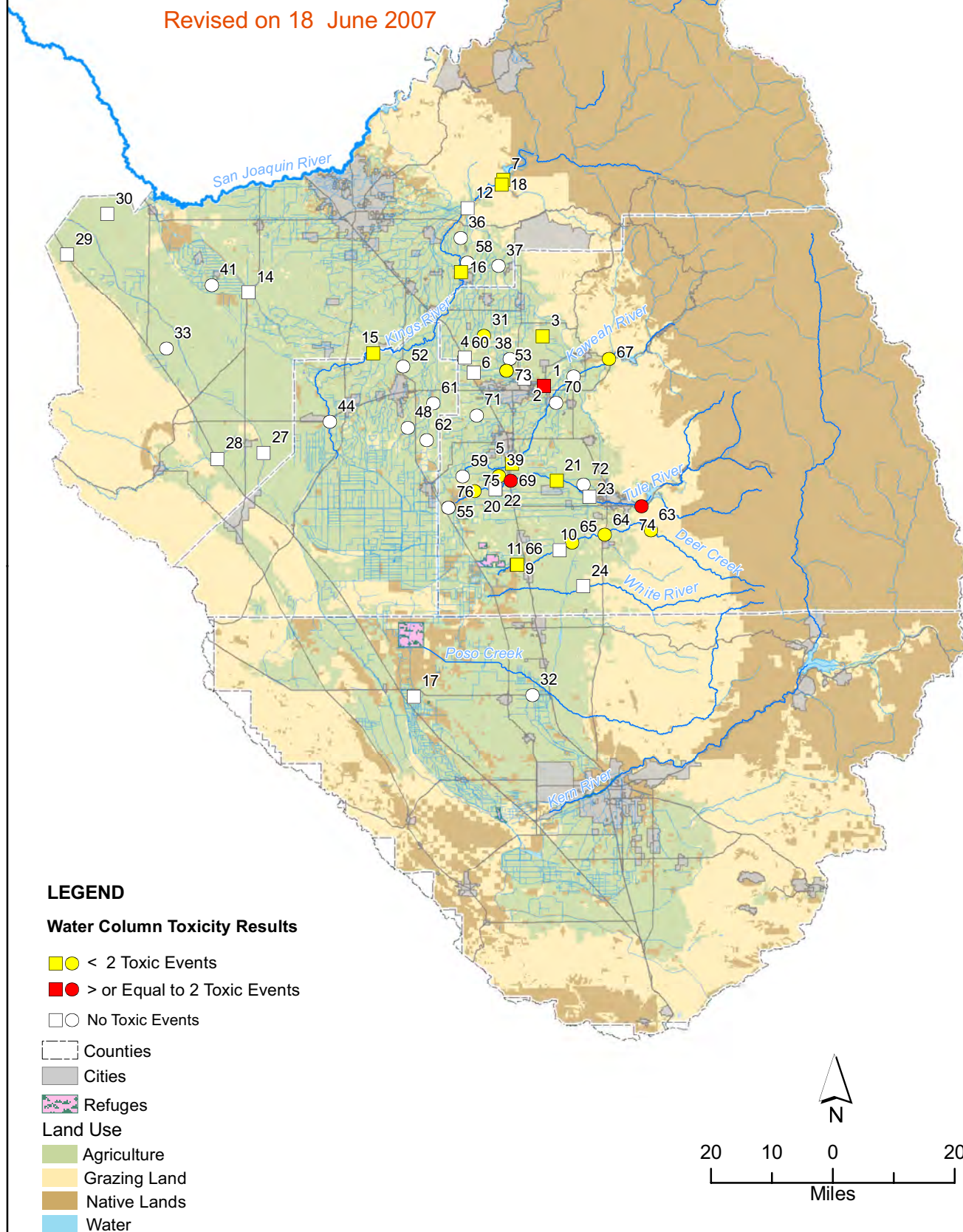
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Figure Z4-4

Toxicity to *Pimephales promelas*

Revised on 18 June 2007



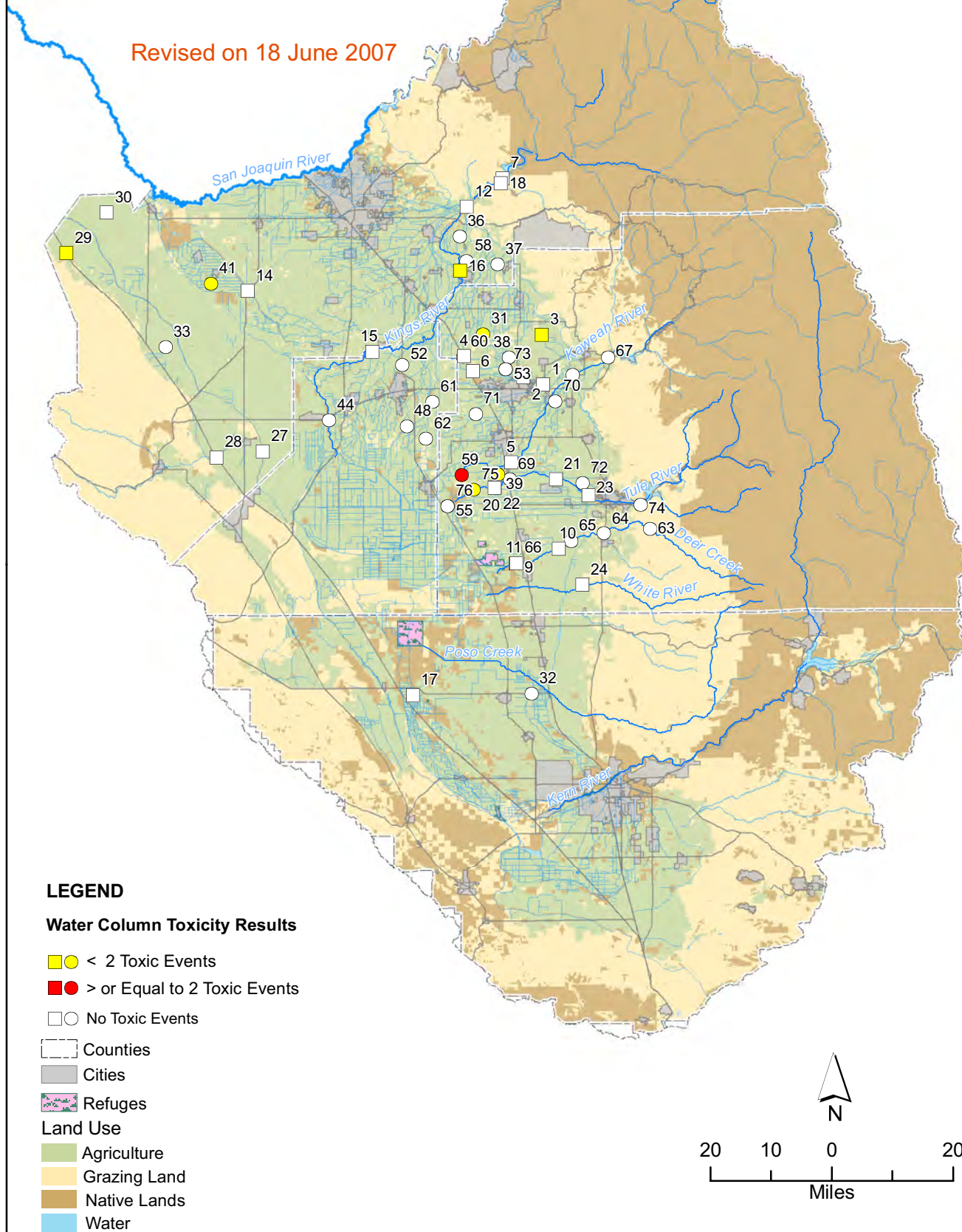
Sources:

- Department of Conservation. 2004. Division of Land Resources. Protection. Farm Land Mapping and Monitoring Program.
 - US EPA. 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water. Office of Science and Technology. BASINS.

DLH

**Figure Z4-5****Toxicity to *Ceriodaphnia dubia***

Revised on 18 June 2007

**Sources:**

- Department of Conservation. 2004. Division of Land Resources. Protection. Farm Land Mapping and Monitoring Program.
 - US EPA. 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water. Office of Science and Technology. BASINS.

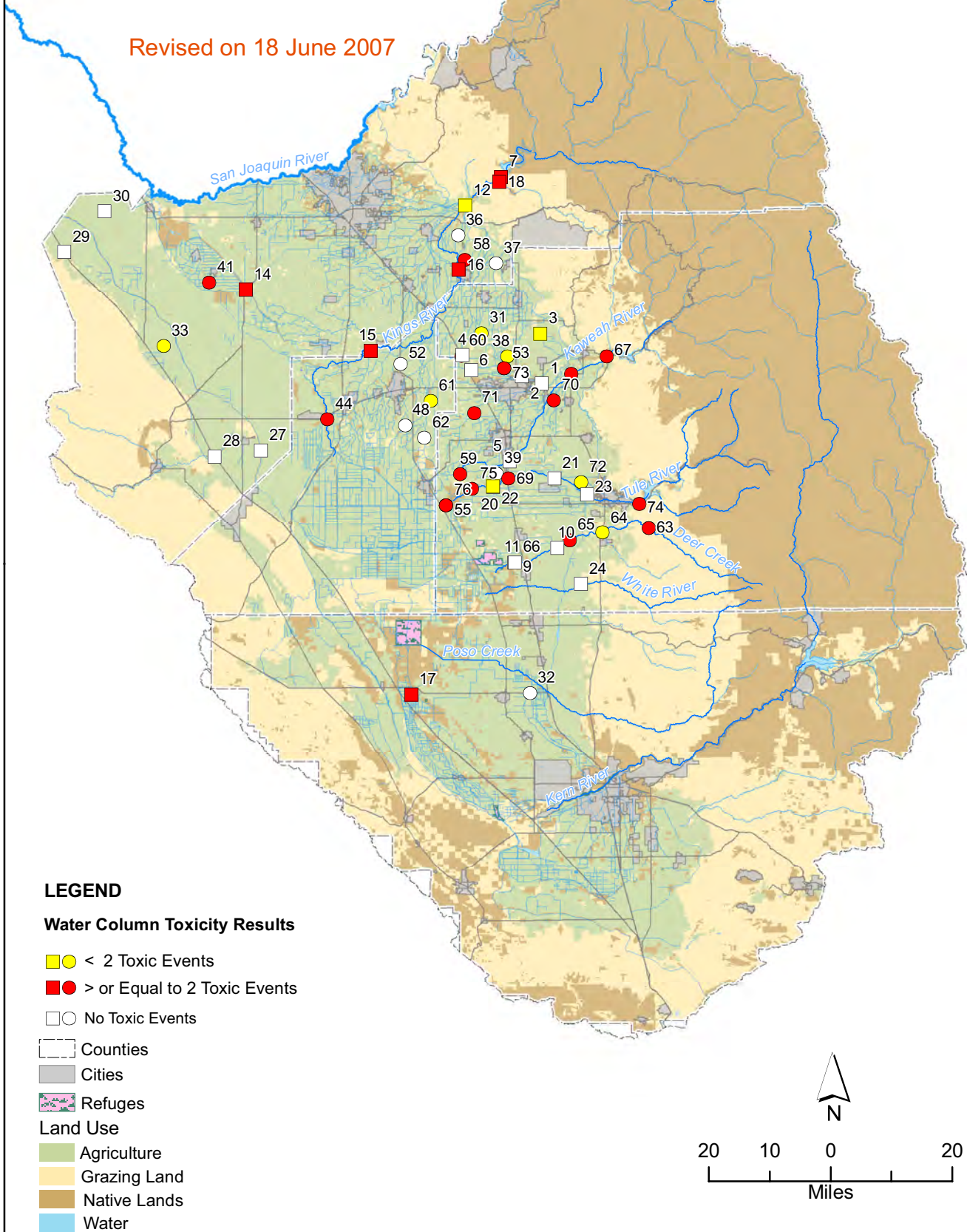
DLH



Figure Z4-6

Toxicity to *Selenastrum capricornutum*

Revised on 18 June 2007



Sources:

- Department of Conservation. 2004. Division of Land Resources. Protection. Farm Land Mapping and Monitoring Program.
 - US EPA. 1998. River REach File 3 (RF3). United States Environmental Protection Agency. Office of Water. Office of Science and Technology. BASINS.

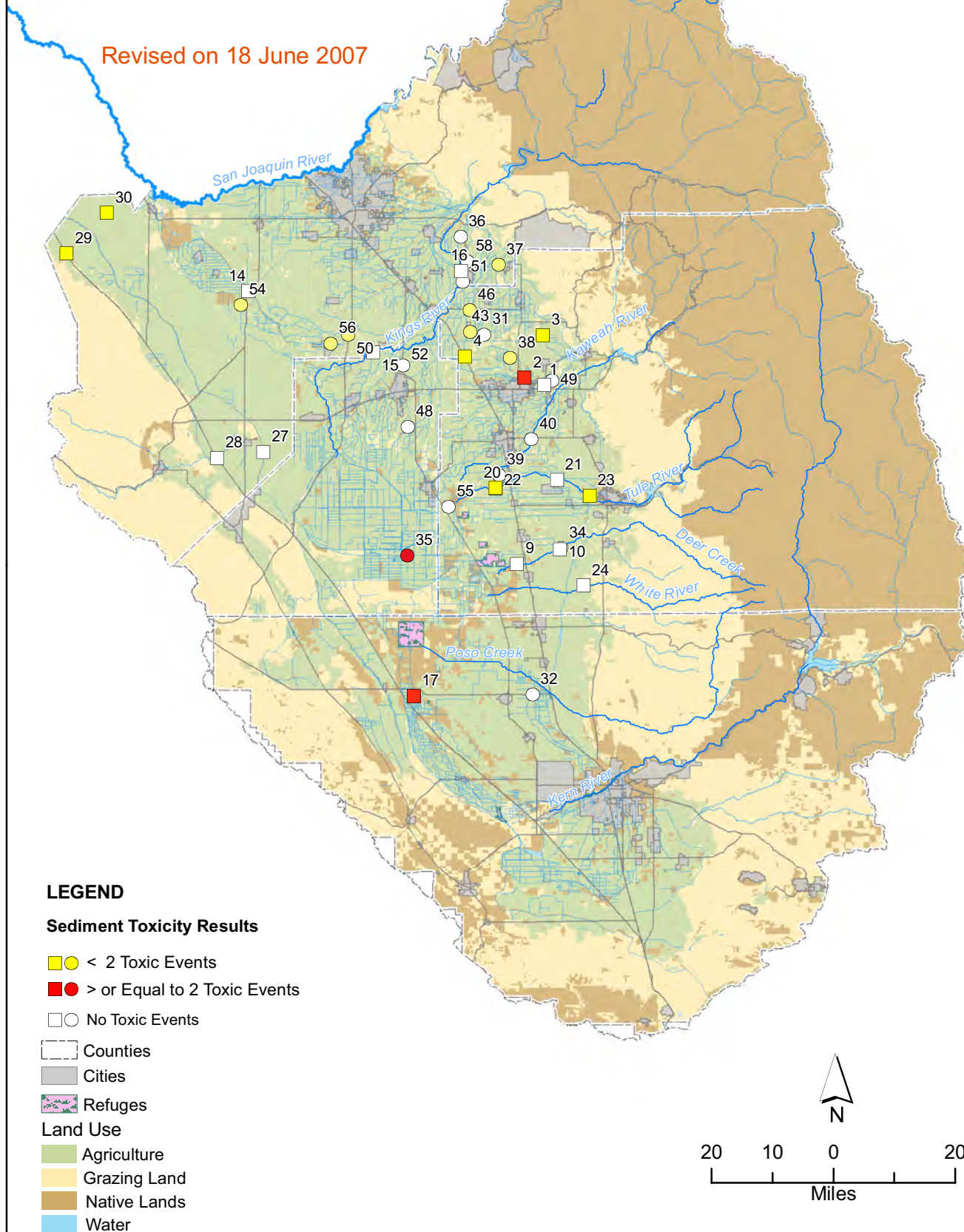
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Figure Z4-7

Toxicity to *Hyaella azteca*

Revised on 18 June 2007



LEGEND

Sediment Toxicity Results

- < 2 Toxic Events
- > or Equal to 2 Toxic Events
- No Toxic Events

- Counties
- Cities
- Refuges

Land Use

- Agriculture
- Grazing Land
- Native Lands
- Water

Sources:

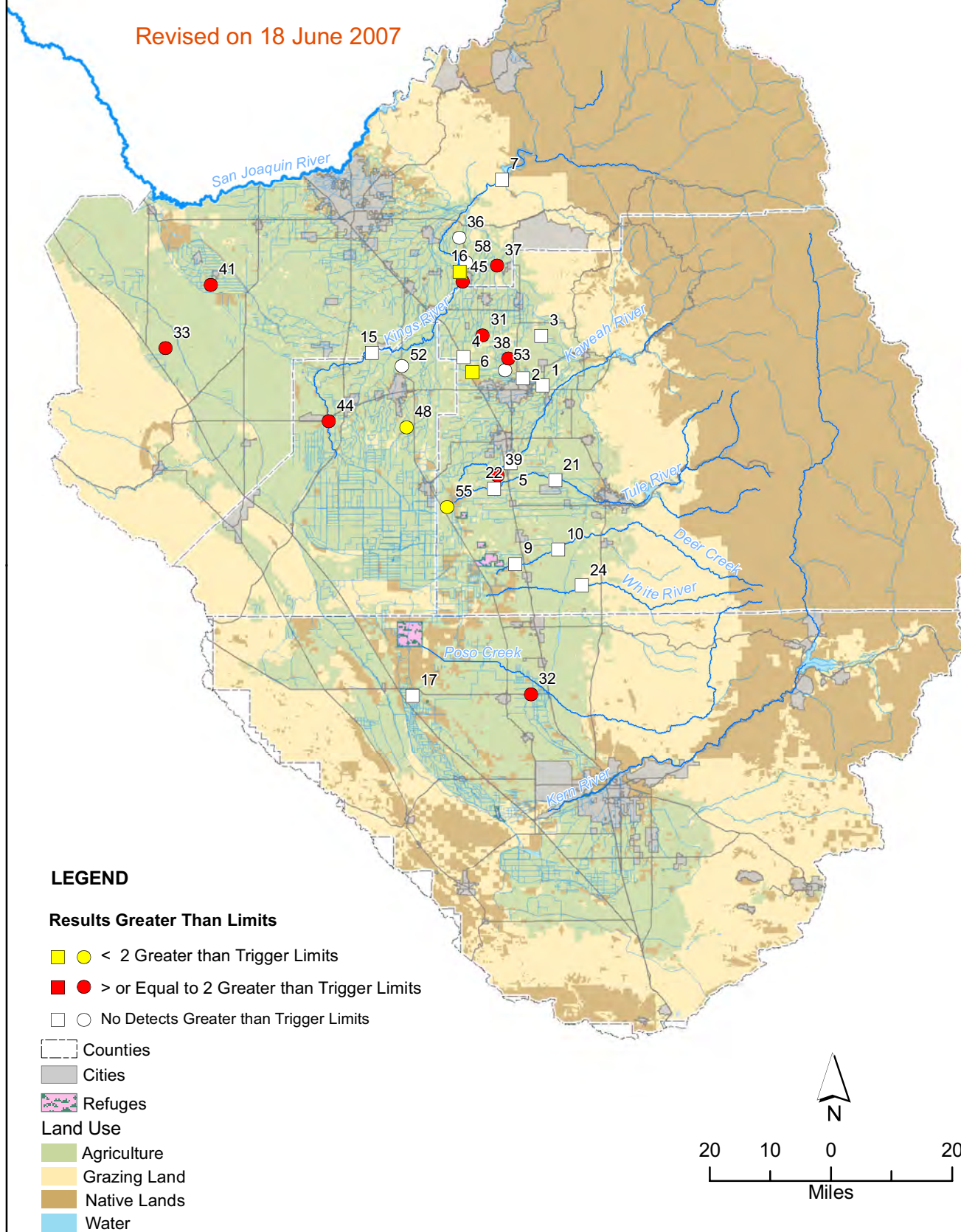
- Department of Conservation, 2004, Division of Land Resources Protection, Farm Land Mapping and Monitoring Program.
 - US EPA, 1998, River REach File 3 (RF3), United States Environmental Protection Agency, Office of Water, Office of Science and Technology, BASINS.

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Figure Z4-8

Monitoring Results for Pesticides

Revised on 18 June 2007



Sources:

- Department of Conservation, 2004, Division of Land Resources Protection, Farm Land Mapping and Monitoring Program.
 - US EPA, 1998, River REach File 3 (RF3), United States Environmental Protection Agency, Office of Water, Office of Science and Technology, BASINS.

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SECTION III. CLOSING SUMMARY

The preceding sections discussed details that have been provided for the four areas (Zones) in the Central Valley. Summary observations about water quality conditions that can be made based on the monitoring data considered in this 2007 Review are identified in the Executive Summary and detailed within each Section Zone Report. The specific monitoring results that were used for this 2007 Review will be posted on the Central Valley Water Board web site at: http://www.waterboards.ca.gov/centralvalley/programs/irrigated_lands.

Data collected and analyzed in this report provides a starting point to help the Board and the Coalitions better understand the potential constituents of concern associated with irrigated lands. Characterization of the inputs is only one component of a comprehensive monitoring program. This report compiles and analyzes the monitoring data collected over the past three years. Additional activities that could influence future assessments are described below.

Monitoring and Reporting Program Issues

The Coalition Group Monitoring and Reporting Program is being revised in part through the efforts of Water Board staff in consultation with the ILP Technical Issues Committee as well as other stakeholders. The changes that are being proposed are based on lessons learned from the previous and current MRP (Order RB5S-2005-0833), as well as on considerations to balance the need for more technical information with concerns about cost effectiveness. The modifications that will be made in the Coalition monitoring plans will have an effect on information available for future data assessments.

Several Coalition groups are engaged in the process of developing Management Plans, based on the exceedances that have been identified during their monitoring and reporting.

MANAGEMENT PLANS

The Irrigated Lands Conditional Waiver, Board Revised Order No. R5-2006-0053 (Revised Order) Attachment B requires that a Management Plan be developed where it is determined that discharges of waste from irrigated lands have caused or contributed to exceedances of applicable water quality standards. A Management Plan will identify the management practices that may be implemented, evaluate the effectiveness of existing management practices in achieving applicable water quality standards, and identify additional actions, including, but not limited to, different or additional management practice implementation or education outreach to achieve applicable water quality standards. The Management Plan will also include a schedule to implement the management practices and the means of assessing and evaluating their effectiveness. Multiple Management Plans are being developed by Coalitions in Zones 1, 2 and 3. Information gathered from Management Plan implementation will be used in concert with monitoring data to evaluate the effectiveness of the Irrigated Lands Program.

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Monitoring Data Gaps

This 2007 Review has summarized the monitoring information generated for the ILP and provided baseline information regarding water quality conditions where sufficient monitoring data was available. It has identified priority areas that clearly warrant actions to improve water quality. It has also identified areas where there has been insufficient information to understand baseline conditions. A summary of the data gaps previously discussed in Section II could generally be addressed as follows:

1. Development of a cost-effective monitoring approach that will be adequate to understand trends, in particular with respect to areas where management plans are being implemented.
2. Identification of limits to be used in implementation of Basin Plan objectives.
3. Collaboration with Coalitions to develop a pesticide monitoring approach that would accurately reflect the pesticides that are actually being applied when the monitoring occurs.
4. Identification of an approach that will evaluate the effects of agriculture at locations and during seasons that have not been sufficiently characterized.

Data gaps do not always need to be addressed by direct monitoring but with appropriate justification, could be addressed by inference from data collected at representative sites, or from the use of modeling techniques.

SALINITY AND BACKGROUND CONTAMINANTS. There are exceedances at monitoring sites that will not be easily addressed, and will require a concerted effort on the part of many agencies and groups, scientific studies, and perhaps the development of new management practices with different approaches to protecting water quality. This is particularly true for some constituents, such as metals and salt, which may be present at background levels and could be increased through certain activities related to irrigated agriculture.

A Central Valley Salinity Management Policy is being developed in cooperation with many State as well as federal agencies. This policy will affect the Irrigated Lands Program.

MULTIPLE LAND USES. Selection of monitoring sites can often be challenging for Coalitions as well as the CVRWQCB, because of the often-present conflict of multiple land uses. The presence of dairies, which are not covered under the Irrigated Lands Conditional Waiver, as well as urbanized areas and other land uses can influence the water quality in areas where irrigated agriculture also exists. At this stage, the program monitoring that is taking place attempts to identify monitoring sites that are tied primarily to irrigated agriculture, yet there is a need to protect all waters of the State, even areas of mixed land use. Increased coordination within Water Board programs and a broader watershed approach to monitor, assess, and implement management practices in collaboration with all types of land-use practitioners would be an exemplary approach to protect water quality.

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PRIORITIZATION OF IMPLEMENTATION. It is important to consider that the data results from monitoring sites that exhibit exceedances may represent localized results, or they may represent broad geographic areas that will require management practice implementation. In many cases, management practices will need to be implemented. In order to address all exceedances, a prioritization sequence for implementing measures is appropriate.

Prioritizing management practice implementation to address water quality issues should be based on approaches that will have the greatest potential to improve water quality. In some cases, multiple water quality impairments could be resolved by addressing one type of exceedance. For example, high levels of suspended solids in water is an impairment which, if improved, could also result in a reduction of pesticides in the water, pesticides in the sediment, water and sediment toxicity, and general physical parameters, such as low dissolved oxygen.

The prioritization in each management should also include an time schedule that identifies appropriate intervals in which progress should be measured and reported. Progress measurements should include updates on water quality conditions as well as tracking of management practice implementation.

MANAGEMENT PRACTICE EFFECTIVENESS. Management plans developed by Coalition Groups require that the effectiveness of the management practice implementation be measured. Construction or installation of management practices may be one measure of implementation effectiveness. Other measures may include outreach to growers that will lead to changes in pesticide applications and reduction of discharges. The ultimate measure of effectiveness will be in the identified improvements to receiving water quality which will be measured in the trend monitoring. However, this may take many years to identify, therefore it is important to measure management practice effectiveness through runoff or localized monitoring where appropriate.

TREND ANALYSIS. This 2007 Review provides baseline information about the possible effects of irrigated agriculture for a significant number of areas within each Zone and for the entire Central Valley Region. Another key element in a comprehensive monitoring program would be trend analysis. This could involve establishing fixed monitoring site locations to obtain ongoing measurements of core water quality parameters to conduct a trend analysis of the resulting data. Core monitoring parameters may include but are not limited to, general physical parameters, suspended solids, pathogens, and toxicity.

Core monitoring sites would be selected to represent areas within the Central Valley in which the ILP Program is being implemented, and would be implemented for a period of time. The information from these monitoring sites, together with tracking of the implemented management practices, and land use changes would help identify the effectiveness of the Irrigated Lands Conditional Waiver Program efforts to address constituents of concern identified in the baseline monitoring.

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Closing

The information summarized in this 2007 Review is the result of a tremendous effort on the part of Central Valley Water Board staff in data compilation, quality control review, and data summary. Tens of thousands of data records were uploaded into electronic format, reviewed, analyzed, and summarized for this report. This took focused dedication and attention to detail on the part of the entire staff of the Irrigated Lands Program.

The 2007 Review is also the result of an admirable effort on the part of the Coalition Groups and Irrigation Districts that performed their monitoring duties in compliance with the Irrigated Lands Conditional Waiver Program, many of whom participated in the quality control review of the draft data summaries as well.

Attachment A

Trigger Limits Used for Zone Data Review*
(Revised draft 16 July 2007)

*Trigger Limits are being used under the ILP as screening values to trigger various actions and to evaluate the need for management of potential water quality problems.

ZONE 1

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use) ¹
General			
pH	6.5 - 8.5 units 7.5-9.5 (Goose Lake)	Numeric	Basin Plan Objective (multiple)
Electrical Conductivity	700 umhos/cm	Numeric or Narrative	1995 Bay Delta Plan & <i>Water Quality for Agriculture</i> , Ayers and Westcot, 1985 (Agriculture)
Dissolved Oxygen (minimum)	7.0 mg/L	Numeric	Basin Plan Objective, page III-5.00 and Table II-2 (aquatic life)
Dissolved Oxygen (minimum)	5.0 mg/L	Numeric	Basin Plan Objective, page III-5.00: for waters designated WARM (aquatic life)
Dissolved Oxygen (minimum)	9.0 mg/L	Numeric	Basin Plan, page III-5.00, Sacramento River from Keswick Dam to Hamilton City, 1 June to 31 August (aquatic life)
Turbidity	variable	Numeric	Basin Plan Objective –(varies based on natural turbidity) (multiple)
Total Dissolved Solids	450 mg/L	Narrative	<i>Water Quality for Agriculture</i> , Ayers and Westcot, 1985 (Agriculture)
E. coli	235 MPN/100 ml	Narrative	USEPA Ambient Water Quality Criteria for Bacteria – 1986 (contact recreation)
Pesticides – Carbamates			
Aldicarb	3.0 ug/L	Narrative	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Carbaryl	2.53 ug/L	Narrative	Basin Plan Toxicity Objective: Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game)(aquatic life)
Carbofuran	0.40 or ND	Numeric: Performance Goal or Pesticide Prohibition	Basin Plan Performance Goal if under Management Plan; Basin Plan Prohibition, page IV-25.00 (MUN, human health)
Methomyl	0.52 ug/L	Narrative	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Pesticides – Organochlorines			
DDD(p,p')	0.00083 ug/L	Numeric	California Toxics Rule (CTR) (human health)
DDE(p,p')	0.00059 ug/L	Numeric	CTR (human health)
DDT(p,p')	0.00059 ug/L	Numeric	CTR (human health)
Dieldrin	0.00014 ug/L	Numeric	CTR (human health)
Pesticides – Organophosphates			
Chlorpyrifos	0.015 ug/L	Numeric	Basin Plan, page III-6.01; San Joaquin River & Delta, pending Sacramento & Feather Rivers (aquatic life)
Diazinon	0.1 ug/L	Numeric	Basin Plan, page III-6.01; San Joaquin River & Delta, pending Sacramento and Feather Rivers (aquatic life)
Dichlorvos	0.085 ug/L	Narrative	Basin Plan Toxicity Objective, Cal/EPA Cancer Potency Factor (MUN, human health)
Dimethoate	1.0 ug/L	Narrative	Basin Plan Toxicity Objective, Notification Level – DHS (MUN, human health)
Disulfoton	0.05 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous

¹ The table includes, in parentheses, the beneficial use intended to be addressed by the standard or most affected by the particular parameter.

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use) ¹
			maximum (aquatic life)
Malathion	0.1 or ND	Numeric: Performance Goal or Pesticide Prohibition	Basin Plan Performance Goal if under a Management Plan; Basin Plan, page IV-25.00 (human health, aquatic life)
Methidathion	0.7 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Parathion, Methyl	0.13 or ND	Numeric: Performance Goal or Pesticide Prohibition	Basin Plan Performance Goal if under a Management Plan; Basin Plan Prohibition, page IV-25.00 (aquatic life, human health)
Pesticides – Pyrethroids			
Cypermethrin, total	0.002 ug/L	Narrative	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game)(aquatic life)
Cyhalothrin, lambda, total	35 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Pesticides – Herbicides			
Atrazine	0.15ug/L	Narrative	Basin Plan Toxicity Objective, California Public Health Goal (MUN)
Diuron	2 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA Health Advisory – Cancer Risk (MUN, human health)
Glyphosate	700 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Molinate	10 ug/L	Numeric: Performance Goal	Basin Plan Performance Goal if under a Management Plan; Basin Plan Prohibition, page IV 25.00 (MUN, human health, aquatic life)
Simazine	4.0 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00 California Primary MCL (MUN, human health)
Thiobencarb	1.0 ug/L	Numeric: Secondary MCL	Basin Plan Pesticides Objective if under a Management Plan; Basin Plan Prohibition, page IV-25.00 (MUN, human health)
Metals			
Aluminum	87 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria, Freshwater Aquatic Life Protection, 4-Day Average (aquatic life)
Antimony	6 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Arsenic	10 ug/L	Narrative	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Boron	700 ug/L	Narrative	Basin Plan Chemical Constituents Objective, <i>Water Quality for Agriculture</i> , Ayers and Westcot, 1985 (agriculture)
Cadmium	0.07 ug/L	Narrative or Numeric	Basin Plan California Public Health Goal (MUN, human health)
Chromium	50 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Copper	Variable. Depends on hardness	Numeric	CTR Freshwater Aquatic Life Protection, 4-day Average (aquatic life)

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use) ¹
Lead	2 ug/L or Variable. Depends on hardness	Narrative or Numeric	Basin Plan narrative toxicity Objective, California Public Health Goal; CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness (MUN, aquatic life)
Mercury	0.05 ug/L	Numeric	CTR Criteria, Human Health Protection – Sources of Drinking Water 30-day Average (MUN, human health)
Nickel	12 ug/L or Variable. Depends on hardness	Narrative or Numeric	Basin Plan Toxicity Objective, California Public Health Goal; CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness (MUN, aquatic life)
Selenium	5.0 ug/L	Numeric	CTR, Freshwater Aquatic Life Protection, 4-Day Average (aquatic life)
Zinc	Variable. Depends on hardness	Numeric	Basin Plan Objectives, page III-4.00; CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (MUN, aquatic life, agriculture, human health)

ZONE 2

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use)
General			
pH	6.5 - 8.5 units	Numeric	Basin Plan (multiple)
Electrical Conductivity	700 umhos/cm	Numeric or Narrative	1995 Bay Delta Plan & <i>Water Quality for Agriculture</i> , Ayers and Westcot, 1985 (agriculture)
Dissolved Oxygen (minimum)	7.0 mg/L	Numeric	Basin Plan, page III-5.00 and Table II-2 (aquatic life)
Turbidity	variable increase	Narrative	Basin Plans – (varies based on natural turbidity) (multiple)
Total Dissolved Solids	450 mg/L	Narrative	<i>Water Quality for Agriculture</i> , Ayers and Westcot, 1985 (agriculture)
Pesticides – Carbamates			
Carbaryl	2.53 ug/L	Narrative	Basin Plan Toxicity Objective: Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Carbofuran	0.40 or ND	Numeric: Performance Goal or Pesticide Prohibition	Basin Plan Performance Goal if under Management Plan; Basin Plan Prohibition, page IV-25.00 (MUN, human health)
Methomyl	0.52 ug/L	Narrative	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Pesticides – Organochlorines			
DDD(p,p')	0.00083 ug/L	Numeric	California Toxics Rule (CTR) (human health)
DDE(p,p')	0.00059 ug/L	Numeric:	CTR (human health)
DDT(p,p')	0.00059 ug/L	Numeric	CTR (human health)
Dieldrin	0.00014 ug/L	Numeric	CTR (human health)
Endrin	0.01 ug/L	Numeric	Basin Plan Pesticides Objective prohibition of detectable persistent chlorinated hydrocarbon pesticides, SIP Minimum Level (MUN, aquatic

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use)
			life)
Methoxychlor	0.03 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous maximum (aquatic life)
Pesticides – Organophosphates			
Azinphos methyl	0.01 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection (aquatic life)
Chlorpyrifos	0.015 ug/L	Numeric	Basin Plan, page III-6.01; San Joaquin River & Delta, pending Sacramento & Feather Rivers (aquatic life)
Diazinon	0.1 ug/L	Numeric	Basin Plan, page III-6.01; San Joaquin River & Delta, pending Sacramento and Feather Rivers (aquatic life)
Dimethoate	1.0 ug/L	Narrative	Basin Plan Toxicity Objective, Notification Level – DHS (MUN, human health)
Disulfoton	0.05 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous maximum (aquatic life)
Malathion	0.1 or ND	Numeric: Performance Goal or Pesticide Prohibition	Basin Plan Performance Goal if under a Management Plan; Basin Plan, page IV-25.00 (human health, aquatic life)
Methidathion	0.7 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Parathion, Methyl	0.13 or ND	Numeric: Performance Goal or Pesticide Prohibition	Basin Plan Performance Goal if under a Management Plan; Basin Plan Prohibition, page IV-25.00 (aquatic life, human health)
Pesticides – Herbicides			
Atrazine	0.15 ug/L	Narrative	Basin Plan Toxicity Objective, California Public Health Goal (MUN,)
Cyanazine	1.0 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA Health Advisory (human health)
Diuron	2 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA Health Advisory – Cancer Risk (MUN, human health)
Glyphosate	700 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Linuron	1.4 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose as a drinking water level* (human health)
Oryzalin	35 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose as a drinking water level (human health)
Simazine	4.0 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Thiobencarb	1.0 ug/L	Numeric	Basin Plan Pesticides Objective if under a Management Plan; Basin Plan prohibition, page IV-25.00 (MUN, human health)
Metals			
Arsenic	10 ug/L	Narrative	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Boron	700 ug/L	Narrative	Basin Plan Chemical Constituents Objective, <i>Water Quality for Agriculture</i> , Ayers and Westcot, 1985 (Agriculture)

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use)
Copper	Variable. Depends on hardness	Numeric	CTR Freshwater Aquatic Life Protection, 4-day Average (aquatic life)
Lead	2 ug/L or Variable. Depends on hardness	Narrative or Numeric	Basin Plan narrative toxicity Objective, California Public Health Goal; CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness (MUN, aquatic life)
Nickel	12 or Variable. Depends on hardness	Narrative or Numeric	Basin Plan Toxicity Objective, California Public Health Goal; CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness (MUN, aquatic life)
Zinc	Variable. Depends on hardness	Numeric	Basin Plan Objectives, page III-4.00; CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (MUN, aquatic life, agriculture, human health)

ZONE 3

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use)
General			
pH	6.5 - 8.5 units	Numeric Objective	Basin Plan (multiple)
Electrical Conductivity	700 umhos/cm	Numeric or Narrative	1995 Bay Delta Plan & <i>Water Quality for Agriculture</i> , Ayers and Westcot, 1985 (agriculture)
Dissolved Oxygen (minimum)	7.0 mg/L	Numeric	Basin Plan, page III-5.00 and Table II-2 (aquatic life)- cold water
Dissolved Oxygen (minimum)	5.0 mg/L	Numeric	Basin Plan, page III-5.00 and Table II-2 (aquatic life)- warm water
E. coli	235 MPN/100 ml	Narrative	USEPA Ambient Water Quality Criteria for Bacteria - 1986 (contact recreation)
Pesticides – Carbamates			
Carbaryl	2.53 ug/L	Narrative	Basin Plan Toxicity Objective: Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Carbofuran	0.40 or ND	Numeric: Performance Goal or Pesticide Prohibition	Basin Plan Performance Goal if under Management Plan; Basin Plan Prohibition, page IV-25.00 (MUN, human health)
Methomyl	0.52 ug/L	Narrative	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Pesticides – Organochlorines			
DDD(p,p')	0.00083 ug/L	Numeric	California Toxics Rule (CTR) (human health)
DDE(p,p')	0.00059 ug/L	Numeric	CTR (human health)
DDT(p,p')	0.00059 ug/L	Numeric	CTR (human health)
Dieldrin	0.00014 ug/L	Numeric	CTR (human health)
Pesticides – Organophosphates			
Chlorpyrifos	0.015 ug/L	Numeric	Basin Plan, page III-6.00; San Joaquin River & Delta, pending Sacramento & Feather Rivers (aquatic life)
Demeton	0.1 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA National

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use)
			Ambient Water Quality Criteria, Freshwater Aquatic Life Protection, Instantaneous (human health, aquatic life)
Diazinon	0.1 ug/L	Numeric	Basin Plan, page III-6.00; San Joaquin River & Delta, pending Sacramento & Feather Rivers (aquatic life)
Dimethoate	1.0 ug/L	Narrative	Basin Plan Toxicity Objective, Notification Level – DHS (MUN, human health)
Malathion	0.1 or ND	Numeric: Performance Goal or Pesticide Prohibition	Basin Plan Performance Goal if under a Management Plan; Basin Plan, page IV-25.00 (human health, aquatic life)
Methidathion	0.7 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Parathion, Methyl	0.13 or ND	Numeric: Performance Goal or Pesticide Prohibition	Basin Plan Performance Goal if under a Management Plan; Basin Plan Prohibition, page IV-25.00 (aquatic life, human health)
Pesticides – Pyrethroids			
Biphenthrin	110 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (human health)
Cypermethrin, total	0.002 ug/L	Narrative	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life, human health)
Permethrin, total	0.03 ug/L	Narrative	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Pesticides – Herbicides			
Atrazine	0.15ug/L	Narrative	Basin Plan Toxicity Objective, California Public Health Goal for Drinking Water based on toxicity to humans (MUN)
Cyanazine	1.0 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA Health Advisory (human health)
Diuron	2 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA Health Advisory – Cancer Risk (MUN, human health)
Glyphosate	700 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Molinate	10 ug/L	Numeric: Performance Goal	Basin Plan Performance Goal if under a Management Plan; Basin Plan Prohibition, page IV 25.00 (MUN, human health, aquatic life)
Simazine	4.0 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Thiobencarb	1.0 ug/L	Numeric: Performance Goal	Basin Plan Pesticides Objective if under a Management Plan; Basin Plan prohibition, page IV-25.00 (MUN, human health)
Metals			
Aluminum	87 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria, Freshwater Aquatic Life Protection, 4-Day Average (aquatic life)
Antimony	6 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Arsenic	10 ug/L	Narrative	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use)
Boron	700 ug/L	Narrative	Basin Plan Chemical Constituents Objective, <i>Water Quality for Agriculture</i> , Ayers and Westcot, 1985 (agriculture)
Cadmium	0.07 ug/L	Narrative or Numeric	Basin Plan, California Public Health Goal For Drinking Water based on toxicity to humans (MUN, human health)
Chromium	50 ug/L	Numeric	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Chromium VI	11 ug/L	Numeric	CTR (aquatic life)
Copper	Variable. Depends on hardness	Numeric	CTR Freshwater Aquatic Life Protection, 4-day Average (aquatic life)
Lead	2 ug/L or Variable. Depends on hardness	Narrative or Numeric	Basin Plan narrative toxicity Objective, California Public Health Goal; CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness (MUN, aquatic life)
Mercury	0.05 ug/L	Numeric	CTR, Human Health Protection – Sources of Drinking Water 30-day Average (MUN, human health, aquatic life)
Nickel	12 ug/L or Variable. Depends on hardness	Narrative and Numeric	Basin Plan Toxicity Objective, California Public Health Goal; CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness (MUN, aquatic life)
Selenium	5.0 ug/L	Numeric	CTR, Freshwater Aquatic Life Protection, 4-Day Average (aquatic life)
Silver	35 ug/L or variable - hardness-dependent	Numeric or Narrative	Basin Plan Toxicity Objective and USEPA IRIS Reference Dose; CTR Aquatic Life Criteria instantaneous maximum (MUN, human health, aquatic life)
Zinc	Variable. Depends on hardness	Numeric	Basin Plan Objectives, page III-4.00; CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (MUN, aquatic life, agriculture, human health)

ZONE 4

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use)
General			
pH	6.5 – 8.3	Numeric	Tulare Basin Plan, page III-3 (multiple)
Electrical Conductivity	Variable, depends on water body	Numeric	Tulare Basin Plan, page III-5 (MUN, Agriculture)
Dissolved Oxygen (minimum)	Variable, depends on water body and aquatic life designation	Numeric	Tulare Basin Plan, page III-3 and Table III-1 (aquatic life)
Turbidity	Variable, depends on natural turbidity	Numeric	Basin Plans - increase varies based on natural turbidity
Total Dissolved Solids	450 mg/L	Narrative	<i>Water Quality for Agriculture</i> , Ayers and Westcot, 1985 (Agriculture)
E. coli	235 MPN/100 mL	Narrative	USEPA Ambient Water Quality Criteria for Bacteria – 1986 (contact recreation)
Pesticides – Carbamates			

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use)
Carbaryl	2.53 ug/L	Narrative	Basin Plan Toxicity Objective: Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Carbofuran	0.5 ug/L	Narrative	Basin Plan Toxicity objective, USEPA National Ambient Water Quality Criteria for Aquatic Life Protection, instantaneous maximum (aquatic life)
Methomyl	0.52 ug/L	Narrative	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Pesticides – Organochlorines			
DDD(p,p')	0.00083 ug/L	Narrative	California Toxics Rule (CTR) (human health)
DDE(p,p')	0.00059 ug/L	Narrative	CTR (human health)
DDT(p,p')	0.00059 ug/L	Narrative	CTR (human health)
Dieldrin	0.00014 ug/L	Narrative	CTR (human health)
Endrin	0.036 ug/L	Numeric	CTR, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (aquatic life)
Methoxychlor	0.03 ug/L	Numeric or Narrative	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous maximum (aquatic life)
Pesticides – Organophosphates			
Azinphos methyl	0.01 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection (aquatic life)
Chlorpyrifos	0.015 ug/L	Narrative	Sacramento San Joaquin Basin Plan, San Joaquin River & Delta numeric standard pending Sacramento & Feather Rivers numeric standard
Diazinon	0.1 ug/L	Narrative	Sacramento San Joaquin Basin Plan, San Joaquin River & Delta numeric standard pending Sacramento & Feather Rivers numeric standard
Dimethoate	1.0 ug/L	Narrative	Basin Plan Toxicity Objective, Notification Level – DHS (human health)
Disulfoton	0.05 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous maximum (aquatic life)
Malathion	0.43 ug/L	Narrative	Basin Plan Toxicity Objective, Water Quality Criteria, 1-hour average, California Department of Fish & Game (aquatic life)
Methidathion	0.07 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Parathion, Methyl	0.08 ug/L	Narrative	Basin Plan Toxicity Objective, Water Quality Criteria, instantaneous maximum, California Department of Fish & Game (aquatic life)
Pesticides – Herbicides			
Atrazine	0.15 ug/L	Narrative	Basin Plan Toxicity Objective, California Public Health Goal (MUN, human health)
Cyanazine	1.0 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA Health Advisory (human health)
Diuron	14 ug/L	Narrative	Basin Plan Toxicity Objective, USEPA Health

Parameter	Water Quality Trigger	Standard Type	Reference (beneficial use)
			Advisory (MUN, human health)
Glyphosate	700 ug/L	Numeric	Basin Plan Chemical Constituents Objective, California Primary MCL (MUN, human health)
Simazine	4.0 ug/L	Numeric	Basin Plan Chemical Constituents Objective, California Primary MCL (MUN, human health)
Thiobencarb	1.0 ug/L	Numeric	Basin Plan Chemical Constituents Objective, California Secondary MCL (MUN)
Metals			
Arsenic	10 ug/L	Narrative	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Boron	1000 ug/L	Numeric	Tulare Basin Plan, page IV-3
Copper	Variable. Depends on hardness	Numeric	CTR, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average – varies with water hardness
Lead	2 ug/L or Variable. Depends on hardness	Numeric or Narrative	Basin Plan narrative toxicity Objective, California Public Health Goal; CTR, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average – varies with water hardness (MUN, aquatic life)
Nickel	12 or Variable. Depends on hardness	Numeric or Narrative	Basin Plan Toxicity Objective, California Public Health Goal; CTR, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness
Zinc	Variable. Depends on hardness	Numeric	CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (aquatic life)

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**ATTACHMENT B
CROP AND PESTICIDE USE
ZONES 1, 2 AND 3
(DPR Pesticide Use Report Database 2005)**

ZONE 1 PESTICIDE USE			
AMADOR COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Wine Grapes	3,874	1,3-Dichloropropene, Abamectin, Aluminum Phosphide, Azadirachtin, Azoxystrobin, Bifenazate, Boscalid, Carbaryl, Chlorpyrifos, Copper Hydroxide, Copper Oxide (Ous), Cyprodinil, Diuron, Fenarimol, Fenhexamid, Fenpropathrin, Fenpyroximate, Flumioxazin, Glyphosate, Imidacloprid, Kaolin, Kresoxim-Methyl, Lime-Sulfur, Malathion, Mancozeb, Myclobutanil, Naled, Napropamide, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Parathion, Petroleum Oil, Potassium Bicarbonate, Pyraclostrobin, Pyrethrins, Pyridaben, Quinoxifen, Simazine, Strychnine, Sulfur, Tebuconazole, Trifloxystrobin, Triflumizole	123,123
2. Irrigated Pasture	1,545	2,4-D, Clopyralid, Monoethanolamine	139
3. Hay, Grain	1,037	2,4-D, Carfentrazone-ethyl	206
4. Alfalfa	467	Chlorpyrifos, Diuron, Lambda-Cyhalothrin, Paraquat Dichloride	612
5. Walnuts	391	Chlorpyrifos, Copper Hydroxide, Glyphosate, Oryzalin, Oxyfluorfen, Simazine	631
AMADOR COUNTY TOTAL:			124,711
BUTTE COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Rice	96,400	(S)-Cypermethrin, 2,4-D, Azoxystrobin, Bensulfuron Methyl, Bispyribac-Sodium, Carbaryl, Carfentrazone-Ethyl, Clomazone, Copper Sulfate (Pentahydrate), Cyhalofop Butyl, Diflubenzuron, Fenoxaprop-P-Ethyl, Glyphosate, Lambda-Cyhalothrin, MCPA, Molinate, Penoxsulam, Propanil, Propiconazole, Sodium Chlorate, Thiobencarb, Triclopyr, Trifloxystrobin	1,235,120
2. Almonds	41,478	2,4-D, Abamectin, Acequinocyl, Aluminum Phosphide, Azadirachtin, Azinphos-Methyl, Azoxystrobin, Benomyl, Bifenazate, Boscalid, Captan, Carbaryl, Carfentrazone-Ethyl, Chlorophacinone, Chloropicrin, Chlorpyrifos, Clethodim, Clofentezine, Copper Hydroxide, Copper Oxide (Ous), Cyprodinil, Diazinon, Diflubenzuron, Diphacinone, EPTC, Esfenvalerate, Fenbutatin-Oxide, Flumioxazin, Gamma Aminobutyric Acid, Glufosinate-Ammonium, Glutamic Acid, Glyphosate, Hexythiazox, Lambda-Cyhalothrin, Maneb, Methidathion, Methoxyfenozide, Methyl Bromide, Myclobutanil, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Phosmet, Propargite, Pyraclostrobin, Pyridaben, Pyriproxyfen, Sethoxydim, Simazine, Sodium Hypochlorite, Spinosad, Strychnine, Sulfur, Tebufenozide, Trifloxystrobin, Trifluralin, Xylene, Zinc Phosphide, Ziram	407,648
3. Walnuts	32,122	1,3-Dichloropropene, 2,4-D, Abamectin, Aluminum Phosphide, Azinphos-Methyl, Bifenazate, Captan, Carfentrazone-Ethyl, Chlorophacinone, Chloropicrin, Chlorpyrifos, Clofentezine, Copper, Diazinon, Dicofof, Diphacinone, Diuron, E,E-8,10-Dodecadien-1-OI, EPTC, Esfenvalerate, Ethalfluralin, Ethephon, Fenamiphos, Fenbutatin-Oxide, Fluazifop-P-Butyl, Flumioxazin, Glyphosate, Halosulfuron, Hexythiazox, Kaolin, Lambda-Cyhalothrin, Malathion, Maneb, Methidathion, Methomyl, Methoxyfenozide, Methyl Parathion, Methyl Bromide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Phosmet, Propargite, Pyridaben, Pyriproxyfen, Sethoxydim, Simazine, Spinosad, Strychnine, Sulfur, Tebufenozide, Trifluralin, Xylene, Zinc Phosphide	524,938

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CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
4. Dried Plums	12,297	1,3-Dichloropropene, 2,4-D, Aluminum Phosphide, Azoxystrobin, Boscalid, Captan, Chlorothalonil, Chlorpyrifos, Copper Hydroxide, Copper Sulfate (Basic), Cyprodinil, Diazinon, Diflubenzuron, Diphacinone, Esfenvalerate, Fenbutatin-Oxide, Flumioxazin, Glyphosate, Hexythiazox, Iprodione, Lambda-Cyhalothrin, Methyl Bromide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Petroleum Oil, Phosmet, Propiconazole, Pyraclostrobin, Spinosad, Strychnine, Sulfur, Thiamethoxam	228,551
5. Peaches	2,987	(E)-5-Decenol, (E)-5-Decenyl Acetate, 1,3-Dichloropropene, 2,4-D, Bifenazate, Boscalid, Carbaryl, Chlorophacinone, Chlorpyrifos, Copper, Cyprodinil, Diazinon, Diflubenzuron, Diphacinone, E-8-Dodecenyl Acetate, Esfenvalerate, Fenbutatin-Oxide, Glyphosate, Hexythiazox, Iprodione, Lambda-Cyhalothrin, Methidathion, Methoxyfenozide, Methyl Bromide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Propiconazole, Pyraclostrobin, Spinosad, Strychnine, Sulfur, Tebuconazole, Z-8-Dodecenol, Z-8-Dodecenyl Acetate, Zinc Phosphide, Ziram	139,073
6. Olives	2,424	Copper Hydroxide, Diuron, Glyphosate, Oxyfluorfen, Simazine, Spinosad	8,214
7. Alfalfa Hay	1,885	4(2,4-Db), Bromoxynil, Carbofuran, Chlorpyrifos, Clethodim, Cyfluthrin, Diuron, Hexazinone, Indoxacarb, Lambda-Cyhalothrin, Malathion, Paraquat Dichloride, Phosmet, Sethoxydim, Trifluralin	3,379
8. Wheat	1,600	2,4-D, 2-Ethylhexyl Ester, 2,4-D, Bromoxynil, Carfentrazone-Ethyl, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, MCPA, Mesosulfuron-Methyl	901
9. Kiwis	1,014	Fenhexamid, Forchlorfenuron, Glyphosate, Methidathion, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Petroleum Oil	6,251
10. Pistachios	618	2,4-D, Azoxystrobin, Boscalid, Cyprodinil, Fludioxonil, Flumioxazin, Glyphosate, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Pyraclostrobin, Thiophanate-Methyl	2,066
TOTAL BUTTE COUNTY:			2,556,141

COLUSA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Rice	136,400	(S)-Cypermethrin, 2,4-D, Azoxystrobin, Bensulfuron Methyl, Bispyribac-Sodium, Carfentrazone-Ethyl, Clomazone, Copper Sulfate (Pentahydrate), Cyhalofop Butyl, Cypermethrin, Diflubenzuron, Fenoxaprop, Glyphosate, Lambda-Cyhalothrin, MCPA, Molinate, Paraquat Dichloride, Pendimethalin, Penoxsulam, Propanil, Propiconazole, Sodium Chlorate, Thiobencarb, Triclopyr, Trifloxystrobin	838,662
2. Almonds	26,400	2,4-D, Abamectin, Acequinocyl, Aluminum Phosphide, Azoxystrobin, Bifenazate, Boscalid, Carbaryl, Chlorpyrifos, Clethodim, Copper Hydroxide, Cyprodinil, Diazinon, Diphacinone, Esfenvalerate, Fenbutatin-Oxide, Flumioxazin, Fosetyl-Al, Gamma Aminobutyric Acid, Glufosinate-Ammonium, Glutamic Acid, Glyphosate, Hexythiazox, Iprodione, Maneb, Mefenoxam, Methoxyfenozide, Myclobutanil, Napropamide, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Potassium Phosphite, Propargite, Pyraclostrobin, Pyridaben, Sethoxydim, Simazine, Spinosad, Strychnine, Sulfur, Tebufenozide, Trifloxystrobin, Ziram	394,117
3. Tomatoes	23,650	(S)-Cypermethrin, (S)-Metolachlor, Abamectin, Azoxystrobin, Carbaryl, Chlorothalonil, Clethodim, Copper, Cymoxanil, Diazinon, Dimethoate, Dimethomorph, Endosulfan, Esfenvalerate, Ethepon, Famoxadone, Glyphosate, Halosulfuron-Methyl, Indoxacarb, Lambda-Cyhalothrin, Mancozeb, Maneb, Mefenoxam, Methamidophos, Methomyl, Metribuzin, Napropamide, Oxyfluorfen, Paraquat Dichloride, Permethrin, Pyraclostrobin, Rimsulfuron, Sethoxydim, Sulfur, Tebufenozide, Trifluralin	163,235
4. Wheat	13,500	2,4-D, Azoxystrobin, Bromoxynil, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Fenoxaprop, Glyphosate, MCPA, Mesosulfuron-Methyl, Pyraclostrobin	12,307

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COLUSA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
5. Alfalfa	6,100	(S)-Cypermethrin, 4(2,4-Db), Bromoxynil, Chlorpyrifos, Clethodim, Cyfluthrin, Cypermethrin, Diuron, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Malathion, Methomyl, Metribuzin, Paraquat Dichloride, Permethrin, Phosmet, Potassium Phosphite, Sethoxydim, Strychnine, Trifluralin	12,740
6. Beans	6,050	(S)-Cypermethrin, (S)-Metolachlor, Abamectin, Acephate, Bifenthrin, Clethodim, Dicofof, Dimethoate, EPTC, Esfenvalerate, Ethalfuralin, Glyphosate, Imidacloprid, Lambda-Cyhalothrin, Malathion, Methomyl, Metribuzin, Naled, Oxyfluorfen, Pendimethalin, Propargite, Sethoxydim, Trifluralin	8,428
7. Walnuts	4,640	1,3-Dichloropropene, 2,4-D, Chlorpyrifos, Copper, Diazinon, Dicofof, Diuron, Esfenvalerate, Ethephon, Fenbutatin-Oxide, Flumioxazin, Glyphosate, Hexythiazox, Lambda-Cyhalothrin, Malathion, Maneb, Methidathion, Methoxyfenozide, Methyl Bromide, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Phosmet, Propargite, Simazine, Tebufenozide	34,620
8. Safflower	4,200	EPTC, Glyphosate, Sodium Chlorate, Trifluralin	1,028
9. Hay, Grain	3,650	Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, 2,4-D, Bromoxynil, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, MCPA,	670
10. Cotton	2,940	Abamectin, Acetamiprid, Bifenthrin, Chlorpyrifos, Cyclanilide, Cyfluthrin, Diuron, Ethephon, Etoxazole, Glyphosate, Imidacloprid, Indoxacarb, Lambda-Cyhalothrin, Malathion, Mepiquat Chloride, Naled, Oxyfluorfen, Paraquat Dichloride, Propargite, Pyraflufen-Ethyl, Pyriithiobac-Sodium, Sethoxydim, Spiromesifen, Tebufenozide, Thiamethoxam, Thidiazuron, Trifluralin, Urea Dihydrogen Sulfate	11,498
COLUSA COUNTY TOTAL:			1,477,305

EL DORADO COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Wine Grapes	2,163	1,3-Dichloropropene, Abamectin, Azoxystrobin, Bifenazate, Boscalid, Buprofezin, Captan, Carbaryl, Chloropicrin, Chlorpyrifos, Clopyralid, Copper Hydroxide, Cyprodinil, Diazinon, Dicofof, Diphacinone, Diuron, Fenarimol, Fenhexamid, Fenpropathrin, Fenpyroximate, Gibberellins, Glyphosate, Imidacloprid, Iprodione, Kaolin, Kresoxim-Methyl, Lime-Sulfur, Mancozeb, Myclobutanil, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Petroleum Distillates, Petroleum Oil, Potassium Bicarbonate, Propargite, Pyraclostrobin, Quinoxifen, Sethoxydim, Simazine, Sodium Hypochlorite, Strychnine, Sulfur, Tebuconazole, Trifloxystrobin, Triflumizole, Trifluralin, Zinc Phosphide	57,332
2. Irrigated Pasture	869	2,4-D, Diuron, Glyphosate, Clopyralid	86
3. Apples	840	1-Naphthaleneacetamide, Acetamiprid, Aluminum Phosphide, Azinphos-Methyl, Bifenazate, Captan, Carbaryl, Chlorpyrifos, Copper Hydroxide, Cyprodinil, Diazinon, E,E-8,10-Dodecadien-1-ol, Fenarimol, Fenbutatin-Oxide, Formetanate Hydrochloride, Glyphosate, Imidacloprid, Kresoxim-Methyl, Lauryl Alcohol, Lime-Sulfur, Mancozeb, Manganese Sulfate, Methoxyfenozide, Mevinphos, Myclobutanil, Myristyl Alcohol, NAA, Oryzalin, Petroleum Distillates, Petroleum Oil, Phosmet, Potash Soap, Pyrethrins, Pyriproxyfen, Simazine, Spinosad, Streptomycin Sulfate, Strychnine, Sulfur, Thiabendazole, Thiophanate-Methyl, Triclopyr, Trifloxystrobin, Zinc Sulfate	22,215
4. Hay	271	None reported	N/A
5. Walnuts	239	Copper Hydroxide, Malathion	217
6. Peaches	101	Azinphos-Methyl, Bifenazate, Boscalid, Brodifacoum, Chlorothalonil, Clofentezine, Copper Hydroxide, Diazinon, E-8-Dodecenyl Acetate, Formetanate Hydrochloride, Glyphosate, Iprodione, Myclobutanil, Petroleum Oil, Phosmet, Propiconazole, Pyraclostrobin, Simazine, Spinosad, Strychnine, Sulfur, Tebuconazole, Z-8-Dodecenol, Z-8-Dodecenyl Acetate	2,084

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CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
7. Cherries	90	Boscalid, Brodifacoum, Copper Hydroxide, Diazinon, Esfenvalerate, Glyphosate, Iprodione, Petroleum Oil, Propiconazole, Pyraclostrobin, Simazine	882
8. Pears	83	Abamectin, Acetamiprid, Azinphos-Methyl, Copper Hydroxide, Diazinon, E,E-8,10-Dodecadien-1-ol, Esfenvalerate, Fenarimol, Formetanate Hydrochloride, Glyphosate, Lauryl Alcohol, Lime-Sulfur, Mancozeb, Methoxyfenozide, Myristyl Alcohol, Petroleum Oil, Phosmet, Streptomycin Sulfate, Sulfur, Triclopyr	5,964
9. Plums	53	Captan, Copper Hydroxide, Diazinon, Glyphosate, Petroleum Oil, Propiconazole, Spinosad	532
EL DORADO COUNTY TOTAL:			89,312

GLENN COUNTY ¹			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Rice	88,876	(S)-Cypermethrin, 2,4-D, Azoxystrobin, Bensulfuron Methyl, Bispyribac-Sodium, Carfentrazone-Ethyl, Clomazone, Copper Sulfate (Pentahydrate), Cyhalofop Butyl, Cypermethrin, Diflubenzuron, Fenoxaprop-Ethyl, Glyphosate, Lambda-Cyhalothrin, MCPA, Methyl Parathion, Molinate, Penoxsulam, Propanil, Propiconazole, Sodium Chlorate, Thiobencarb, Toxaphene, Triclopyr, Trifloxystrobin, Xylene	886,342
2. Almonds	28,001	2,4-D, Abamectin, Aluminum Phosphide, Azinphos-Methyl, Azoxystrobin, Bifenazate, Boscalid, Captan, Carbon Dioxide, Chlorophacinone, Chlorpyrifos, Clethodim, Copper Hydroxide, Cyprodinil, Diazinon, Diflubenzuron, Esfenvalerate, Fenbutatin-Oxide, Flumioxazin, Gamma Aminobutyric Acid, Glufosinate-Ammonium, Glutamic Acid, Glyphosate, Halosulfuron, Hexythiazox, Iprodione, Lambda-Cyhalothrin, Magnesium Phosphide, Maneb, Mefenoxam, Methoxyfenozide, Methyl Bromide, Myclobutanil, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Phosmet, Phosphine, Potassium Phosphite, Propargite, Pyraclostrobin, Pyridaben, Sethoxydim, Simazine, Spinosad, Strychnine, Sulfur, Trifloxystrobin, Xylene, Zinc Phosphide, Ziram	307,959
3. Walnuts	11,340	2,4-D, Abamectin, Aluminum Phosphide, Carfentrazone-Ethyl, Chlorpyrifos, Clethodim, Clofentezine, Copper, Diazinon, Dicofof, Diuron, Esfenvalerate, Ethepon, Fenbutatin-Oxide, Flumioxazin, Glufosinate-Ammonium, Glyphosate, Hexythiazox, Kaolin, Lambda-Cyhalothrin, Malathion, Maneb, Methidathion, Methoxyfenozide, Methyl Bromide, Methyl Parathion, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Phosmet, Propargite, Pyriproxyfen, Sethoxydim, Simazine, Spinosad, Strychnine, Tebufenozide, Xylene	171,545
4. Alfalfa	10,506	(S)-Cypermethrin, 2,4-Db, Chlorpyrifos, Clethodim, Copper Hydroxide, Cyfluthrin, Cypermethrin, Diuron, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Malathion, Methomyl, Norflurazon, Paraquat Dichloride, Permethrin, Phosmet, Sethoxydim, Trifluralin	23,215
5. Corn	10,353	(S)-Metolachlor, 2,4-D, 2-Ethylhexyl Ester, 2,4-D, Bromoxynil Heptanoate, Captan, Carfentrazone-Ethyl, Dicamba, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Esfenvalerate, Glyphosate, Halosulfuron, Lindane, Methomyl, Nicosulfuron, Paraquat Dichloride, Pendimethalin, Permethrin, Propargite, Rimsulfuron, Spiromesifen	8,352
6. Pasture, Irrigated	7,797	2,4-D, Glyphosate	77
7. Sunflower	6,915	Aluminum Phosphide, Chlorpyrifos, Clethodim, Esfenvalerate, Ethalfluralin, Imazamox, Lambda-Cyhalothrin, Paraquat Dichloride, Pendimethalin, Sethoxydim, Sodium Chlorate	9,604
8. Dried Plums	6,829	1,3-Dichloropropene, 2,4-D, Aluminum Phosphide, Azoxystrobin, Boscalid, Captan, Chlorothalonil, Chlorpyrifos, Copper Hydroxide, Cyprodinil, Diazinon, Dicofof, Esfenvalerate, Fluazifop-P-Butyl, Glyphosate, Iprodione, Lambda-Cyhalothrin, Lime-Sulfur, Magnesium Phosphide, Myclobutanil, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Petroleum Oil, Phosmet, Propargite, Propiconazole, Pyraclostrobin, Pyrethrins, Strychnine, Sulfur, Xylene	174,923

REVISED DRAFT

GLENN COUNTY ¹			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
9. Barley	5,639	2,4-D, Bromoxynil, Carfentrazone-Ethyl, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Glyphosate, MCPA	1,405
10. Wheat	5,019	2,4-D, Bromoxynil, Carfentrazone-Ethyl, Diclofop-Methyl, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Glyphosate, MCPA, Mesosulfuron-Methyl, Pyraclostrobin	1,703
GLENN COUNTY TOTAL:			1,585,125

LAKE COUNTY ¹			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Grapes, Wine	7,518	2,4-D, Abamectin, Acid Blue 9, Azoxystrobin, Bifenazate, Boscalid, Buprofezin, Chlorophacinone, Chlorpyrifos, Copper, Cryolite, Cyprodinil, Dimethoate, Diphacinone, Diuron, Fenarimol, Fenhexamid, Fenpropathrin, Fenpyroximate, Flumioxazin, Glufosinate, Imidacloprid, Kresoxim-Methyl, Lime-Sulfur, Mancozeb, Methoxyfenozide, Myclobutanil, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Petroleum Distillates, Petroleum Oil, Potassium Bicarbonate, Pymetrozine, Pyraclostrobin, Pyrethrins, Pyridaben, Quinoxifen, Simazine, Sodium Hypochlorite, Spinosad, Sulfaquinoxaline, Sulfur, Tartrazine, Tebuconazole, Thiophanate-Methyl, Trifloxystrobin, Triflumizole, Warfarin, Zinc Phosphide	377,006
2. Walnuts	2,695	2,4-D, Aluminum Phosphide, Chlorpyrifos, Copper, Diphacinone, Diuron, Glyphosate, Malathion, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Simazine, Spinosad, Sulfur, Trifloxystrobin	1,679
3. Pears	2,482	2,4-D, Abamectin, Acetamiprid, Azinphos-Methyl, Bifenazate, Chlorpyrifos, Clopyralid, Copper Hydroxide, Diazinon, Diuron, Dodine, E,E-8,10-Dodecadien-1-ol, E-11-Tetradecen-1-yl Acetate, E-8-Dodecenyl Acetate, Esfenvalerate, Fenarimol, Fenpropathrin, Glyphosate, Lauryl Alcohol, Lime-Sulfur, Mancozeb, Methoxyfenozide, Myristyl Alcohol, NAA, Norflurazon, Oryzalin, Oxyfluorfen, Oxytetracycline, Petroleum Oil, Phosmet, Pyridaben, Simazine, Spinosad, Streptomycin Sulfate, Sulfaquinoxaline, Sulfur, Tebufenozide, Thiabendazole, Thiamethoxam, Thiophanate-Methyl, Triclopyr, Trifloxystrobin, Triflumizole, Warfarin, Z-11-Tetradecen-1-yl Acetate, Z-8-Dodecenol, Z-8-Dodecenyl Acetate, Ziram	201,163
4. Pasture, Irrigated	2,000	Copper Sulfate (Pentahydrate), Glyphosate, Triclopyr, Butoxyethyl Ester	53
LAKE COUNTY TOTAL:			579,901

MODOC COUNTY ¹			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Irrigated Pasture	50,000	2,4-D, Dicamba, Dimethoate, Glyphosate, Metribuzin	1,046
2. Alfalfa	33,570	4(2,4-Db), Chlorpyrifos, Clethodim, Cyfluthrin, Dimethoate, Glyphosate, Hexazinone, Imazamox, Indoxacarb, Lambda-Cyhalothrin, Malathion, Metribuzin, Paraquat Dichloride, Permethrin	9,997
3. Grain	9,851	2,4-D, Carboxin, Dicamba, Malathion, Thiram	309
4. Wheat	9,144	2,4-D, Azoxystrobin, Carboxin, Dicamba, Dimethoate, Ethephon, Fenoxaprop-P-Ethyl, Glyphosate, Mancozeb, MCPA, Propiconazole, Pyraclostrobin, Tebuconazole, Thiram	6,692
5. Potatoes	4,340	1,4-Dimethylnaphthalene, Azoxystrobin, Boscalid, Chlorothalonil, Chlorpropham, Clethodim, Cyfluthrin, Cymoxanil, Diquat Dibromide, Glyphosate, Indoxacarb, Maleic Hydrazide, Mancozeb, Mefenoxam, Metam-Sodium, Methamidophos, Metribuzin, Oxamyl, Permethrin, Potassium Phosphite, Pymetrozine, Pyraclostrobin, Rimsulfuron, Sethoxydim, Thiabendazole	304,786

REVISED DRAFT

CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
6. Onions	1,075	Azoxystrobin, Bromoxynil Octanoate, Chlorothalonil, Chlorpyrifos, Copper Hydroxide, Fenamidone, Fluazifop-P-Butyl, Glyphosate, Lambda-Cyhalothrin, Malathion, Mancozeb, Mefenoxam, Oxamyl, Oxyfluorfen, Pendimethalin, Permethrin	7,821
7. Horseradish	971	Glyphosate	84
MODOC COUNTY TOTAL:			330,735

LASSEN COUNTY ¹			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
		No Data Available	
LASSEN COUNTY TOTAL:			unknown

NEVADA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Pasture	14,000	Aluminum Phosphide, Clopyralid, Glyphosate, Triclopyr	111
2. Grapes	350	Abamectin, Azoxystrobin, Bifenazate, Boscalid, Copper Hydroxide, Cyprodinil, Fenarimol, Fenhexamid, Flumioxazin, Glyphosate, Imidacloprid, Iprodione, Kresoxim-Methyl, Lime-Sulfur, Mancozeb, Manganese Sulfate, Myclobutanil, Nonanoic Acid, Potassium Bicarbonate, Pyraclostrobin, Quinoxifen, Sulfur, Tebuconazole, Trifloxystrobin, Zinc Sulfate	7,395
NEVADA COUNTY TOTAL:			7,506

PLACER COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Irrigated Pasture	18,000	2,4-D, Clopyralid, Glyphosate, MCPA	382
2. Rice	14,500	(S)-Cypermethrin, 2,4-D, Azoxystrobin, Bensulfuron Methyl, Bispyribac-Sodium, Carfentrazone-Ethyl, Clomazone, Copper Sulfate (Pentahydrate), Cyhalofop Butyl, Fenoxaprop-P-Ethyl, Glyphosate, Halosulfuron, Lambda-Cyhalothrin, MCPA, Molinate, Pendimethalin, Penoxsulam, Propanil, Thiobencarb, Triclopyr	104,200
3. Grapes	230	Boscalid, Copper Hydroxide, Cyprodinil, Fenarimol, Fenhexamid, Glyphosate, Imidacloprid, Kresoxim-Methyl, Lime-Sulfur, Mancozeb, Myclobutanil, Oxyfluorfen, Petroleum Distillates, Potassium Bicarbonate, Pyraclostrobin, Pyridaben, Quinoxifen, Sulfur, Tebuconazole, Trifloxystrobin, Triflumizole	839
4. Oranges	180	Chlorpyrifos, Copper Hydroxide, Glyphosate, Petroleum Oil	1,028
5. Plums	144	Boscalid, Copper Hydroxide, Cyprodinil, Diazinon, Esfenvalerate, Glyphosate, Lambda-Cyhalothrin, Lime-Sulfur, Malathion, Myclobutanil, Oryzalin, Oxyfluorfen, Permethrin, Petroleum Oil, Phosmet, Propiconazole, Pyraclostrobin, Spinosad, Sulfur	777

REVISED DRAFT

CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
6. Peaches	106	Azinphos-Methyl, Boscalid, Copper Hydroxide, Copper Sulfate (Basic), Cyprodinil, Diazinon, Diflubenzuron, E-8-Dodecenyl Acetate, Esfenvalerate, Fenbutatin-Oxide, Formetanate Hydrochloride, Glyphosate, Iprodione, Myclobutanil, Permethrin, Petroleum Oil, Phosmet, Propiconazole, Pyraclostrobin, Spinosad, Tebuconazole, Z-8-Dodecenol, Z-8-Dodecenyl Acetate, Ziram	767
7. Apples	61	Acetamiprid, Carbaryl, Copper Hydroxide, Cyprodinil, Diazinon, Esfenvalerate, Fenarimol, Glyphosate, Lime-Sulfur, Malathion, Mancozeb, Methoxyfenozide, Myclobutanil, Paraquat Dichloride, Permethrin, Petroleum Oil, Phosmet, Spinosad, Streptomycin Sulfate, Trifloxystrobin	1,322
8. Pears	48	Acetamiprid, Copper Hydroxide, Cyprodinil, Diazinon, Esfenvalerate, Malathion, Methoxyfenozide, Petroleum Oil, Phosmet, Spinosad, Streptomycin Sulfate, Trifloxystrobin	795
PLACER COUNTY TOTAL:			110,110

PLUMAS COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Irrigated Pasture	65,000	Data Not Available	
2. Alfalfa	6,000	Data Not Available	
3. Hay	3,000	Data Not Available	
4. Grain	1,000	Data Not Available	
PLUMAS COUNTY TOTAL:			210

SACRAMENTO COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Corn	33,203	(S)-Metolachlor, 2,4-D, Atrazine, Bifenthrin, Butylate, Carbaryl, Carfentrazone-Ethyl, Chlorpyrifos, Dicamba, Dimethoate, EPTC, Esfenvalerate, Glyphosate, Lambda-Cyhalothrin, Methomyl, Nicosulfuron, Oxyfluorfen, Phorate, Propargite, Sodium Chlorate, Spiromesifen, Trifluralin	33,998
2. Grapes	28,045	Abamectin, Acetamiprid, Bifenazate, Borax, Boscalid, Carbaryl, Chlorpyrifos, Copper, Cyprodinil, Diuron, E-11-Tetradecen-1-Yl Acetate, Fenamiphos, Fenarimol, Fenhexamid, Fenpropathrin, Fenpyroximate, Flumioxazin, Gibberellins, Glyphosate, Imidacloprid, Kresoxim-Methyl, Lime-Sulfur, Mancozeb, Methoxyfenozide, Myclobutanil, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Petroleum Distillates, Petroleum Oil, Propargite, Pyraclostrobin, Quinoxifen, Sethoxydim, Simazine, Strychnine, Sulfur, Tebuconazole, Trifloxystrobin, Triflumizole, Trifluralin, Z-11-Tetradecen-1-Yl Acetate, Zinc Phosphide	2,411,236
3. Irrigated Pasture	18,100	2,4-D, Paraquat Dichloride	3,563
4. Alfalfa	13,932	4(2,4-Db), Abamectin, Bifenthrin, Bromoxynil Heptanoate, Bromoxynil Octanoate, Carbofuran, Chlorpyrifos, Clethodim, Dimethoate, Diquat Dibromide, Diuron, Formetanate Hydrochloride, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Methomyl, Metribuzin, Oxydemeton-Methyl, Paraquat Dichloride, Permethrin, Sethoxydim, Trifluralin	11,647
5. Rice	8,155	(S)-Cypermethrin, 2,4-D, Azoxystrobin, Bispyribac-Sodium, Clomazone, Copper Sulfate (Pentahydrate), Cyhalofop Butyl, Fenoxaprop-Ethyl, Fenoxaprop-P-Ethyl, Glyphosate, Halosulfuron, Lambda-Cyhalothrin, Penoxsulam, Propanil, Thiobencarb, Triclopyr	77,598
6. Safflower	7,340	EPTC, Glyphosate, Sodium Chlorate, Trifluralin	4,287

REVISED DRAFT

SACRAMENTO COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
7. Wheat	6,623	2,4-D, Azoxystrobin, Bromoxynil, Carfentrazone-Ethyl, Diclofop-Methyl, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Dimethoate, Glyphosate, MCPA, Mesosulfuron-Methyl	3,682
8. Pears	6,000	2,4-D, Abamectin, Acetamiprid, Azinphos-Methyl, Bifenazate, Carbaryl, Clofentezine, Copper Hydroxide, Cyprodinil, Diazinon, Diuron, E,E-8,10-Dodecadien-1-ol, E-8-Dodecenyl Acetate, Esfenvalerate, Fenarimol, Fenpropathrin, Fosetyl-Al, Glyphosate, Hexythiazox, Kaolin, Kresoxim-Methyl, Lambda-Cyhalothrin, Lauryl Alcohol, Lime-Sulfur, Mancozeb, Methoxyfenozide, Myclobutanil, Myristyl Alcohol, Naa, Norflurazon, Oryzalin, Oxyfluorfen, Oxytetracycline, Paraquat Dichloride, Petroleum Oil, Phosmet, Pyriproxyfen, Simazine, Spinosad, Streptomycin Sulfate, Strychnine, Sulfur, Trifloxystrobin, Z-8-Dodecenol, Z-8-Dodecenyl Acetate, Zinc Phosphide, Ziram	414,948
9. Tomatoes	3,097	(S)-Metolachlor, 2,4-D, Azoxystrobin, Carbaryl, Chlorothalonil, Clethodim, Copper Hydroxide, Dimethoate, Esfenvalerate, Ethepon, Glyphosate, Halosulfuron, Halosulfuron-Methyl, Kaolin, Lambda-Cyhalothrin, Mancozeb, Metribuzin, Napropamide, Oxyfluorfen, Pyraclostrobin, Rimsulfuron, Sulfur, Trifluralin	58,396
10. Sudan	2,834	2,4-D, Atrazine, Chlorpyrifos, Diquat Dibromide, EPTC, Glyphosate, Halosulfuron, Lambda-Cyhalothrin, Methomyl, Oxyfluorfen, Paraquat Dichloride, Propyzamide, Sethoxydim	5,324
SACRAMENTO COUNTY TOTAL:			3,024,679

SHASTA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Irrigated Pasture	33,000	2,4-D, Carbaryl, Chlorsulfuron, Clopyralid, Dicamba, Glyphosate, Hexazinone, Triclopyr	1,642
2. Hay	15,000	2,4-D, Bromoxynil, Chloropicrin, Dicamba, Glyphosate, Malathion, Methyl Bromide	3,343
3. Alfalfa	5,700	Bromoxynil Octanoate, Carbaryl, Chlorpyrifos, Cyfluthrin, Glyphosate, Hexazinone, Methidathion, Metribuzin, Paraquat Dichloride, Sethoxydim	1,544
4. Wild Rice	4,600	Carfentrazone-Ethyl, Glyphosate	1,017
5. Mint	1,800	Acephate, Bentazon, Bromoxynil Octanoate, Chlorpyrifos, Diuron, Flumioxazin, Malathion, Oxyfluorfen, Paraquat Dichloride, Propargite	4,240
6. Walnuts	924	2,4-D, Chlorpyrifos, Clofentezine, Copper Hydroxide, Dicofof, Diuron, Fenbutatin-Oxide, Glyphosate, Hexythiazox, Maneb, Methoxyfenozide, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Propargite, Simazine	16,080
SHASTA COUNTY TOTAL:			27,866

SIERRA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Irrigated Pasture	34,445	Bromoxynil Octanoate, Chlorsulfuron	1
2. Alfalfa	1,200	4(2,4-Db), Bromoxynil Octanoate, Imazethapyr, Strychnine, Zinc Phosphide	27
3. Oats	60	2,4-D, Glyphosate, Zinc Phosphide	74
4. Grain	40	2,4-D	10
5. Rye	40	2,4-D	34
SIERRA COUNTY TOTAL:			146

REVISED DRAFT

SOLANO COUNTY ¹			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Alfalfa	34,605	(S)-Cypermethrin, 2,4-D, 4(2,4-Db), Bromoxynil, Chlorpyrifos, Clethodim, Cyfluthrin, Cypermethrin, Dimethoate, Diuron, Glyphosate, Hexazinone, Imazamox, Indoxacarb, Lambda-Cyhalothrin, Methomyl, Norflurazon, Paraquat Dichloride, Permethrin, Sethoxydim, Trifluralin	45,844
2. Irrigated Pasture	32,566	2,4-D, Clopyralid, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Glyphosate, MCPA	441
3. Wheat	11,201	2,4-D, Azoxystrobin, Bromoxynil Heptanoate, Bromoxynil Octanoate, Carfentrazone-Ethyl, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Dimethoate, Fenoxaprop-P-Ethyl, Glyphosate, MCPA, Mesosulfuron-Methyl	15,092
4. Rye Grass	8,107	2,4-D, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Dimethoate, MCPA	5,456
5. Sudan Grass	7,938	2,4-D, Lambda-Cyhalothrin, Methomyl	206
6. Walnuts	7,142	2,4-D, Aluminum Phosphide, Bifenazate, Boscalid, Chlorophacinone, Chlorpyrifos, Copper, Cyprodinil, Diazinon, Diphacinone, Diuron, E,E-8,10-Dodecadien-1-ol, E-8-Dodecenyl Acetate, Esfenvalerate, Ethephon, Fenbutatin-Oxide, Garlic, Glyphosate, Hexythiazox, Kaolin, Lambda-Cyhalothrin, Malathion, Maneb, Metam-Sodium, Methyl Bromide, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Phosmet, Propargite, Pyraclostrobin, Simazine, Spinosad, Strychnine, Tebufenozide, Triclopyr, Trifluralin, Z-8-Dodecenol	96,249
7. Corn	6,445	(S)-Cypermethrin, (S)-Metolachlor, 2,4-D, Azoxystrobin, Bifenthrin, Bromoxynil Heptanoate, Bromoxynil Octanoate, Carfentrazone-Ethyl, Dicamba, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Dimethoate, Esfenvalerate, Glyphosate, Lambda-Cyhalothrin, Methomyl, Nicosulfuron, Propargite, Rimsulfuron, Sethoxydim, Sodium Chlorate, Spinosad	4,669
8. Safflower	6,276	Trifluralin	1,132
9. Grapes	4,291	Quinoxifen, Simazine, Strychnine, Sulfur, Tebuconazole, Thiophanate-Methyl, Trifloxystrobin, Triflumizole, Zinc Phosphide	389,358
10. Beans	2,789	(S)-Cypermethrin, (S)-Metolachlor, Acephate, Carbaryl, Dicofof, Dimethoate, Ethalfuralin, Glyphosate, Lambda-Cyhalothrin, Methomyl, Metribuzin, Oxyfluorfen, Propargite, Sethoxydim, Sodium Chlorate, Trifluralin, Xylene	5,212
SOLANO COUNTY TOTAL:			563,659

SUTTER COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Rice	105,880	(S)-Cypermethrin, 2,4-D, Azoxystrobin, Bensulfuron Methyl, Bispyribac-Sodium, Carbaryl, Carfentrazone-Ethyl, Clomazone, Copper, Cyhalofop Butyl, Diflubenzuron, Fenoxaprop-Ethyl, Fenoxaprop-P-Ethyl, Glyphosate, Halosulfuron, Lambda-Cyhalothrin, Malathion, MCPA, Molinate, Pendimethalin, Penoxsulam, Propanil, Propiconazole, Sodium Chlorate, Thiobencarb, Triclopyr, Trifloxystrobin	935,439
2. Walnuts	24,277	1,3-Dichloropropene, 2,4-D, 2,4-Xylenol, Abamectin, Aluminum Phosphide, Bifenazate, Chlorpyrifos, Clofentezine, Copper, Diazinon, Dicofof, Diphacinone, Diuron, E,E-8,10-Dodecadien-1-ol, Esfenvalerate, Ethephon, Fenbutatin-Oxide, Fluazifop-P-Butyl, Flumioxazin, Glyphosate, Hexythiazox, Kaolin, Lambda-Cyhalothrin, Malathion, Maneb, Meta-Cresol, Methidathion, Methoxyfenozide, Methyl Bromide, Methyl Parathion, Naled, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Phosmet, Propargite, Pyridaben, Pyriproxyfen, Sethoxydim, Simazine, Spinosad, Strychnine, Sulfur, Tebufenozide, Trifluralin, Xylene , Zinc Phosphide	326,250

REVISED DRAFT

SUTTER COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
3. Plums	22,285	1,3-Dichloropropene, 2,4-D, Azoxystrobin, Bifenazate, Boscalid, Captan, Carfentrazone-Ethyl, Chlorothalonil, Chlorpyrifos, Copper, Cyprodinil, Diazinon, Diflubenzuron, Esfenvalerate, Fenbutatin-Oxide, Flumioxazin, Glyphosate, Iprodione, Lambda-Cyhalothrin, Methidathion, Methyl Bromide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Petroleum Distillates, Petroleum Oil, Propiconazole, Pyraclostrobin, Pyridaben, Sethoxydim, Sulfur, Xylene, Zinc Phosphide, Ziram	429,012
4. Peaches	11,657	1,3-Dichloropropene, 2,4-D, Azoxystrobin, Bifenazate, Boscalid, Carbaryl, Chlorpyrifos, Clofentezine, Copper, Cyprodinil, Diazinon, Diflubenzuron, E-8-Dodecenyl Acetate, Esfenvalerate, Fenbutatin-Oxide, Fluaizop-P-Butyl, Formetanate Hydrochloride, Glyphosate, Hexythiazox, Iprodione, Lambda-Cyhalothrin, Lime-Sulfur, Methidathion, Methyl Bromide, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Hydrocarbons, Petroleum Oil, Propiconazole, Pyraclostrobin, Pyridaben, Pyriproxyfen, Sethoxydim, Spinosad, Sulfur, Tebuconazole, Xylene, Z-8-Dodecenyl Acetate, Ziram	596,415
5. Wheat	11,580	2,4-D, Azoxystrobin, Bromoxynil, Carfentrazone-Ethyl, Dicamba, Diclofop-Methyl, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Fenoxaprop-P-Ethyl, MCPA, Mesosulfuron-Methyl, Methyl Bromide, Propiconazole, Pyraclostrobin	23,535
6. Safflower	10,641	EPTC, Glyphosate, Oxyfluorfen, Sodium Chlorate, Trifluralin	5,564
7. Alfalfa	7,004	(S)-Cypermethrin, 4(2,4-Db), Bromoxynil, Carbofuran, Chlorpyrifos, Clethodim, Cypermethrin, Diuron, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Methomyl, Norflurazon, Paraquat Dichloride, Sethoxydim, Trifluralin	4,845
8. Almonds	6,139	1,3-Dichloropropene, 2,4-D, Abamectin, Aluminum Phosphide, Azoxystrobin, Bifenazate, Boscalid, Chlorpyrifos, Copper Hydroxide, Cyprodinil, Diazinon, Diflubenzuron, Esfenvalerate, Flumioxazin, Glyphosate, Hexythiazox, Iprodione, Lambda-Cyhalothrin, Maneb, Methyl Bromide, Myclobutanil, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Potassium Phosphite, Propargite, Pyraclostrobin, Pyridaben, Pyriproxyfen, Simazine, Spinosad, Sulfur, Trifloxystrobin, Ziram	37,875
9. Tomatoes	5,200	(S)-Cypermethrin, (S)-Metolachlor, Azoxystrobin, Boscalid, Chlorothalonil, Copper, Cymoxanil, Diazinon, Dimethoate, Dimethomorph, Endosulfan, Ethephon, Famoxadone, Gamma-Cyhalothrin, Glyphosate, Halosulfuron, Indoxacarb, Kaolin, Lambda-Cyhalothrin, Mancozeb, Maneb, Mefenoxam, Metam-Sodium, Methamidophos, Methomyl, Methoxyfenozide, Metribuzin, Napropamide, Pyraclostrobin, Rimsulfuron, Sethoxydim, Sulfur, Tebufenozide, Trifluralin	98,562
10. Sunflower	4,069	Esfenvalerate, Ethalfluralin, Gamma-Cyhalothrin, Lambda-Cyhalothrin, Paraquat Dichloride, Sethoxydim, Sodium Chlorate, Trifluralin	16,108
SUTTER COUNTY TOTAL:			2,473,605

TEHAMA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Irrigated Pasture	22,000	2,4-D, Clopyralid, Glyphosate, Triclopyr	283
2. Walnuts	15,587	2,4-D, Abamectin, Aluminum Phosphide, Bifenazate, Chloropicrin, Chlorpyrifos, Clofentezine, Copper Hydroxide, Diazinon, Dicofol, Diflubenzuron, Diuron, Esfenvalerate, Ethephon, Fenbutatin-Oxide, Glufosinate-Ammonium, Glyphosate, Halosulfuron-Methyl, Kaolin, Lambda-Cyhalothrin, Malathion, Maneb, Methidathion, Methoxyfenozide, Methyl Bromide, Methyl Parathion, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Phosmet, Propargite, Propylene Oxide, Pyriproxyfen, Sethoxydim, Simazine, Spinosad, Strychnine, Tebufenozide, Triclopyr, Trifluralin	311,083

REVISED DRAFT

CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
3. Prunes	8,327	2,4-D, Abamectin, Azoxystrobin, Bifenazate, Boscalid, Captan, Carbaryl, Chloropicrin, Chlorothalonil, Chlorpyrifos, Clethodim, Copper Hydroxide, Cyprodinil, Diazinon, Dicofof, Esfenvalerate, Fenbutatin-Oxide, Flumioxazin, Glufosinate-Ammonium, Glyphosate, Iprodione, Lambda-Cyhalothrin, Methidathion, Methoxyfenozide, Methyl Bromide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Petroleum Oil, Phosmet, Propiconazole, Pyraclostrobin, Pyridaben, Sethoxydim, Spinosad, Strychnine, Sulfur, Thiophanate-Methyl, Xylene	108,231
4. Almonds	7,426	2,4-D, Abamectin, Aluminum Phosphide, Azinphos-Methyl, Azoxystrobin, Boscalid, Captan, Chlorpyrifos, Copper Hydroxide, Cyprodinil, Diazinon, Diflubenzuron, Diphacinone, Esfenvalerate, Fenbutatin-Oxide, Flumioxazin, Gamma Aminobutyric Acid, Glutamic Acid, Glyphosate, Halosulfuron-Methyl, Iprodione, Maneb, Methoxyfenozide, Myclobutanil, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Petroleum Oil, Phosmet, Propargite, Pyraclostrobin, Pyridaben, Simazine, Sulfur, Trifluralin, Xylene , Ziram	55,721
5. Olives	5,616	1,7-Dioxaspiro-(5,5)-Undecane, 2,4-D, Ammonium Bicarbonate, Copper, Diuron, Glyphosate, Lambda-Cyhalothrin, Methidathion, NAA, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Simazine, Spinosad, Strychnine	16,916
6. Grain	4,869	2,4-D, Bromoxynil Heptanoate, Carfentrazone-Ethyl, Dicamba, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Glyphosate, MCPA	1,406
7. Alfalfa	3,639	(S)-Cypermethrin, 2,4-D, 4(2,4-Db), Bromoxynil, Chlorpyrifos, Clethodim, Cyfluthrin, Diuron, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Malathion, Norflurazon, Paraquat Dichloride, Pendimethalin, Permethrin, Phosmet, Sethoxydim, Trifluralin	3,328
8. Wheat	1,751	2,4-D, Aluminum Phosphide, Carfentrazone-Ethyl, MCPA	167
9. Corn	1,728	2,4-D, Diuron, Glyphosate, Paraquat Dichloride, Permethrin, Propargite	2,277
10. Rice	800	Copper, Glyphosate	5,964
TEHAMA COUNTY TOTAL:			505,376

YOLO COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Alfalfa	45,776	(S)-Cypermethrin, 4(2,4-Db), Benefin, Bromoxynil, Carbofuran, Chlorpyrifos, Clethodim, Cyfluthrin, Cypermethrin, Dimethoate, Diuron, Eptc, Gamma-Cyhalothrin, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Malathion, Methomyl, Metribuzin, Paraquat Dichloride, Permethrin, Sethoxydim, Strychnine, Sulfur, Trifluralin	71,782
2. Tomatoes	42,232	(S)-Cypermethrin, (S)-Metolachlor, Abamectin, Acetamiprid, Azoxystrobin, Carbaryl, Chlorothalonil, Copper, Cyfluthrin, Cymoxanil, Diazinon, Dicofof, Dimethoate, Dimethomorph, Emamectin Benzoate, Endosulfan, EPTC, Esfenvalerate, Ethephon, Ethion, Famoxadone, Fosetyl-Al, Gamma Aminobutyric Acid, Gamma-Cyhalothrin, Glutamic Acid, Glyphosate, Halosulfuron-Methyl, Indoxacarb, Kaolin, Lambda-Cyhalothrin, Mancozeb, Maneb, Manganese Sulfate, Mefenoxam, Metam-Sodium, Methamidophos, Methomyl, Metribuzin, Napropamide, Oxyfluorfen, Paraquat Dichloride, Permethrin, Petroleum Hydrocarbons, Potash Soap, Potassium N-Methyldithiocarbamate, Pyraclostrobin, Rimsulfuron, Sethoxydim, Spinosad, Sulfur, Thiamethoxam, Trifluralin, Xylene , Zinc Sulfate	525,177
3. Rice	34,670	(S)-Cypermethrin, Azoxystrobin, Bensulfuron Methyl, Bispyribac-Sodium, Clomazone, Copper Sulfate (Pentahydrate), Cyhalofop Butyl, Fenoxaprop-Ethyl, Fenoxaprop-P-Ethyl, Glyphosate, Halosulfuron, Halosulfuron, Lambda-Cyhalothrin, Molinate, Paraquat Dichloride, Penoxsulam, Propanil, Sodium Chlorate, Thiobencarb, Triclopyr	240,870
4. Wheat	34,647	2,4-D, Acetamiprid, Aluminum Phosphide, Azoxystrobin, Bromoxynil, Carfentrazone-Ethyl, Dicamba, Diclofop-Methyl, Difenoconazole, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Fenoxaprop-P-Ethyl, Glyphosate, Imazamox, Lambda-Cyhalothrin, Magnesium Phosphide, MCPA, Mefenoxam, Mesosulfuron-Methyl, Methomyl, Pyraclostrobin, Sulfur	21,770

REVISED DRAFT

YOLO COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
5. Sunflower	13,615	(S)-Metolachlor, Chlorpyrifos, Cyfluthrin, Esfenvalerate, Ethalfluralin, Gamma-Cyhalothrin, Glyphosate, Imazamox, Lambda-Cyhalothrin, Mefenoxam, Paraquat Dichloride, Sethoxydim, Sodium Chlorate, Trifluralin, Zinc Phosphide	40,292
6. Irrigated Pasture	13,000	2,4-D, Clopyralid, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Glyphosate, MCPA, Zinc Phosphide	909
7. Safflower	12,955	(S)-Metolachlor, Chlorpyrifos, Cyfluthrin, Esfenvalerate, Ethalfluralin, Gamma-Cyhalothrin, Glyphosate, Imazamox, Lambda-Cyhalothrin, Mefenoxam, Paraquat Dichloride, Sethoxydim, Sodium Chlorate, Trifluralin, Zinc Phosphide	2,565
8. Walnuts	9,605	2,4-D, Abamectin, Aluminum Phosphide, Azinphos-Methyl, Bifenazate, Chlorophacinone, Chlorpyrifos, Copper, Diazinon, Diphacinone, Diuron, E,E-8,10-Dodecadien-1-ol, E-8-Dodecenyl Acetate, Esfenvalerate, Ethephon, Fenbutatin-Oxide, Glyphosate, Hexythiazox, Isoxaben, Kaolin, Lambda-Cyhalothrin, Malathion, Maneb, Metam-Sodium, Methoxyfenozide, Methyl Bromide, Methyl Parathion, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Phosmet, Potassium Phosphite, Propargite, Pyriproxyfen, Sethoxydim, Simazine, Spinosad, Strychnine, Tebufenozide, Trifluralin, Xylene, Z-8-Dodecenol, Z-8-Dodecenyl Acetate, Zinc Phosphide	129,337
9. Almonds	9,149	2,4-D, Abamectin, Aluminum Phosphide, Azoxystrobin, Bifenazate, Boscalid, Chlorophacinone, Chlorpyrifos, Cyprodinil, Diphacinone, Esfenvalerate, Fenbutatin-Oxide, Flumioxazin, Fosetyl-Al, Gamma Aminobutyric Acid, Glutamic Acid, Glyphosate, Iprodione, Mefenoxam, Methoxyfenozide, Myclobutanil, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Potash Soap, Potassium Phosphite, Propargite, Pyraclostrobin, Pyridaben, Pyridaben, Sethoxydim, Simazine, Spinosad, Strychnine, Sulfur, Trifluralin, Ziram	48,034
10. Grapes	8,464	2,4-D, Abamectin, Aluminum Phosphide, Azoxystrobin, Bifenazate, Boscalid, Chlorpyrifos, Copper, Cryolite, Cyprodinil, Diazinon, Dimethoate, Diuron, E-11-Tetradecen-1-yl Acetate, Fenamiphos, Fenarimol, Fenhexamid, Fenpropathrin, Fenpyroximate, Flumioxazin, Gibberellins, Glufosinate-Ammonium, Glyphosate, Imidacloprid, Iprodione, Kaolin, Kresoxim-Methyl, Lime-Sulfur, Mancozeb, Metam-Sodium, Methoxyfenozide, Myclobutanil, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Petroleum Distillates, Petroleum Oil, Phosmet, Potassium Bicarbonate, Propargite, Pyraclostrobin, Pyridaben, Quinoxifen, Sethoxydim, Simazine, Sodium Hypochlorite, Sulfur, Tebuconazole, Thiazopyr, Trifloxystrobin, Triflumizole, Trifluralin, Z-11-Tetradecen-1-yl Acetate, Zinc Phosphide	1,269,226
YOLO COUNTY TOTAL:			2,350,368

YUBA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Rice	35,005	(S)-Cypermethrin, 2,4-D, Azoxystrobin, Bensulfuron Methyl, Bispyribac-Sodium, Carbaryl, Carfentrazone-Ethyl, Clomazone, Copper Sulfate (Pentahydrate), Cyhalofop Butyl, Diflubenuron, Fenoxaprop-P-Ethyl, Glyphosate, Lambda-Cyhalothrin, Molinate, Parathion, Pendimethalin, Penoxsulam, Propanil, Sodium Chlorate, Thiobencarb, Triclopyr, Xylene	201,674
2. Plums	11,800	1,3-Dichloropropene, 2,4-D, Azoxystrobin, Captan, Carfentrazone-Ethyl, Chlorophacinone, Chlorothalonil, Chlorpyrifos, Copper, Cyprodinil, Diazinon, Esfenvalerate, Fenbutatin-Oxide, Glyphosate, Lambda-Cyhalothrin, Methidathion, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Petroleum Oil, Phosmet, Propiconazole, Pyrethrins, Spinosad, Sulfur, Ziram	198,732
3. Irrigated Pasture	9,600	No Data Available	

REVISED DRAFT

YUBA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
4. Walnuts	9,505	1,3-Dichloropropene, 2,4-D, Abamectin, Azinphos-Methyl, Bifenazate, Chlorpyrifos, Clofentezine, Copper, Diazinon, Diuron, E,E-8,10-Dodecadien-1-ol, Esfenvalerate, Ethephon, Fenbutatin-Oxide, Glyphosate, Halosulfuron, Hexythiazox, Kaolin, Lambda-Cyhalothrin, Lauryl Alcohol, Malathion, Maneb, Methoxyfenozide, Methyl Bromide, Methyl Parathion, Myristyl Alcohol, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Phosmet, Propargite, Simazine, Spinosad, Strychnine, Xylene	227,511
5. Peaches	6,050	1,3-Dichloropropene, 2,4-D, Azadirachtin, Bifenazate, Boscalid, Carbaryl, Chlorpyrifos, Clofentezine, Copper, Cyprodinil, Diazinon, E-8-Dodecenyl Acetate, Esfenvalerate, Fenbutatin-Oxide, Fluzifop-P-Butyl, Glyphosate, Iprodione, Lambda-Cyhalothrin, Malathion, Methidathion, Methoxyfenozide, Methyl Bromide, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Permethrin, Petroleum Distillates, Petroleum Oil, Propiconazole, Pyraclostrobin, Pyridaben, Spinosad, Sulfur, Tebuconazole, Xylene, Z-8-Dodecenol, Z-8-Dodecenyl Acetate, Zinc Phosphide, Ziram	374,926
6. Corn	1,086	Carfentrazone-Ethyl, Glyphosate	575
7. Almonds	1,069	2,4-D, Aluminum Phosphide, Azoxystrobin, Boscalid, Captan, Chlorothalonil, Clofentezine, Copper Hydroxide, Cyprodinil, Diflubenzuron, Esfenvalerate, Glyphosate, Myclobutanil, Oxyfluorfen, Permethrin, Petroleum Distillates, Propargite, Pyraclostrobin, Pyriproxyfen, Ziram	10,768
8. Kiwi	285	1,3-Dichloropropene, Glyphosate, Methidathion, Methyl Bromide, Petroleum Oil, Strychnine	11,769
9. Alfalfa	148	4(2,4-Db), Carbofuran, Clethodim	57
YUBA COUNTY TOTAL:			1,026,103
ZONE 1 TOTAL:			

Footnote 1: Although portions of Glenn, Lake, Modoc, Lassen, and Solano Counties are not within Coalition areas or Region 5, pesticide use data for the entire counties is part of this summary.

ZONE 2 PESTICIDE USE			
CALAVERAS COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Walnuts	650	2,4-D, Chlorpyrifos, Copper Hydroxide, Diuron, Glyphosate, Malathion, Oxyfluorfen, Paraquat Dichloride, Propargite, Simazine, Spinosad, Strychnine	1,973
2. Grapes	500	Abamectin, Bifenazate, Boscalid, Copper, Cyprodinil, Fenarimol, Fenhexamid, Flumioxazin, Glufosinate-Ammonium, Glyphosate, Kresoxim-Methyl, Mancozeb, Myclobutanil, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Propargite, Pyraclostrobin, Quinoxifen, Simazine, Strychnine, Sulfur, Tebuconazole, Trifloxystrobin	12,183
3. Olives	140	Glyphosate, Simazine	7
4. Apples	70	Chlorpyrifos, Glyphosate, Myclobutanil, Phosmet, Streptomycin Sulfate	15
CALAVERAS COUNTY TOTAL:			14,178

REVISED DRAFT

SAN JOAQUIN COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Corn, all	96,660	(S)-Cypermethrin, (S)-Metolachlor, 2,4-D, Atrazine, Bifenthrin, Bromoxynil, Carbaryl, Carfentrazone-Ethyl, Chlorpyrifos, Dicamba, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Dimethoate, Diuron, EPTC, Esfenvalerate, Glyphosate, Halosulfuron, Lambda-Cyhalothrin, Malathion, Mancozeb, Methomyl, Metolachlor, Metribuzin, Nicosulfuron, Oxydemeton-Methyl, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Phorate, Propargite, Rimsulfuron, Sethoxydim, Simazine, Sodium Chlorate, Spiromesifen, Trifluralin	80,990
2. Grapes, all	96,243	1,3-Dichloropropene, 2,4-D, Abamectin, Acetamiprid, Aluminum Phosphide, Ampelomyces Quisqualis, Azadirachtin, Azoxystrobin, Bifenazate, Boscalid, Buprofezin, Captan, Carbaryl, Chlorpyrifos, Clethodim, Copper, Cryolite, Cyprodinil, Diazinon, Dicloran, Dicofof, Diphacinone, Diuron, E-11-Tetradecen-1-Yl Acetate, Fenamiphos, Fenarimol, Fenbutatin-Oxide, Fenhexamid, Fenpropathrin, Fenpyroximate, Flumioxazin, Gamma Aminobutyric Acid, Gibberellins, Glufosinate-Ammonium, Glutamic Acid, Glyphosate, Imidacloprid, Iprodione, Kaolin, Kresoxim-Methyl, Lime-Sulfur, Mancozeb, Maneb, Metam-Sodium, Methomyl, Methoxyfenozide, Myclobutanil, Naled, Napropamide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Phosacetin, Phosmet, Potassium Bicarbonate, Propargite, Pyraclostrobin, Pyrethrins, Pyridaben, Quinoxifen, Sethoxydim, Simazine, Spinosad, Strychnine, Sulfur, Tebuconazole, Trifloxystrobin, Triflumizole, Trifluralin, Z-11-Tetradecen-1-Yl Acetate, Zinc Phosphide, Ziram	6,332,304
3. Hay, all	95,500	(S)-Cypermethrin, 2,4-D, 4(2,4-Db), Aluminum Phosphide, Bromoxynil, Carbaryl, Carbofuran, Chlorpyrifos, Clethodim, Copper Hydroxide, Cyfluthrin, Cypermethrin, Dimethoate, Diuron, EPTC, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Malathion, Methomyl, Metribuzin, Mevinphos, Norflurazon, Oxydemeton-Methyl, Paraquat Dichloride, Permethrin, Phosmet, Sethoxydim, Sulfur, Tebufenozide, Trifluralin, Zinc Phosphide	125,767
4. Tomatoes, all	47,090	Fenpropathrin, Gamma Aminobutyric Acid, Glutamic Acid, Glyphosate, Halosulfuron, Imidacloprid, Indoxacarb, Kaolin, Lambda-Cyhalothrin, Malathion, Mancozeb, Maneb, Manganese Sulfate, Mefenoxam, Metalaxyl, Methamidophos, Methomyl, Methoxyfenozide, Metribuzin, Myclobutanil, Napropamide, Oxyfluorfen, PCNB, Permethrin, Potassium Bicarbonate, Pyraclostrobin, Pyrethrins, Pyriproxyfen, Rimsulfuron, Sethoxydim, Spinosad, Spiromesifen, Sulfur, Tebufenozide, Thiamethoxam, Trifluralin, Zinc Sulfate	1,352,657
5. Walnuts, English	43,200	Clofentezine, Copper, Diazinon, Dicofof, Diflubenzuron, Diphacinone, Diuron, E,E-8,10-Dodecadien-1-ol, Esfenvalerate, Ethephon, Fenbutatin-Oxide, Flumioxazin, Glyphosate, Halosulfuron, Hexythiazox, Isoxaben, Kaolin, Lambda-Cyhalothrin, Malathion, Maneb, Mefenoxam, Metalaxyl, Methidathion, Methoxyfenozide, Methyl Bromide, Methyl Parathion, Naled, Norflurazon, Oryzalin, Oxydemeton-Methyl, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Phosmet, Propargite, Pyridaben, Pyriproxyfen, Sethoxydim, Simazine, Sodium Nitrate, Spinosad, Strychnine, Sulfur, Tebufenozide, Trifluralin, Xylene, Zinc Phosphide	498,311
6. Almond, meats	43,000	1,3-Dichloropropene, 2,4-D, Abamectin, Acephate, Aluminum Phosphide, Azoxystrobin, Bifenazate, Boscalid, Captan, Carbaryl, Chlorophacinone, Chloropicrin, Chlorothalonil, Chlorpyrifos, Clethodim, Clofentezine, Copper, Cyprodinil, Dazomet, Diazinon, Diflubenzuron, EPTC, Esfenvalerate, Etoxazole, Fenbutatin-Oxide, Flumioxazin, Gamma Aminobutyric Acid, Glufosinate-Ammonium, Glutamic Acid, Glyphosate, Hexythiazox, Iprodione, Lambda-Cyhalothrin, Maneb, Methidathion, Methoxyfenozide, Methyl Bromide, Myclobutanil, Napropamide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Phosmet, Propargite, Pyraclostrobin, Pyriproxyfen, Sethoxydim, Simazine, Sodium Hypochlorite, Sodium Nitrate, Spinosad, Strychnine, Sulfur, Thiazopyr, Thiophanate-Methyl, Trifloxystrobin, Trifluralin, Xylene, Zinc Phosphide, Ziram	431,422
7. Silage, other	30,700	2,4-D, Bromoxynil, Carfentrazone-Ethyl, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Glyphosate, MCPA, Oxyfluorfen	5,681
8. Wheat	20,400	2,4-D, Azoxystrobin, Bromoxynil, Carfentrazone-Ethyl, Dicamba, Diclofop-Methyl, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Dimethoate, Fenoxaprop-P-Ethyl, Glyphosate, MCPA, Mesosulfuron-Methyl, Oxyfluorfen, Pyraclostrobin	12,077

REVISED DRAFT

CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
9. Cherries, all	15,500	1,3-Dichloropropene, 2,4-D, Aluminum Phosphide, Boscalid, Captan, Carbaryl, Chlorophacinone, Chloropicrin, Chlorpyrifos, Clofentezine, Copper, Diazinon, Diphacinone, Esfenvalerate, Fenamiphos, Fenbuconazole, Fenbutatin-Oxide, Fenhexamid, Flumioxazin, Gamma Aminobutyric Acid, Gibberellins, Glutamic Acid, Glyphosate, Hexythiazox, Hydrogen Cyanamide, Imidacloprid, Iprodione, Iron Phosphate, Kaolin, Lambda-Cyhalothrin, Lime-Sulfur, Malathion, Mefenoxam, Methidathion, Methoxyfenozide, Methyl Bromide, Methyl Parathion, Myclobutanil, Napropamide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Phosmet, Propargite, Propiconazole, Pyraclostrobin, Pyriproxyfen, Quinoxifen, Sethoxydim, Simazine, Spinosad, Strychnine, Sulfur, Tebuconazole, Thiamethoxam, Thiazopyr, Xylene, Zinc Phosphide	306,503
10. Asparagus	13,994	2,4-D, Chlorpyrifos, Clopyralid, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Disulfoton, Diuron, Fluazifop-P-Butyl, Fosetyl-Al, Glyphosate, Halosulfuron, Linuron, Malathion, Mefenoxam, Metribuzin, Myclobutanil, Paraquat Dichloride, Sethoxydim, Trifluralin	43,913
TOTAL SAN JOAQUIN COUNTY:			9,189,625
CONTRA COSTA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Corn, all	9,290	(S)-Cypermethrin, (S)-Metolachlor, 2,4-D, Bifenthrin, Carbaryl, Carfentrazone-Ethyl, Chlorpyrifos, Cypermethrin, Diazinon, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Esfenvalerate, Glyphosate, Lambda-Cyhalothrin, Malathion, Methomyl, Methyl Parathion, Metolachlor, Nicosulfuron, Oxydemeton-Methyl, Propargite, Rimsulfuron	26,974
2. Alfalfa and other hay	3,280	(S)-Cypermethrin, 4(2,4-Db), Benefin, Bromoxynil, Carbofuran, Chlorpyrifos, Clethodim, Diuron, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Lambda-Cyhalothrin, Methomyl, Paraquat Dichloride, Phosmet, Sethoxydim	6,097
3. Grapes	1,940	2,4-D, Abamectin, Azoxystrobin, Bifenazate, Boscalid, Carbaryl, Copper, Cyprodinil, Diazinon, Diuron, E-11-Tetradecen-1-Yl Acetate, Fenarimol, Fenhexamid, Fenpropathrin, Flumioxazin, Gibberellins, Glufosinate-Ammonium, Glyphosate, Hydrogen Cyanamide, Imidacloprid, Kresoxim-Methyl, Lime-Sulfur, Methoxyfenozide, Myclobutanil, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Phosmet, Potassium Bicarbonate, Propargite, Pyraclostrobin, Quinoxifen, Simazine, Spinosad, Strychnine, Sulfur, Tebuconazole, Trifloxystrobin, Triflumizole, Z-11-Tetradecen-1-Yl Acetate	136,963
4. Wheat	1,530	2,4-D, Azoxystrobin, Bromoxynil, Carfentrazone-Ethyl, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Glyphosate, MCPA, Mesosulfuron-Methyl	1275
5. Tomatoes	1,181	(S)-Cypermethrin, (S)-Metolachlor, Chlorothalonil, Copper, Dimethoate, Esfenvalerate, Fenpropathrin, Fosetyl-Al, Gamma Aminobutyric Acid, Glutamic Acid, Imidacloprid, Lambda-Cyhalothrin, Mancozeb, Manganese Sulfate, Mefenoxam, Methomyl, Methoxyfenozide, Metribuzin, Myclobutanil, Permethrin, Piperonyl Butoxide, Pyraclostrobin, Pyrethrins, Rimsulfuron, Spinosad, Spiromesifen, Sulfur, Zinc Sulfate	19,157
6. Safflower	822	Glyphosate, Trifluralin	344
7. Walnuts	723	2,4-D, Aluminum Phosphide, Azinphos-Methyl, Chlorpyrifos, Copper, Diazinon, Diuron, Fosetyl-Al, Glyphosate, Lambda-Cyhalothrin, Methyl Bromide, Methyl Parathion, Norflurazon, Oryzalin, Oxyfluorfen, Pendimethalin, Phosmet, Propargite, Simazine, Spinosad, Trifluralin, Xylene	3,846
8. Apricots	542	Azoxystrobin, Boscalid, Carbaryl, Chlorothalonil, Copper, Cyprodinil, Diazinon, E-8-Dodecenyl Acetate, Esfenvalerate, Glyphosate, Hexythiazox, Iprodione, Lambda-Cyhalothrin, Myclobutanil, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Potassium Bicarbonate, Propiconazole, Pyraclostrobin, Spinosad, Thiamethoxam, Thiophanate-Methyl, Trifloxystrobin, Z-8-Dodecenol, Z-8-Dodecenyl Acetate, Ziram	2,243

REVISED DRAFT

CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
9. Cherries	334	2,4-D, Aluminum Phosphide, Boscalid, Carbaryl, Chlorothalonil, Copper, Diazinon, E-8-Dodecenyl Acetate, Esfenvalerate, Fenbutatin-Oxide, Fenhexamid, Flumioxazin, Gamma Aminobutyric Acid, Gibberellins, Glutamic Acid, Glyphosate, Hexythiazox, Iprodione, Lambda-Cyhalothrin, MSMA, Myclobutanil, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Phosphorus, Propargite, Pyraclostrobin, Pyrethrins, Sodium Nitrate, Sulfur, Tebuconazole, Thiamethoxam, Trifloxystrobin, Triflumizole, Z-8-Dodecenol, Z-8-Dodecenyl Acetate	2,265
10. Apples	304	Azinphos-Methyl, Bifenazate, Carbaryl, Cyprodinil, Diazinon, Esfenvalerate, Ethepon, Fenpropathrin, Glyphosate, Hexythiazox, Kresoxim-Methyl, NAA, Oxamyl, Oxyfluorfen, Paraquat Dichloride, Phosmet, Potassium Bicarbonate, Pyriproxyfen, Trifloxystrobin, Triflumizole	4,010
CONTRA COSTA COUNTY TOTAL:			203,174
ZONE 2 TOTAL: 9,406,977			

ZONE 3 PESTICIDE USE

TUOLUMNE COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Irrigated Pasture	1,200	2,4-D, Clopyralid, Triclopyr, Butoxyethyl Ester	18
TUOLUMNE COUNTY TOTAL:			18
MERCED COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Almonds	87,123	Glyphosate, Halosulfuron, Hexythiazox, Iprodione, Kaolin, Lambda-Cyhalothrin, Lime-Sulfur, Magnesium Phosphide, Maneb, Mefenoxam, Methidathion, Methomyl, Methoxyfenozide, Methyl Bromide, Myclobutanil, Napropamide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Phosmet, Phosphine, Potassium Phosphite, Propargite, Propiconazole, Pyraclostrobin, Pyridaben, Pyriproxyfen, Sethoxydim, Simazine, S-Methoprene, Sodium Tetrathiocarbonate, Spinosad, Strychnine, Sulfur, Thiazopyr, Thiophanate-Methyl, Trifloxystrobin, Trifluralin, Zinc Phosphide, Ziram	1,103,157
2. Corn	82,114	(S)-Cypermethrin, (S)-Metolachlor, 2,4-D, Azoxystrobin, Bifenthrin, Butylate, Captan, Carbaryl, Carfentrazone-Ethyl, Chlorpyrifos, Dicamba, Diflufenzopyr, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Dimethoate, EPTC, Esfenvalerate, Flumioxazin, Glyphosate, Halosulfuron, Halosulfuron-Methyl, Imazethapyr, Lambda-Cyhalothrin, Lindane, Malathion, Methomyl, Methyl Bromide, Nicosulfuron, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Propargite, Pyraflufen-Ethyl, Rimsulfuron, Sethoxydim, Sodium Chlorate, Spiromesifen, Sulfur, Trifluralin	131,510
3. Alfalfa	78,560	(S)-Cypermethrin, 4(2,4-Db), Abamectin, Aluminum Phosphide, Benefin, Bifenthrin, Bromoxynil Heptanoate, Bromoxynil Octanoate, Carbaryl, Carbofuran, Chlorpyrifos, Clethodim, Cyfluthrin, Cypermethrin, Dimethoate, Diuron, EPTC, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Malathion, Methomyl, Metribuzin, Mevinphos, Naled, Norflurazon, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Distillates, Petroleum Hydrocarbons, Phosmet, Sethoxydim, Strychnine, Trifluralin, Zinc Phosphide	237,682

REVISED DRAFT

CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
4. Cotton	63,670	(S)-Cypermethrin, (S)-Metolachlor, Abamectin, Acephate, Acetamiprid, Aldicarb, Azoxystrobin, Bifenthrin, Captan, Carfentrazone-Ethyl, Chlorpyrifos, Clethodim, Cyclanilide, Cyfluthrin, Cypermethrin, Deltamethrin, Dicofol, Dimethoate, Diuron, Endothall, Ethepon, Etoxazole, Farnesol, Fenpyroximate, Fluazifop-P-Butyl, Flumioxazin, Garlic, Glyphosate, Imidacloprid, Indoxacarb, Iprodione, Lambda-Cyhalothrin, Lindane, Malathion, Mepiquat Chloride, Methomyl, Methoxyfenozide, MSMA, Naled, Nerolidol, Oxamyl, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Phorate, Prometryn, Propargite, Pymetrozine, Pyraflufen-Ethyl, Pyriothion-Sodium, S,S,S-Tributyl Phosphorotrithioate, Sethoxydim, Sodium Chlorate, Spinosad, Spiromesifen, Sulfur, Thiamethoxam, Thidiazuron, Trifluralin, Urea Dihydrogen Sulfate, Xylene	434,253
5. Irrigated Pasture	59,000	2,4-D, Bromoxynil Octanoate, Dicamba, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Malathion, MCPA, Naled	1,701
6. Tomatoes	25,375	(S)-Cypermethrin, (S)-Metolachlor, 1,3-Dichloropropene, Abamectin, Acetamiprid, Azoxystrobin, Boscalid, Carbaryl, Chlorothalonil, Clethodim, Copper Hydroxide, Cyfluthrin, Cymoxanil, Diazinon, Dicofol, Dimethoate, Dimethomorph, Eamectin Benzoate, Esfenvalerate, Ethepon, Famoxadone, Fenpropathrin, Fosetyl-Al, Gamma Aminobutyric Acid, Glutamic Acid, Glyphosate, Imidacloprid, Indoxacarb, Lambda-Cyhalothrin, Malathion, Mancozeb, Maneb, Mefenoxam, Metalaxyl, Metam-Sodium, Methamidophos, Methomyl, Methoxyfenozide, Metribuzin, Myclobutanil, Ortho-Phenylphenol, Oxamyl, Oxyfluorfen, Paraquat Dichloride, Permethrin, Pyraclostrobin, Rimsulfuron, Sethoxydim, Sodium Hypochlorite, Spinosad, Spiromesifen, Sulfur, Tebufenozide, Trifluralin, Xylene	947,819
7. Grapes	11,542	1,3-Dichloropropene, 2,4-D, Abamectin, Aluminum Phosphide, Azoxystrobin, Bifenazate, Boscalid, Buprofezin, Captan, Carbaryl, Chlorpyrifos, Copper, Cyprodinil, Dicloran, Diuron, Ethepon, Fenamiphos, Fenarimol, Fenhexamid, Fenpropathrin, Fenpyroximate, Fluazifop-P-Butyl, Flumioxazin, Gibberellins, Glufosinate-Ammonium, Glyphosate, Imidacloprid, Iprodione, Kresoxim-Methyl, Lime-Sulfur, Methomyl, Methoxyfenozide, Myclobutanil, Naled, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Petroleum Distillates, Phosmet, Potassium Bicarbonate, Propargite, Pyraclostrobin, Pyridaben, Sethoxydim, Simazine, Spinosad, Sulfur, Tebuconazole, Thiophanate-Methyl, Trifloxystrobin, Triflumizole, Ziram	1,100,492
8. Wheat	11,325	2,4-D, Aluminum Phosphide, Azoxystrobin, Bromoxynil, Carfentrazone-Ethyl, Dicamba, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Fenoxaprop-P-Ethyl, Malathion, MCPA, Metribuzin, Paraquat Dichloride, Pyraclostrobin	10,274
9. Sweet Potatoes	10,257	1,3-Dichloropropene, Aluminum Phosphide, Chloropicrin, Chlorpyrifos, Clethodim, Dicloran, Fluazifop-P-Butyl, Glyphosate, Malathion, Metam-Sodium, Methomyl, Methoxyfenozide, Methyl Bromide, Napropamide, Sethoxydim, Spiromesifen	706,953
MERCED COUNTY TOTAL:			4,673,841
STANISLAUS COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Corn	102,300	(S)-Metolachlor, 2,4-D, Aluminum Phosphide, Bifenthrin, Bromoxynil, Butylate, Carbaryl, Carfentrazone-Ethyl, Chlorpyrifos, Dicamba, Diflufenzopyr, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Dimethoate, Diuron, EPTC, Esfenvalerate, Glyphosate, Halosulfuron, Lambda-Cyhalothrin, MCPA, Methomyl, Methyl Parathion, Metribuzin, Nicosulfuron, Oxyfluorfen, Paraquat Dichloride, Permethrin, Propargite, Rimsulfuron, Sethoxydim, Spiromesifen, Sulfur	94,796

REVISED DRAFT

CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
2. Almonds	97,300	1,3-Dichloropropene, 2,4-D, Abamectin, Aluminum Phosphide, Azinphos-Methyl, Azoxystrobin, Bifenazate, Boscalid, Calcium Hypochlorite, Captan, Carbaryl, Carfentrazone-Ethyl, Chlorophacinone, Chlorothalonil, Chlorpyrifos, Clethodim, Clofentezine, Copper, Cyprodinil, Diazinon, Diflubenzuron, Dinoseb, Diphacinone, E,E-8,10-Dodecadien-1-ol, EPTC, Esfenvalerate, Etoxazole, Fenbutatin-Oxide, Fluazifop-P-Butyl, Flumioxazin, Fosetyl-Al, Gamma Aminobutyric Acid, Glufosinate-Ammonium, Glutamic Acid, Glyphosate, Halosulfuron, Hexythiazox, Iprodione, Lambda-Cyhalothrin, Lime-Sulfur, Maneb, Mefenoxam, Metalaxyl, Metam-Sodium, Methidathion, Methoprene, Methoxyfenozide, Methyl Bromide, MSMA, Myclobutanil, Napropamide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Distillates, Petroleum Oil, Phosmet, Potash Soap, Potassium Dichromate, Potassium Phosphite, Propargite, Propiconazole, Pyraclostrobin, Pyridaben, Pyriproxyfen, Sethoxydim, Simazine, S-Methoprene, Sodium Hypochlorite, Sodium Tetrathiocarbonate, Spinosad, Strychnine, Sulfur, Tebufenozide, Thiophanate-Methyl, Trifloxystrobin, Trifluralin, Xylene, Zinc Phosphide, Ziram	1,463,807
3. Irrigated Pasture	72,000	2,4-D, Aluminum Phosphide, Clopyralid, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Diphacinone, Diuron, Glyphosate, Paraquat Dichloride, Triclopyr	1,556
4. Alfalfa	35,000	(S)-Cypermethrin, 2,4-D, 4(2,4-Db), Aluminum Phosphide, Bifenthrin, Bromoxynil, Carbofuran, Chlorpyrifos, Clethodim, Cyfluthrin, Cypermethrin, Dimethoate, Diuron, EPTC, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Malathion, Methomyl, Metribuzin, Norflurazon, Paraquat Dichloride, Permethrin, Phosmet, Propargite, Sethoxydim, Trifluralin	58,187
5. Walnuts	26,700	1,3-Dichloropropene, 2,4-D, Abamectin, Aluminum Phosphide, Azinphos-Methyl, Azoxystrobin, Bifenazate, Boscalid, Carfentrazone-Ethyl, Chloropicrin, Chlorpyrifos, Clethodim, Clofentezine, Copper, Cyprodinil, Diazinon, Dicofof, Diflubenzuron, Diuron, E,E-8,10-Dodecadien-1-ol, Esfenvalerate, Ethephon, Fenbutatin-Oxide, Flumioxazin, Gamma Aminobutyric Acid, Glufosinate-Ammonium, Glutamic Acid, Glyphosate, Halosulfuron-Methyl, Hexythiazox, Kaolin, Lambda-Cyhalothrin, Malathion, Maneb, Methidathion, Methoxyfenozide, Methyl Bromide, Methyl Parathion, Naled, Napropamide, Norflurazon, Oryzalin, Oxydemeton-Methyl, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Oil, Phosmet, Potassium Phosphite, Propargite, Pyraclostrobin, Pyriproxyfen, Sethoxydim, Simazine, Spinosad, Strychnine, Tebufenozide, Xylene	435,121
6. Oats	24,200	2,4-D, Aluminum Phosphide, Bromoxynil, Carfentrazone-Ethyl, Dicamba, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Glyphosate, Malathion, MCPA, Methomyl	10,346
7. Tomatoes	14,198	(S)-Cypermethrin, (S)-Metolachlor, Abamectin, Azoxystrobin, Carbaryl, Chlorothalonil, Copper, Cyfluthrin, Cymoxanil, Dicofof, Dimethoate, Dimethomorph, Emamectin Benzoate, Esfenvalerate, Ethephon, Famoxadone, Fenpropathrin, Fosetyl-Al, Gamma Aminobutyric Acid, Glutamic Acid, Glyphosate, Imidacloprid, Indoxacarb, Lambda-Cyhalothrin, Mancozeb, Maneb, Metam-Sodium, Methomyl, Methoxyfenozide, Metribuzin, Myclobutanil, Napropamide, Oxamyl, Oxyfluorfen, Paraquat Dichloride, Pebulate, Permethrin, Pyraclostrobin, Rimsulfuron, Spinosad, Spiromesifen, Sulfur, Tebufenozide, Trifluralin	223,678
8. Beans	11,900	(S)-Metolachlor, Acephate, Bifenthrin, Carbaryl, Chlorothalonil, Copper Hydroxide, Cypermethrin, Dicofof, Dimethoate, Esfenvalerate, Ethalfuralin, Ethoprop, Glyphosate, Lambda-Cyhalothrin, Maneb, Methomyl, Naled, Oxyfluorfen, Pendimethalin, Propargite, Rimsulfuron, Spinosad, Sulfur, Trifluralin	46,460
9. Grapes	10,100	1,3-Dichloropropene, 2,4-D, Abamectin, Aluminum Phosphide, Azoxystrobin, Bifenazate, Boscalid, Buprofezin, Carbaryl, Carfentrazone-Ethyl, Chlorpyrifos, Copper, Cyprodinil, Diazinon, Dicloran, Dicofof, Diphacinone, Diuron, E-11-Tetradecen-1-Yl Acetate, Fenamiphos, Fenarimol, Fenbutatin-Oxide, Fenhexamid, Fenpropathrin, Fenpyroximate, Flumioxazin, Gibberellins, Glufosinate-Ammonium, Glyphosate, Imidacloprid, Kresoxim-Methyl, Lime-Sulfur, Malathion, Methomyl, Methoxyfenozide, Myclobutanil, Naled, Napropamide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Potassium Bicarbonate, Propargite, Pyraclostrobin, Pyridaben, Sethoxydim, Simazine, Spinosad, Sulfur, Tebuconazole, Triadimefon, Trifloxystrobin, Triflumizole, Z-11-Tetradecen-1-Yl Acetate	751,649

REVISED DRAFT

CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
10. Peaches	8,040	(E)-5-Decenol, (E)-5-Decenyl Acetate, 1,3-Dichloropropene, 2,4-D, Aluminum Phosphide, Amino Ethoxy Vinyl Glycine Hydrochloride, Azoxystrobin, Bifenazate, Boscalid, Captan, Carbaryl, Chlorothalonil, Chlorpyrifos, Clofentezine, Copper, Cyprodinil, Diazinon, Diflubenzuron, E,E-8,10-Dodecadien-1-ol, E-11-Tetradecen-1-yl Acetate, E-8-Dodecenyl Acetate, Esfenvalerate, Fenbuconazole, Fenbutatin-Oxide, Flumioxazin, Formetanate Hydrochloride, Gibberellins, Glyphosate, Hexythiazox, Imidacloprid, Iprodione, Kaolin, Lambda-Cyhalothrin, Lauryl Alcohol, Lime-Sulfur, Methidathion, Methoxyfenozide, Methyl Bromide, Myclobutanil, Myristyl Alcohol, Napropamide, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Permethrin, Petroleum Distillates, Petroleum Oil, Phosmet, Piperonyl Butoxide, Potassium Bicarbonate, Potassium Phosphite, Propiconazole, Pyraclostrobin, Pyrethrins, Pyridaben, Sethoxydim, Simazine, Spinosad, Strychnine, Sulfur, Tebuconazole, Thiophanate-Methyl, Trifloxystrobin, Vinclozolin, Z-11-Tetradecen-1-yl Acetate, Z-8-Dodecenol, Z-8-Dodecenyl Acetate, Ziram	322,197
STANISLAUS COUNTY TOTAL:			3,407,797
MADERA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Grapes	82,400	2,4-D, 2-Methyl-4-Isothiazolin-3-One, 5-Chloro-2-Methyl-4-Isothiazolin-3-One, Abamectin, Acetamiprid, Ampelomyces Quisqualis, Azoxystrobin, Bifenazate, Boscalid, Buprofezin, Captan, Carbaryl, Carfentrazone-Ethyl, Chlorpyrifos, Clethodim, Copper, Cryolite, Cyprodinil, Diazinon, Dicloran, Dicofol, Dimethoate, Diphacinone, Diuron, Ethephon, Fenamiphos, Fenarimol, Fenbutatin-Oxide, Fenhexamid, Fenpropathrin, Fenpyroximate, Flumioxazin, Forchlorfenuron, Gamma Aminobutyric Acid, Gibberellins, Glufosinate-Ammonium, Glutamic Acid, Glyphosate, Imidacloprid, Iprodione, Iron Phosphate, Isoxaben, Kresoxim-Methyl, Lime-Sulfur, Mancozeb, Maneb, Methomyl, Methoxyfenozide, Msma, Myclobutanil, Naled, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Phosmet, Potassium Bicarbonate, Potassium Sorbate, Propargite, Pyraclostrobin, Pyridaben, Quinoxifen, Sethoxydim, Simazine, Spinosad, Strychnine, Sulfur, Tebuconazole, Tebufenozide, Thiophanate-Methyl, Trifloxystrobin, Triflumizole, Trifluralin, Xylene, Zinc Phosphide, Ziram	7,653,885
2. Almonds	57,400	1,3-Dichloropropene, 2,4-D, Diethanolamine Salt, 2,4-D, Dimethylamine Salt, Abamectin, Acephate, Aluminum Phosphide, Azinphos-Methyl, Azoxystrobin, Bifenazate, Borax, Boscalid, Captan, Carbon, Carfentrazone-Ethyl, Chlorothalonil, Chlorpyrifos, Neem Oil, Clethodim, Clofentezine, Copper, Cyfluthrin, Cyprodinil, Diazinon, Diflubenzuron, Dinoseb, Diphacinone, EPTC, Esfenvalerate, Etoxazole, Fenbutatin-Oxide, Fenpyroximate, Fluazifop-P-Butyl, Flumioxazin, Gamma Aminobutyric Acid, Glufosinate-Ammonium, Glutamic Acid, Glyphosate, Halosulfuron-Methyl, Hexythiazox, Iprodione, Isoxaben, Kaolin, Lambda-Cyhalothrin, Mancozeb, Maneb, Mefenoxam, Methoxyfenozide, Methyl Bromide, Mevinphos, Msma, Myclobutanil, Napropamide, Nitrpyrin, Norflurazon, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Parathion, Pendimethalin, Permethrin, Propargite, Pyraclostrobin, Pyridaben, Pyriproxyfen, Sethoxydim, Simazine, Sodium Chlorate, Sodium Nitrate, Spinosad, Strychnine, Sulfaquinoxaline, Sulfur, Tebufenozide, Thiazopyr, Thiophanate-Methyl, Trifloxystrobin, Trifluralin, Warfarin, Xylene, Ziram	452,408
3. Alfalfa	36,700	(S)-Cypermethrin, 4(2,4-Db), Abamectin, Bifenthrin, Bromoxynil, Carbaryl, Chlorpyrifos, Clethodim, Copper Hydroxide, Cyfluthrin, Cypermethrin, Dimethoate, Diuron, EPTC, Glyphosate, Hexazinone, Imazamox, Imazethapyr, Indoxacarb, Lambda-Cyhalothrin, Malathion, Methomyl, Naled, Norflurazon, Paraquat Dichloride, Permethrin, Propargite, Sethoxydim, Trifluralin	68,914

REVISED DRAFT

CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
4. Pistachios	24,100	2,4-D, Abamectin, Aluminum Phosphide, Azoxystrobin, Boscalid, Buprofezin, Carbaryl, Carbon, Carfentrazone-Ethyl, Chlorophacinone, Copper, Diphacinone, Flumioxazin, Glyphosate, Isoxaben, Methoxyfenozide, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Parathion, Pendimethalin, Permethrin, Phosmet, Pyraclostrobin, Sodium Nitrate, Strychnine, Sulfur, Thiazoppyr, Thiophanate-Methyl, Trifloxystrobin, Trifluralin, Xylene	189,123
5. Wheat	22,900	Azoxystrobin, Bromoxynil, Carfentrazone-Ethyl, Dicamba, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Glyphosate, MCPA, Oxyfluorfen, Propiconazole	4,305
6. Corn	19,500	(S)-Metolachlor, Bifenthrin, Captan, Carbaryl, Carfentrazone-Ethyl, Chlorpyrifos, Dicamba, Diflufenzopyr, Diglycolamine Salt Of 3,6-Dichloro-O-Anisic Acid, Dimethoate, Flumioxazin, Glyphosate, Halosulfuron, Lambda-Cyhalothrin, Lindane, Methomyl, Nicosulfuron, Oxyfluorfen, Permethrin, Propargite, Spinosad, Spiromesifen	11,904
7. Cotton	14,700	(S)-Cypermethrin, (S)-Metolachlor, Abamectin, Acephate, Acetamiprid, Aldicarb, Bifenthrin, Cacodylic Acid, Carfentrazone-Ethyl, Chlorpyrifos, Clethodim, Cyclanilide, Cyfluthrin, Cypermethrin, Deltamethrin, Dicofof, Dimethoate, Diuron, Endothall, Esfenvalerate, Ethephon, Etoxazole, Fluazifop-P-Butyl, Flumioxazin, Glufosinate-Ammonium, Glyphosate, Imidacloprid, Indoxacarb, Lambda-Cyhalothrin, Mepiquat Chloride, Methomyl, Methoxyfenozide, Methyl Parathion, MSMA, Oxyfluorfen, Paraquat Dichloride, Pendimethalin, Phorate, Piperonyl Butoxide, Profenofos, Prometryn, Propargite, Pyraflufen-Ethyl, Pyrethrins, Pyriothobac-Sodium, S,S,S-Tributyl Phosphorotrithioate, Sethoxydim, Sodium Cacodylate, Sodium Chlorate, Spinosad, Spiromesifen, Thiamethoxam, Thidiazuron, Toxaphene, Trifluralin, Urea Dihydrogen Sulfate, Xylene	89,461
8. Figs	7,680	Chlorophacinone, Glyphosate, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Strychnine	10,916
9. Tomatoes	3,900	(S)-Cypermethrin, (S)-Metolachlor, Acetamiprid, Chlorothalonil, Clethodim, Copper, Cymoxanil, Dicofof, Dimethoate, Dimethomorph, Emamectin Benzoate, Esfenvalerate, Famoxadone, Fenpropathrin, Glyphosate, Imidacloprid, Indoxacarb, Kaolin, Lambda-Cyhalothrin, Mancozeb, Maneb, Mefenoxam, Methoxyfenozide, Metribuzin, Myclobutanil, Oxyfluorfen, Pyraclostrobin, Sethoxydim, Spinosad, Sulfur, Trifluralin	253,651
10. Oranges	3,830	2,4-D, Isopropyl Ester, Abamectin, Acetamiprid, Aluminum Phosphide, Azoxystrobin, Bromacil, Carbaryl, Chlorpyrifos, Copper, Cryolite, Cyfluthrin, Diphacinone, Diuron, Fenbutatin-Oxide, Fenpropathrin, Formetanate Hydrochloride, Fosetyl-Al, Gamma Aminobutyric Acid, Gibberellins, Glutamic Acid, Glyphosate, Imidacloprid, Kaolin, Mefenoxam, Metaldehyde, Methidathion, Oryzalin, Oxyfluorfen, Paraquat Dichloride, Pendimethalin	78,890
MADERA COUNTY TOTAL:			8,813,457
MARIPOSA COUNTY			
CROP	ACRES	CROP PESTICIDES	TOTAL POUNDS APPLIED
1. Grain & Hay	755	Data Not Available	0
2. Irrigated Pasture	710	Data Not Available	0
3. Grapes	88	Aluminum Phosphide, Boscalid, Captan, Fenarimol, Glyphosate, Myclobutanil, Oryzalin, Oxyfluorfen, Petroleum Distillates, Potassium Bicarbonate, Pyraclostrobin, Sulfur	444
4. Apples	60	E,E-8,10-Dodecadien-1-ol, Kresoxim-Methyl, Lauryl Alcohol, Myristyl Alcohol, Prohexadione Calcium, Triflumizole	1
MARIPOSA COUNTY TOTAL:			445
ZONE 3 TOTAL:			