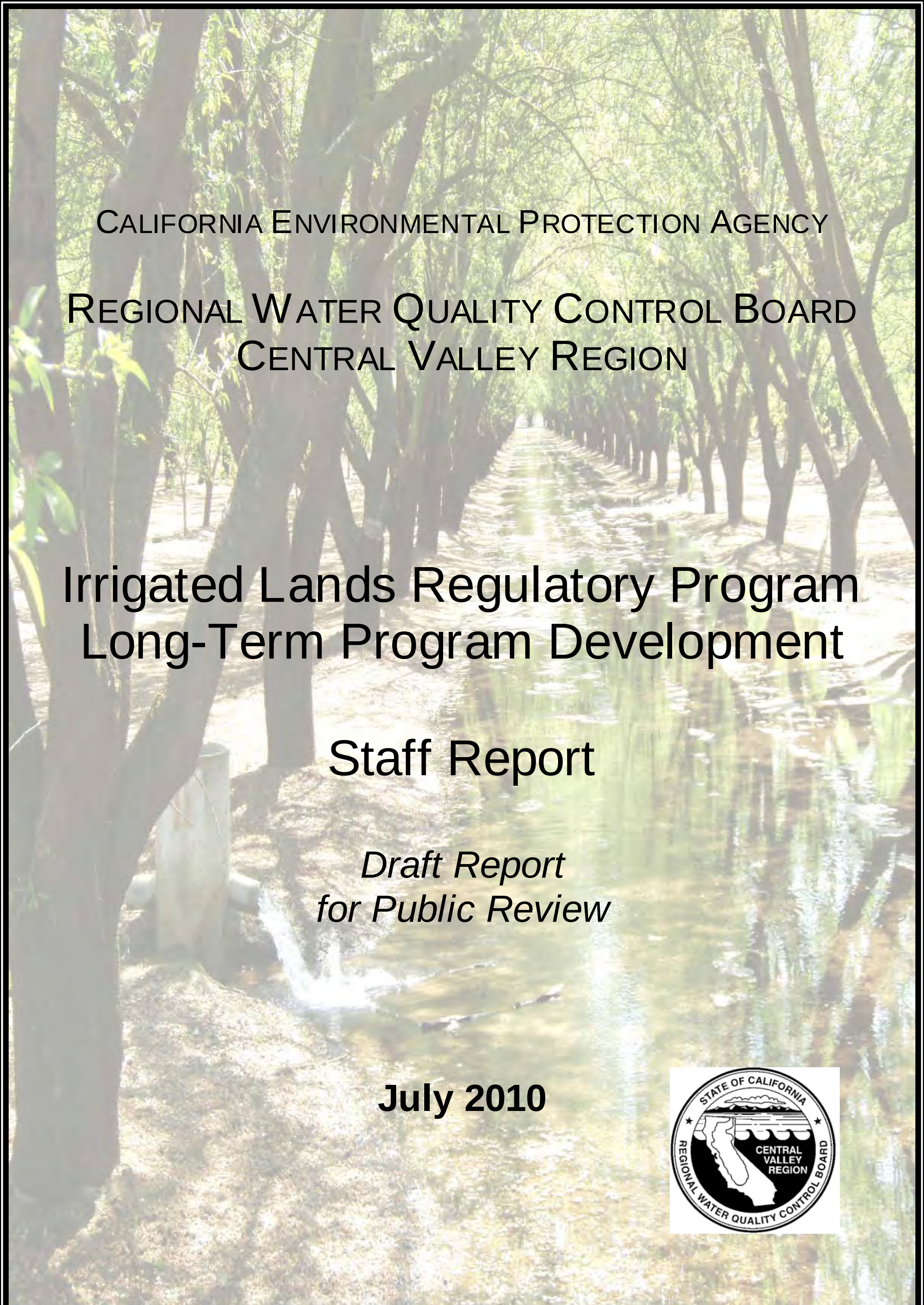

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

Irrigated Lands Regulatory Program Long-Term Program Development

Staff Report

Draft Report for Public Review

July 2010

STATE OF CALIFORNIA
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California Environmental Protection Agency

Regional Water Quality Control Board
Central Valley Region

Irrigated Lands Regulatory Program
Long-Term Program Development

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LIST OF ACRONYMS/ABBREVIATIONS

ACL	Administrative Civil Liability
BAT	best available technology economically achievable
BCT	best practicable control technology currently achievable
BMP	best management practice
BPTC	best practicable treatment or control
CAC	County Agricultural Commissioner
CCR	California Code of Regulations
CDFA	California Department of Food and Agriculture
Central Valley Water Board	Central Valley Regional Water Quality Control Board
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
COD	chemical oxygen demand
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
CWC	California Water Code
DPR	California Department of Pesticide Regulation
ECR	Existing Conditions Report
EIR	Environmental Impact Report
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FWQMP	farm water quality management plan
GQMP	groundwater quality management plan
GWMP	(local existing) groundwater management plan
GWPA	groundwater protection areas (DPR)
GWPL	groundwater protection list (DPR)
ILRP	Irrigated Lands Regulatory Program
JPA	joint powers authority
MAA	Management Agency Agreement
MCL	maximum contaminant level
MDL	method detection limit
MEP	maximum extent practicable
MP	management practice
MRP Plan	monitoring and reporting program plan
MS4	municipal separate storm sewer system
NASS	National Agricultural Statistics Service, USDA
NMP	nutrient management plan
NPDES	National Pollutant Discharge Elimination System
NPS Policy	State Water Board Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program
NPS	nonpoint source
PCPA	Pesticide Contamination Prevention Act
PEIR	Program Environmental Impact Report

PREC	Pesticide Regulation & Evaluation Committee (DPR)
PY	Personnel-year
RL	reporting limit
ROWD	report of waste discharge
SNV	specific numerical values (DPR)
State Water Board	State Water Resources Control Board
SVOC	semi-volatile organic compounds
SWAMP	Surface Water Ambient Monitoring Program
SWPPP	Storm Water Pollution Prevention Plan
TIC	Technical Issues Committee
TMDL	Water Board Total Maximum Daily Load Program
TSS	total suspended solids
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
Waiver	conditional waiver of waste discharge requirements
WDRs	waste discharge requirements
WIDB	DPR's well inventory database
µg/l	micrograms per liter

EXECUTIVE SUMMARY

In 2003 the California Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board) adopted a conditional waiver of waste discharge requirements (WDRs) for discharges from irrigated agricultural lands (irrigated lands regulatory program or "ILRP"). The ILRP's requirements were designed to reduce wastes discharged from irrigated agricultural sites to Central Valley surface waters (e.g., tailwater, runoff from fields, subsurface drains). The 2003 waiver program was set to expire in 2006, at which time the Central Valley Water Board adopted a new conditional waiver for discharges from irrigated agricultural lands that continues the 2003 interim program until 2011.

As part of the 2003 and 2006 waiver programs, the Central Valley Water Board directed staff to prepare an environmental impact report (EIR) for a long-term ILRP that would protect State waters from irrigated agricultural waste discharges. Although the requirements of the current ILRP are aimed to protect surface water bodies, the directive to develop a long-term program and EIR is not as explicit, as "State" waters include ground and surface waters within the State (California Water Code, Section 13050[e]).

General Context for the Preferred Alternative

Virtually all Water Board regulatory programs rely on the same fundamental activities: (1) monitoring, (2) assessment, (3) planning, and (4) implementation. These activities are related and often iterative. Broadly speaking, monitoring involves the collection of data that allows stakeholders and the Board to assess whether the objectives of the regulatory program are being achieved. Based on the assessment of the data, plans are developed or adjusted to address any identified water quality issues. Alternatively, the information from the assessment may lead to a conclusion that no changes are needed. Finally, any plan that is developed must be implemented with adequate monitoring or feedback mechanisms to ensure the planned activities are being carried out.

The monitoring, assessment, planning, and implementation activities are considered in the context of the water quality issues that must be addressed. For certain areas and crops, available information may indicate:

1. no or limited effects of agricultural discharge on water quality;

2. clear relationships between discharge and water quality problems; or

3. uncertainty as to whether irrigated agriculture is contributing to an identified problem (e.g., agricultural waste discharges are often commingled, either in a shared drainage conveyance or shared groundwater aquifer. This commingling of discharge makes it more difficult to determine whether specific irrigated agricultural operations are contributing to a water quality

problem or whether there is a general practice used by all operations that must be changed to improve water quality).

Each of these circumstances suggests a different regulatory approach—limited requirements in the first instance; a focus on implementing appropriate practices to correct the water quality problem in the second instance; and a focus on additional investigation in the third instance.

In developing the preferred alternative (or "recommended alternative"), Water Board staff are mindful that there is a balancing of costs associated with a new regulatory program. A more stringent regulatory program may increase the likelihood of improving and protecting water quality, but the cost of compliance for regulated entities and the State to oversee the program can be overly burdensome. The California Water Code (CWC) requires that costs be considered when developing programs for agriculture. Given that agricultural operators are price takers in the market and cannot directly pass on their costs to consumers, these costs become especially important. Conversely, a regulatory program that is lax or allows too much time for compliance can lead to an exacerbation of water quality problems and prolonged impacts on beneficial uses.

To assist the Central Valley Water Board in trying to strike the appropriate balance, a Stakeholder Advisory Workgroup was formed. The Workgroup included representatives from local, State, and federal agencies; agricultural interests; water suppliers; environmental/environmental justice groups; and other interested parties. Over the course of 9 months (December 2008–August 2009), the Advisory Workgroup came to consensus on the goals and objectives of the program and the five alternatives that should be considered and analyzed.

At the request of the Advisory Workgroup, Water Board staff developed a "straw proposal" based on an initial review of the five alternatives and staff's review of existing Water Board regulatory programs that address irrigated agriculture or are structured to deal with a large group of waste dischargers. In April and May 2010, staff reviewed the straw proposal with stakeholders. Stakeholders were generally supportive of the straw proposal, although there were a number of concerns. The elements that received stakeholder support; the concerns expressed; and the environmental impact, economic analysis, and policy analysis described below all were considered in developing the preferred alternative.

The five programmatic alternatives have been evaluated against the long-term ILRP goals and objectives and State policy and law and considered in a Draft PEIR[1] and Draft ILRP Economics Report (economics report).[2] The results of the evaluation have been used to identify the elements of each alternative that best

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[1] *Draft Irrigated Lands Regulatory Program Program Environmental Impact Report* (ICF International 2010) (Draft PEIR)

[2] ICF International 2010, Draft Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program) (Draft ILRP Economics Report).

achieve the evaluation measures (e.g., goals and objectives, policy, environmental impacts, cost). These elements have been combined to create a recommended long-term ILRP. This report (1) summarizes the information that the Central Valley Water Board has considered in the development of a recommended long-term ILRP, (2) describes and evaluates the range of proposed program alternatives, and (3) provides a recommended alternative based on the policy, economic, and environmental review.

Elements of the long-term ILRP alternatives found to best achieve evaluation measures are summarized below.

- Scope: consideration of surface “and” groundwater waste discharges to achieve the goals and objectives proposed by the Stakeholder Advisory Workgroup (current ILRP does not include waste discharge to groundwater)
- Third-party lead or coalition groups, as opposed to Central Valley Water Board lead, to take advantage of local knowledge and administrative/cost efficiencies in dealing with a few groups versus thousands of individual operations
- Regional surface and groundwater quality management plans, as opposed to individual water quality management plans, to minimize paperwork/administrative burdens while clearly defining the expectations and approach for addressing water quality problems
- Regional surface and groundwater quality monitoring, as opposed to individual or no water quality monitoring, to take advantage of cost efficiencies in coordinating with other monitoring efforts while providing sufficient information to characterize water quality
- The above elements are included in a Central Valley Water Board staff-recommended long-term ILRP provided in this report.

This report is intended to provide interested stakeholders with the information necessary to understand the process that the Central Valley Water Board has conducted in the development of a recommended long-term ILRP and the rationale for the recommended ILRP components. This report considers and summarizes the results of the Draft PEIR and economics report.

During the July 28–September 27, 2010, long-term ILRP Draft PEIR comment period, interested stakeholders are encouraged to provide comments on this report, the Draft PEIR, and the economics report. To facilitate a timely and accurate response to comments received, the Central Valley Water Board requests that written comments include (1) a heading indicating the page/section of report (s) (PEIR/economics/staff report) the comment is addressing, (2) a summary of comment/recommended change, and (3) any discussion supporting the comment/recommended change. The Central Valley Water Board prefers that comments be submitted electronically to the following email address: ILRPcomments@icfi.com. If email is unavailable, written comments should be provided to:

ILRP Comments
Ms. Megan Smith
ICF International
630 K Street, Suite 400
Sacramento, CA 95814
Fax: (916) 456-6724

Stakeholder comments will be considered during the development of a final recommended long-term ILRP and Final PEIR. Any questions regarding the long-term ILRP or this notification should be directed to Adam Laputz at (916) 464-4848 or awlaputz@waterboards.ca.gov.

I. INTRODUCTION

There are numerous and varying irrigated agricultural operations within the boundaries of the Central Valley Water Board. Common to all types of these operations is the use of water to sustain crops. Depending on irrigation method, water use, geography, geology, and the "waste" constituents (e.g., nutrients, pesticides, pathogens) present or used at a site, there is the possibility that water discharged from the site will carry these constituents off site and into ground or surface waters.

The Central Valley Regional Water Quality Control Board Irrigated Lands Regulatory Program (ILRP) was initiated in 2003 with the adoption of a conditional waiver of WDRs for discharges from irrigated lands. The 2003 waiver program was renewed in 2006 (current ILRP). The current ILRP's requirements are designed to reduce wastes discharged from irrigated agricultural sites (e.g., tailwater, runoff from fields, subsurface drains) to Central Valley surface waters (Central Valley Water Board 2006).

In addition to providing conditions, or requirements, for discharge of waste from irrigated agricultural lands to surface waters, the Central Valley Water Board's current ILRP establishes that Board staff will develop a program environmental impact report (PEIR) for a long-term ILRP (long-term program) that will protect waters of the State from said discharges. Although the requirements of the current ILRP are aimed to protect surface water bodies, the directive to develop a long-term program and PEIR is not as limited, as waters of the State include ground and surface waters within the State of California (CWC, Section 13050[e]).

The Central Valley Water Board completed an Existing Conditions Report (ECR) for Central Valley irrigated agricultural operations in December 2008. The ECR was developed to establish baseline conditions for estimating potential environmental and economic effects of long-term ILRP alternatives in a PEIR and other associated analyses. The ECR has been used in the development of this report and is incorporated by reference.

In fall 2008, the Central Valley Water Board convened the Long-Term ILRP Stakeholder Advisory Workgroup (Workgroup). The Workgroup included a range of stakeholder interests representing local government, industry, agricultural, and environmental/environmental justice coalitions throughout the Central Valley. The main goal of the Workgroup was to provide Central Valley Water Board staff with input on the development of the long-term ILRP. Central Valley Water Board staff and the Workgroup developed long-term program goals and objectives and a range of proposed alternatives for consideration in a PEIR and economic analysis. In August 2009 the Workgroup approved these goals, objectives, and range of proposed alternatives for the long-term ILRP. The Workgroup process, long-term ILRP goals and objectives, and range of alternatives are included in the December 2009 "Proposed Long-Term Irrigated Lands Regulatory Program

Alternatives" document (Alternatives Document—Appendix A). The Central Valley Water Board has committed to evaluate the Workgroup-approved range of alternatives in economics, PEIR, and policy analyses.

As part of the development of the long-term ILRP, the Central Valley Water Board's contractor, ICF International, has developed a Draft PEIR[3] and economics report.[4] The results of the Draft PEIR and economic analysis have been considered in evaluating proposed alternatives and developing the staff-recommended alternative in this report.

This report (1) summarizes the information Central Valley Water Board staff (staff) have considered in the development of a recommended long-term ILRP, (2) describes and evaluates the range of proposed program alternatives, and (3) provides a recommended staff alternative based on the policy, economic, and environmental review.

II. CURRENT IRRIGATED LANDS REGULATORY PROGRAM DESCRIPTION

A. Background

In 2003 the Central Valley Water Board adopted a revised conditional waiver of WDRs for discharges from irrigated agricultural lands (the original was adopted in 1982 and revised in 2002). The current ILRP essentially began with the adoption of the 2003 conditional waiver.

B. Regulatory Setting: Conditional Waivers

Owners and operators of irrigated agricultural operations, nursery stock production, managed wetlands, and greenhouse operations with permeable floors that have the potential to discharge waste to surface waters of the State and do not currently discharge under a waiver, WDRs, or National Pollutant Discharge Elimination System (NPDES) permits must obtain regulatory coverage under the current ILRP. The current ILRP implements the CWC. Under the current ILRP, irrigated agricultural operations[5] have three regulatory options: individual WDRs, an individual conditional waiver of WDRs, or a coalition group conditional waiver of WDRs. The vast majority of operators have chosen the coalition group conditional waiver, a few have chosen the individual waiver, and none are currently regulated under WDRs. Approximately 25,000 growers are

[3] Draft Irrigated Lands Regulatory Program Environmental Impact Report (ICF International 2010) (Draft PEIR)

[4] ICF International 2010, Draft Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program) (Draft ILRP Economics Report).

[5] For ease of reading purposes, this report will use the terms "irrigated agricultural operations," "irrigated lands," "operators," or "growers" to refer to all types of discharges regulated through the ILRP, which also includes discharges from nursery stock production, managed wetlands, and greenhouse operations with permeable floors.

currently enrolled in the program, equating to 5 million of the approximately 7 million acres[6] of commercial irrigated agricultural lands in the Central Valley Region.

Conditions that must be met by coalitions and growers include ensuring the Central Valley Water Board knows who is participating in the program (names and parcels are identified); conducting monitoring to determine whether discharges from irrigated lands are affecting surface waters; and developing and implementing measures to address identified water quality problems.

C. Coalition Groups

Most irrigated agricultural operations choose to participate in a coalition group (generally referred to as third-party group). Coalition groups conduct water quality monitoring, submit reports to the Central Valley Water Board, and develop management plans to address water quality problems. All program enrollees must comply with the conditions in the Coalition Group Conditional Waiver, including the requirement to implement management practices that protect water quality. There are currently eight coalition groups:

- California Rice Commission
- East San Joaquin Water Quality Coalition
- Goose Lake Water Quality Coalition
- Sacramento Valley Water Quality Coalition
- San Joaquin County and Delta Water Quality Coalition
- Southern San Joaquin Valley Water Quality Coalition
- Westlands Water District Stormwater Coalition
- Westside San Joaquin River Watershed Coalition

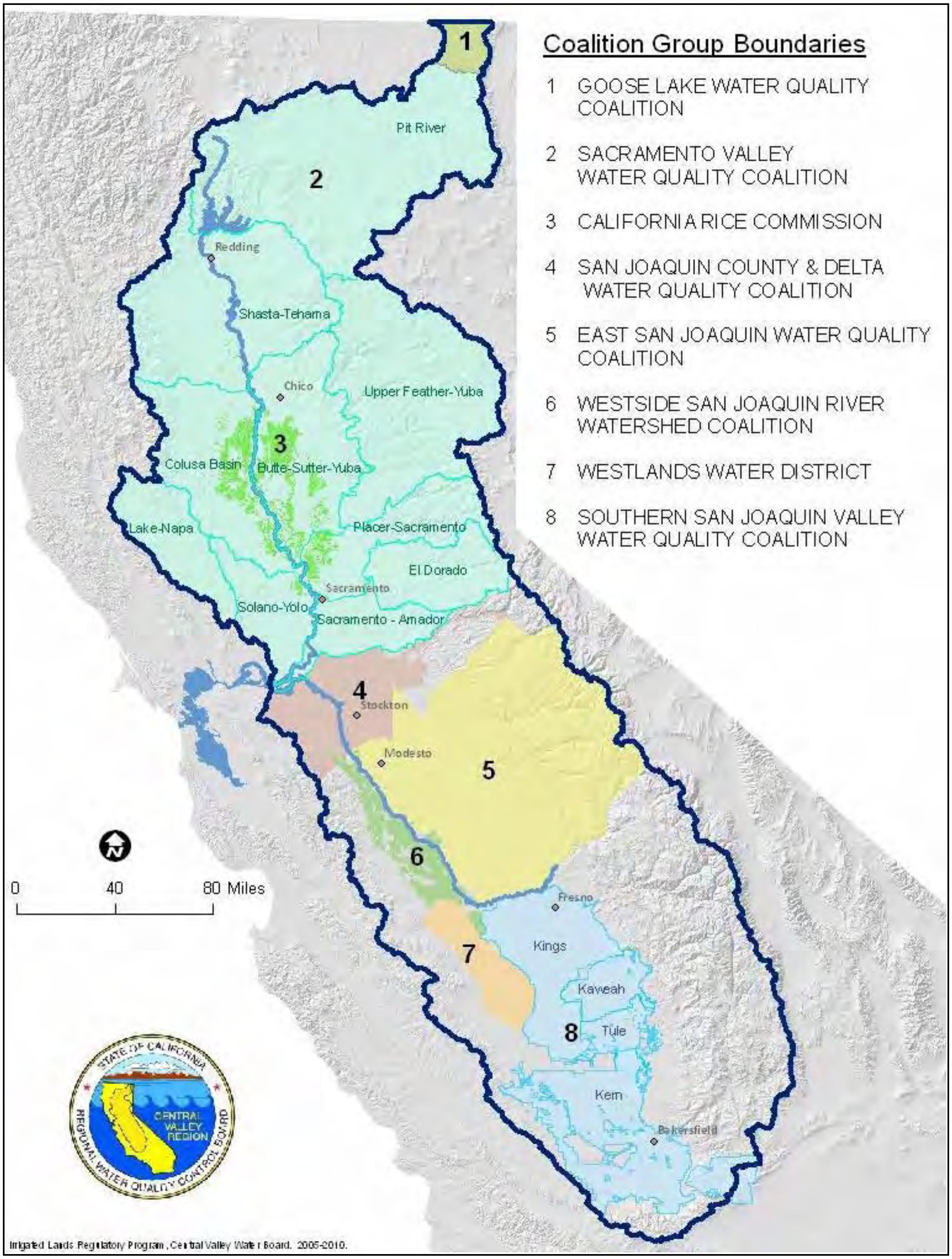
Most coalitions are geographically based, although one is commodity-based (rice). Two coalitions are further subdivided into subwatershed groups (Sacramento Valley Water Quality Coalition and Southern San Joaquin Valley Water Quality Coalition). Figure 1 shows the current Central Valley Water Board approved coalitions and their boundaries. Coalitions charge member growers annual fees based on acreage of land enrolled.

Coalitions provide a local presence and an efficient means to address water quality problems. Water Board staff are working with only a few coalition

[6] Total irrigated agricultural acreage calculations range from 6.5 million (2007 USDA Agricultural Census) to over 8 million (2006–2008 CA Department of Conservation's Farmland Monitoring and Mapping Program, ECR). Seven million acres is cited here as a measure of the most current information. The ECR, which is the baseline for environmental and economic review (Draft PEIR/Economics Report), estimates approximately 8 million acres of irrigated agricultural lands within the Central Valley.

representatives for routine program work, rather than tens of thousands of individuals.

Figure 1. Current ILRP Coalition Groups



D. Monitoring and Reporting

All coalition groups prepare and implement a monitoring and reporting program plan (MRP Plan) to assess potential irrigated agricultural water quality impacts of its members. Coalition groups currently are required to monitor roughly 70 constituents at every site, monthly during the irrigation season and twice during the storm season. These constituents include pesticides, metals, nutrients, toxicity, pathogens, general chemistry, and physical parameters.

Where monitoring results show more than one exceedance of a particular waste constituent at the same monitoring site within a 3-year period, coalition groups are required to prepare and submit a management plan to address the exceedances with their members. Under the current program, the Central Valley Water Board has required that the coalitions develop management plans to address 686 waste constituent–water body combinations. The first step in implementing a management plan often is conducting source identification studies. Once sources are known, growers must implement management practices to address the water quality problem.

E. Enforcement

1. Individual Agricultural Operation Enforcement

ILRP requirements are enforced using two types of compliance actions: administrative actions and water quality actions. For example, an irrigated agricultural operator who does not respond to a Central Valley Water Board, CWC Section 13267, *Request for Technical Report,* would be placed under enforcement based on failure to respond to the technical report. On the other hand, a grower unlawfully discharging waste to surface waters could be placed under enforcement based on water quality actions.

Staff periodically conduct inspections to determine whether an operation has the potential to discharge, and therefore should be participating in the ILRP. Staff also conducts inspections in response to complaints. Routine inspections by Water Board staff are not conducted for each irrigated agricultural operation under the current ILRP.

2. Coalition Group Enforcement

Coalition groups are third-party entities representing irrigated lands operations. Because coalition groups are not discharging waste, the Central Valley Water Board has limited authority to directly enforce program requirements. Program enforcement options are limited to direct actions upon irrigated agricultural operators, or revoking Water Board coalition approval. Most coalition groups do not have regulatory authority over members to require implementation of water quality management practice(s). In these cases, coalitions provide members information on management practices through mailers and group meetings, and rely on the Central Valley Water Board to enforce program requirements.

III. CENTRAL VALLEY IRRIGATED LANDS ENVIRONMENTAL AND INDUSTRY SETTING

A. Industry Summary

1. History

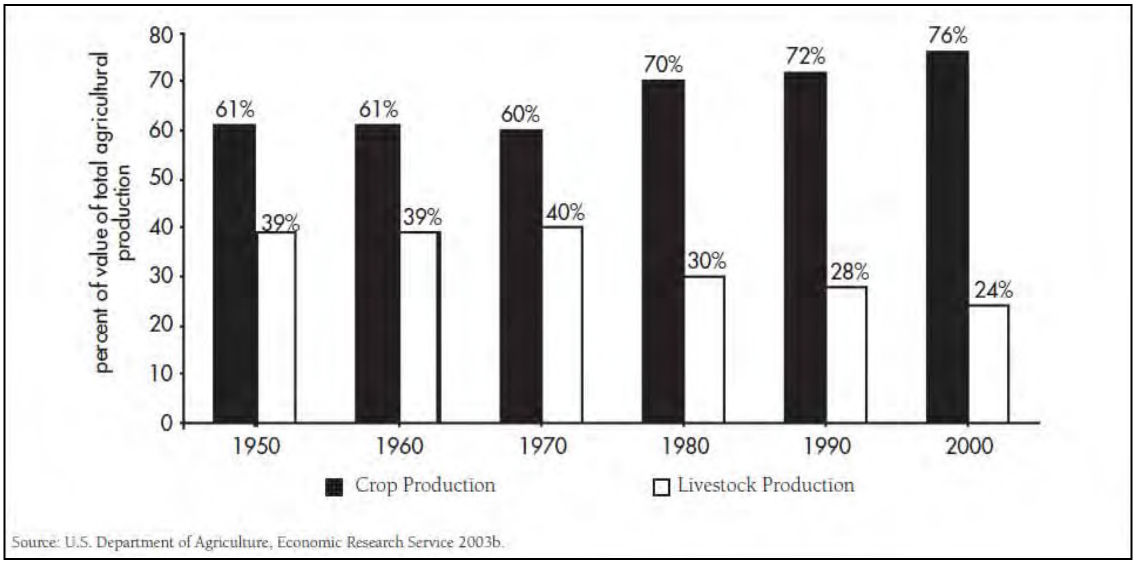
California's Central Valley has been one of the most productive agricultural regions in the world for more than 60 years. Contrary to the high agricultural productivity in the area, most regions in the Central Valley are arid to semiarid and are naturally water-deficient. Early irrigation in the valley, starting at the end of the nineteenth century, was limited to gravity diversions from the San Joaquin River and developed into intense groundwater pumping starting in the 1920s, leading to an increase in irrigated acreage westwards and upslope.

Transformation from extensive to intensive agriculture[7] occurred around the turn of the twentieth century, from 1890 to 1930 (Johnston and McCalla 2004). During this 40-year rapid expansion period, irrigated agricultural acres increased from about 1 million to almost 5 million acres. In 1948, California permanently took over as the largest agricultural State in the union in terms of value of production (Johnston and McCalla 2004).

After completion of the Central Valley Project and the State Water Project in 1953 and 1967, respectively, much of the San Joaquin Valley was irrigated with high-quality imported water from the Sacramento Valley conveyed by the Delta-Mendota Canal and the California Aqueduct (Schoups et al. 2005). This allowed irrigated agriculture to expand by more than 3 million acres. Agriculture shifted from majority animal to majority plant production (see Figure 2), and the share of intensive agricultural crops (fruits, nuts, berries, and vegetables) rose from 63 percent in 1950 to 77 percent of total crop products by 2000. Growth was most pronounced in nursery products (rising from 4 percent to15 percent).

[7] Intensive agriculture describes a system characterized by high inputs of capital, labor, and/or heavy usage of technologies such as pesticides and fertilizers relative to land area.

Figure 2. Crop and Livestock Shares of Total Agricultural Production in California, 1950–2000



Source: From Johnston and McCalla 2004.

2. Central Valley Agriculture Today

Central Valley agriculture continues to be sustained by the extensive system of reservoirs and canals and also by the availability of groundwater (Faunt et al. 2009).

Agricultural Output Economics

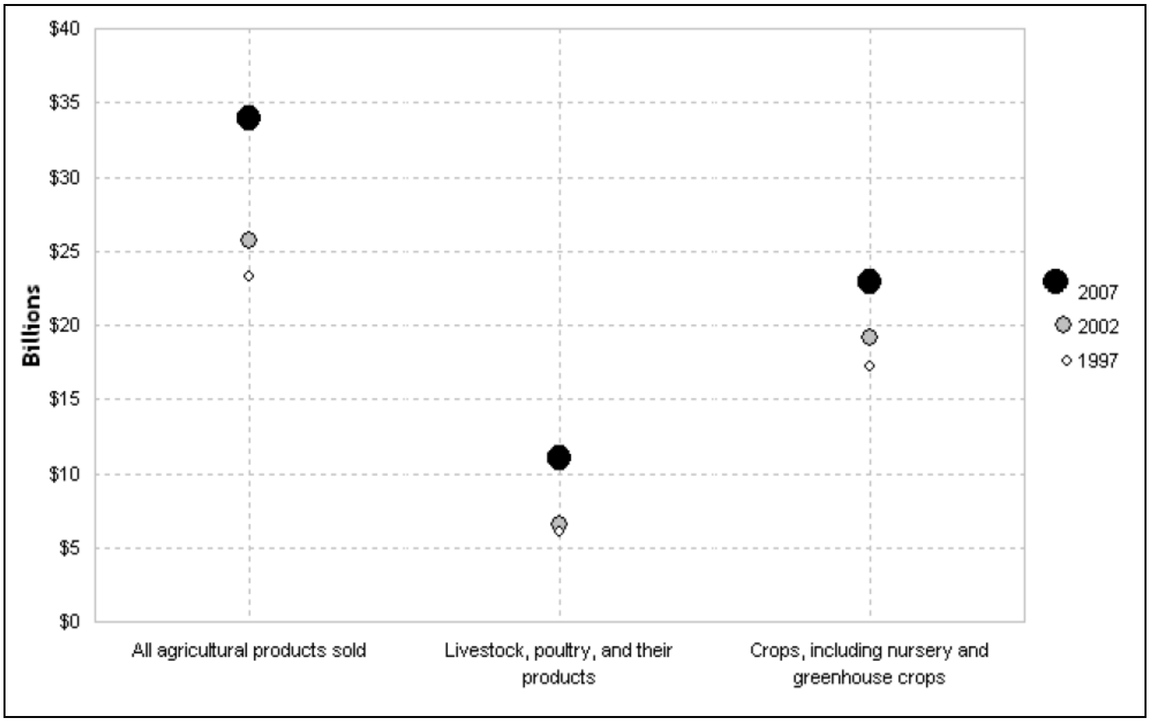
California's agricultural sector produces $39 billion[8] in goods and services each year (USDA 2008, see Figure 3). The market value of agricultural products grown on Central Valley irrigated land was about $13 billion in 2007. Using about 1 percent of U.S. farmland, the Central Valley supplies 12 percent of U.S. agricultural output by value (Great Valley Center 2009). California surpasses Texas, the second highest agriculturally productive State, by almost 92 percent. Eight of the nation's top 10 producing counties are in California; Fresno is the leading agricultural county in the nation. Six of the seven top producing counties in California are in the Central Valley (listed in decreasing order: Fresno, Tulare, Kern, Merced, Stanislaus, San Joaquin, and Kings Counties).

The estimated average market value of products sold per farm in the Central Valley was between $350,000 and $480,000, and the estimated net cash per farm average in 2007 was $72,000. The net cash per farm average varied widely among Central Valley counties; -$10,233 in Nevada County and $410,658 in Kern County. All nine counties with an average net profit loss in 2007 are in the

[8] Value is for total agricultural products and services throughout California.

foothill and upper watershed regions, as are all five counties with an average net profit of less than $20,000. See Table 1 for more information.

Figure 3. California Market Value of Agricultural Products Sold



Source: From the 2007 Census of Agriculture, California Report.

Table 1. Summary of Central Valley Agricultural Operations in 2007

	Central Valley Totals
Number of Farms	
Irrigated Land	**34,124**
All Cropland	**36,541**
Fruits, tree nuts, berries	22,349
Other crops and hay	4,141
Grains, oilseeds, dry beans, dry peas	3,894
Pasture	2,195
Vegetables, melons, potatoes	2,125
Nursery, greenhouse, floriculture, sod	829
Cotton and cottonseed	818
Cut Christmas trees, short-rotation woody crops	191
Acres	
Irrigated Land	6,521,541
All Cropland	7,345,984
Average Size of Farm	414
Median Size of Farm	36
Market Value of Products Sold	
Fruits, tree nuts, berries	$7,707,251,000
Vegetables, melons, potatoes	$2,179,456,000
Grains, oilseeds, dry beans, dry peas	$991,518,000
Nursery, greenhouse, floriculture, sod	$748,005,000
Other crops and hay	$604,130,000
Cotton and cottonseed	$554,628,000
Cut Christmas trees, short-rotation woody crops	$1,502,000
Source: From the 2007 Census of Agriculture, California Report.	

Acres and Farm Size

According to the U.S. Department of Agriculture (USDA) National Agricultural Statistics Service's (NASS) 2007 Census of Agriculture, there were about 34,000 irrigated farms on 6.5 million acres in the Central Valley in 2007. According to the California Department of Conservation's Farmland Mapping and Monitoring Program, there were approximately 7.5 million acres of irrigated agriculture in the Central Valley in 2007.[9]

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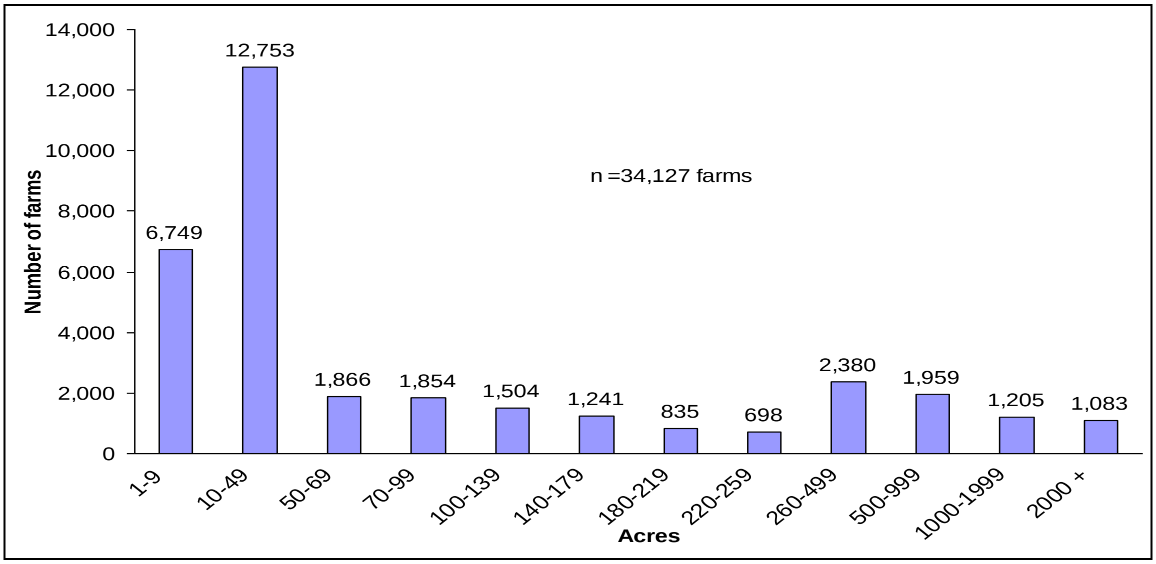
[9] All numbers should be considered estimates of Central Valley Water Board totals because (a) the 2007 Census of Agriculture definition of a farm (operation with annual sales of at least $1,000) differs from the ILRP definition; (b) some counties are partially outside Central Valley Water Board boundaries; and (c) the 2007 Census of Agriculture does not provide information if there is a risk of disclosing an individual respondent(s) data. California Department of Conservation's Farmland Mapping and Monitoring Program estimate of 7.5 million acres is probably closer to the actual acreage, as this number includes land in farms making less than $1,000 per year and land for individual farms that USDA did not disclose. Neither of these totals

Between 2000 and 2006, 35,488 acres of the Central Valley's prime agricultural land was converted to urban uses (Central Valley Center 2009).[10]

More than half of the farms in the Central Valley are less than 50 acres in size. While the average farm size is 414 acres, the median size is 36 acres. Approximately 80 percent of California farms are family- or individually operated (see Figures 4 and 5).

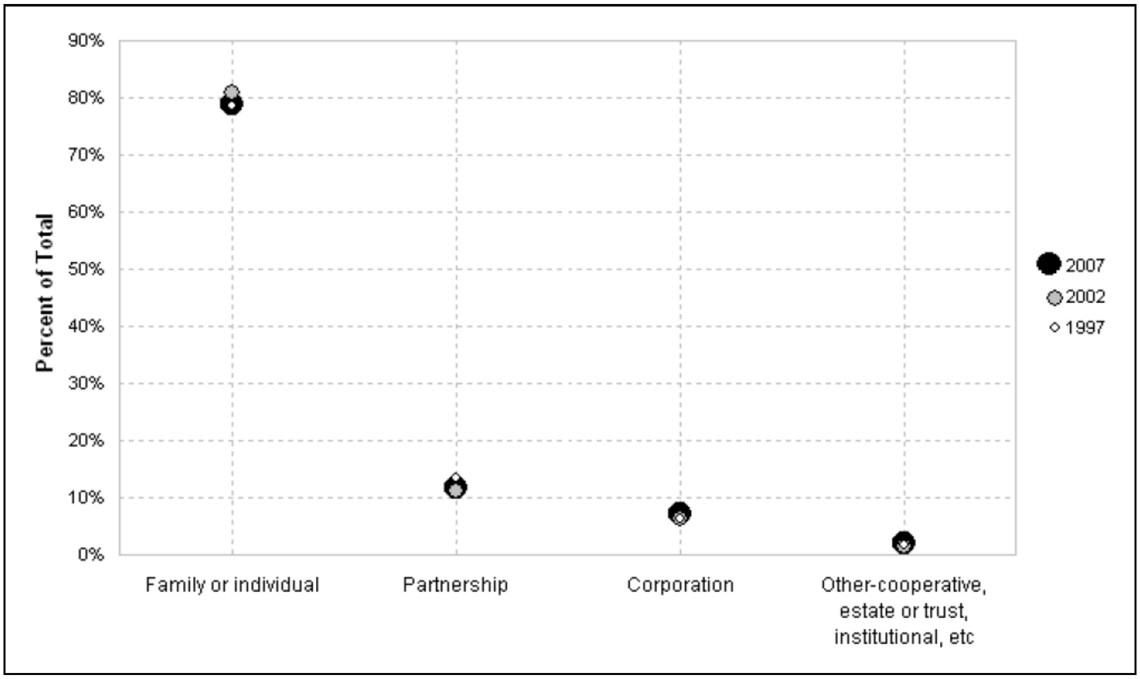
Figure 4. Distribution of Central Valley Farm Size in 2007



includes acres of managed wetlands, which are approximately an additional 80,765 acres. The ECR, which is the baseline for environmental and economic review (Draft PEIR/Economics Report), estimates approximately 8 million acres of irrigated agricultural lands in the Central Valley.

[10] Prime farmland is defined in section 5.10.2 of the Draft PEIR.

Figure 5. California Farms by Type of Organization—Percent of Total



Source: From the 2007 USDA Census of Agriculture, California Report.

Crop Diversity

Sixty-one percent of Central Valley farms grow a fruit, nut, or berry crop. The next largest category is "other crops and hay," which comprises 11 percent of Central Valley farms. More than 250 different crops are grown in the Central Valley, but in 2007 the top 20 crops made up approximately 78 percent of the total cropland acres. See Table 2 for more information.

Table 2. Top 20 crops by acreage in the Central Valley, 2007

Crop	2007 Acres	Crop	2007 Acres
Almonds	1,103,000	Tomatoes	109,000
Alfalfa	1,007,000	Prunes	82,000
Rice	606,000	Safflower	74,000
Grapes	568,000	Oranges	57,000
Winter wheat	511,000	Olives	53,000
Cotton	486,000	Clover	51,000
Corn	412,000	Double crop: winter wheat/corn	39,000
Walnuts	345,000	Barley	26,000
Pistachios	168,000	Asparagus	17,000
Oats	155,000	Sunflowers	16,000
Source: From the 2007 USDA Cropland Data Layer. Rounded to the nearest 1,000 acres.			

Organic farming has been one of the fastest growing segments of U.S. and California agriculture for more than a decade (USDA 2010). California is the leading State in certified organic cropland. In 2007 there were 369,000 certified organic acres in California.

California's agricultural industry receives various support services from organizations such as the USDA's Natural Resources Conservation Service, University of California Cooperative Extension, the California Farm Bureau Federation, the California Department of Food and Agriculture (CDFA), and many commodity-, region-, and growing style–specific boards and associations.

Irrigation Practices

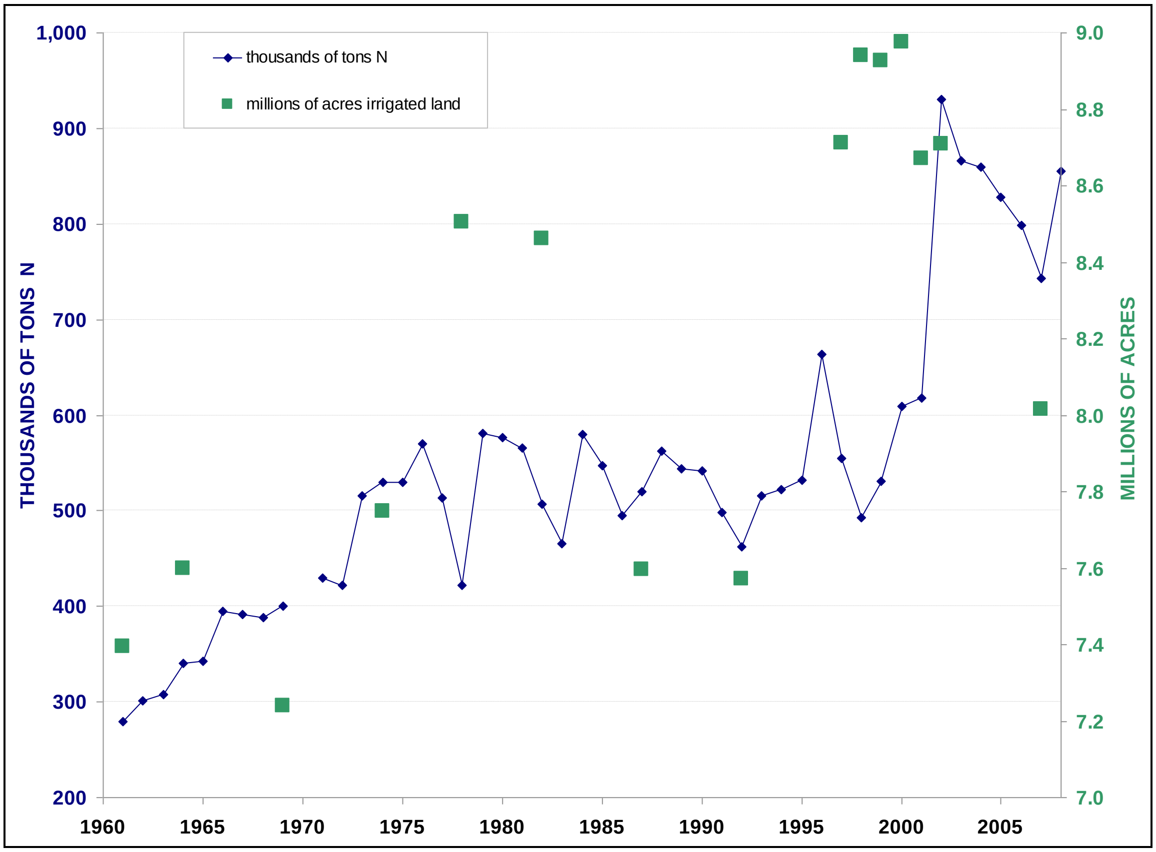
Irrigation practices throughout the Central Valley include methods such as gravity-driven irrigation (flood and furrow), sprinklers, and drip. According to Orang et al. (2005), acreage of gravity-driven irrigation systems has declined from 80 percent of all irrigated acreage in 1970 to 50 percent in 2000. During the same time period, percent acreage of drip irrigation systems has increased from zero to 30 percent. In general, more runoff occurs from flood and furrow irrigation than sprinkler irrigation, and there is usually little to no runoff from drip irrigation if used properly.

Fertilizer Use

The use of synthetic nitrogen fertilizers has increased steadily in the last 50 years, rising almost twentyfold to the current worldwide rate of 1 billion tons per year (Glass 2003). The current California rate of synthetic nitrogen fertilizer use is estimated at 856,000 tons of nitrogen per year from county-level fertilizer purchasing information (CDFA 2010). The reported tons of nitrogen in fertilizers purchased by farm users annually in California increased threefold between 1961 and 2008 (279,000 to 856,000 tons), according to reports submitted to the CDFA. During the same time period, irrigated acres in California increased by approximately 8 percent. Figure 6 shows the tons of purchased nitrogen fertilizer and estimated irrigated acreage in California from 1961–2008.

The majority of inorganic fertilizer is applied to cropland versus pastureland. Approximately 61 percent of cropland in the Central Valley was fertilized with commercial fertilizer, lime, and soil conditioners in 2007, versus 1 percent of pastureland; however, these numbers vary widely by county and crop. Percent of cropland fertilized per county in 2007 ranged from 84 percent in Fresno County to 4 percent in Mariposa County. Percent of pastureland fertilized in 2007 ranged from 6 percent in San Joaquin County to less than 1 percent in Sierra and Kern Counties. These percentages do not account for the type, tonnage, or frequency of fertilizers used, only whether use occurred at least once per year.

Figure 6. Statewide Annual Reported Tons of Nitrogen Purchased for Farm Use and Irrigated Acreage, 1961–2008[11]



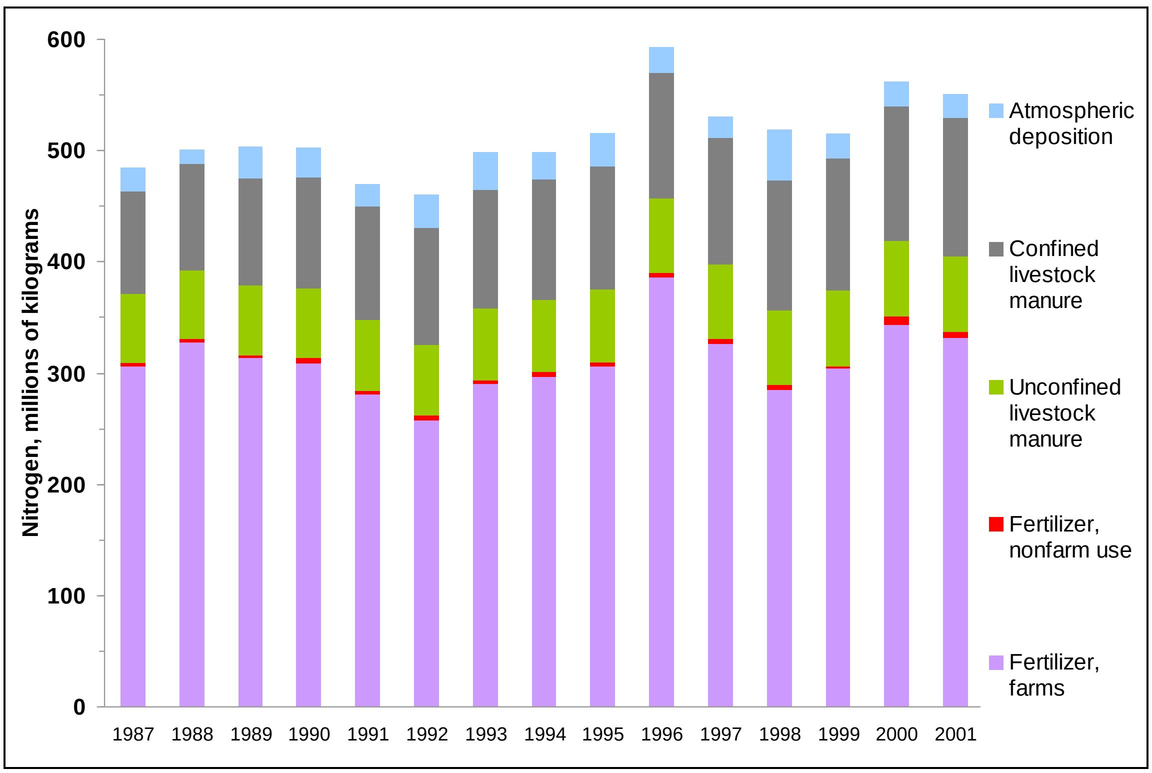
In the U.S. Geological Survey (USGS) Scientific Investigations Report 2006-5012: County Level Estimates of Nutrient Inputs to the Land Surface of the Conterminous United States, 1982–2001 (2006 USGS Nutrient Input Report), Ruddy, Lorenz, and Mueller (2006) used existing data to estimate and allocate nutrient input data for fertilizer use, livestock manure, and atmospheric deposition to counties in the conterminous United States for the years 1982 through 2001. The purpose of the study was to consolidate nutrient input data from fertilizer use, livestock manure, and atmospheric deposition and make them available in a consistent format. They found that of the sources included in the study, farm fertilizer was the largest source of nitrogen, and these inputs were highest in the upper Midwest, along eastern coastal areas, and in irrigated areas of the West. The study did not consider potential nitrogen inputs from human waste and did not take into account nitrogen plant uptake, legume nitrogen fixation, or any other nitrogen sinks (i.e., the data do not represent net inputs to the environment after gross inputs and outputs are balanced).

[11] Annual nitrogen data as reported to the CDFA by the last licensee selling/distributing fertilizers to unlicensed purchasers for farm use. Acres of irrigated land as reported in the USDA Ag Census, except for 1998–2001 data, which is from the California Department of Water Resources.

Data sources for the 2006 USGS Nutrient Input Report include state and county fertilizer sales from the Association of American Plant Food Control Officials; State and county fertilizer expenditures as well as livestock populations from the USDA NASS Census of Agriculture; human population per county from the U.S. Census Bureau; and nutrient wet deposition chemistry for point locations from the National Atmospheric Deposition Program.

Between 1987 and 2001, an average of 862 million kilograms/950 thousand tons nitrogen was created or used annually in California from the study sources, with the total remaining fairly constant over this time period. On average, 513 million kilograms/565 thousand tons of the California total were in the Central Valley (60 percent; see Figure 7). Within the Central Valley, the average percent contribution of the total nitrogen (for the sources considered in this study) are: farm fertilizer use, 60.5 percent; confined livestock manure, 21.1 percent; unconfined livestock manure, 12.7 percent; atmospheric deposition, 5 percent; non-farm fertilizer use, 0.8 percent.

Figure 7. Central Valley Estimated Nitrogen Input from Fertilizers, Manure, and Atmospheric Deposition in Millions of Kilograms, 1987–2001



Source: After Ruddy, Lorenz, Mueller (USGS) 2006.

B. Potential Waste Discharge from Irrigated Agricultural Lands

Agricultural production practices can result in a number of wastes entering surface and groundwater, including sediment, nutrients, pathogens, pesticides, metals, and salts. Discharge of these wastes may degrade water quality, affect beneficial uses, and impose costs on water users (e.g., treatment for drinking water use).

Waste may be discharged to surface waters in tailwater, tile drain discharge, stormwater runoff, drift of sprayed materials into surface waters, and direct disposal via spills and leaks. Wastes may be leached to groundwater during irrigation; discharged to groundwater in stormwater, irrigation water, or other surface runoff that reaches dry wells or other conduits; disposed directly (spills and leaks) into wells or other conduits; and leached during irrigation events designed to force salts below the root zone.

While irrigated agricultural practices can contribute to water quality degradation, agriculture is not generally the sole source of these pollutants in Central Valley ground and surface water. Urban, industrial, mining, timber, and natural sources also may contribute to waste constituent loads.

More detailed information on agricultural constituents of concern, their effects on water quality, and pathways of discharge to surface and groundwater is given in Chapters 3 (surface water) and 4 (groundwater) of the ECR.

C. Water Quality Data Summary for Ground and Surface Waters Accepting Irrigated Agricultural Waste

The ECR, prepared by ICF Jones and Stokes, was initiated in 2005 and released in final version in December 2008. The ECR was conducted to support the development of the long-term ILRP and PEIR, as well as to serve as a baseline of information on surface and groundwater quality, land uses, existing regulatory programs, and management practices within a unique combination of California Department of Water Resources' (DWR's) Calwater watershed boundaries and ECR-defined watersheds[12] in the Central Valley region. Figure 8 graphically depicts the ECR watersheds (white boundaries and text) and the subbasins discussed.

The ECR summarizes surface water quality data based on two main data sources: the 2002 303(d) list, and ILRP monitoring data collected from May 2004 through October 2006. The ECR's main surface water quality findings are summarized below by basin:

Sacramento River Basin

Of the eight ECR watersheds in the Sacramento River Basin, only one watershed does not contain a water body that is 303(d) listed as impaired from irrigated agriculture. However, management plans are being required for water bodies in all eight watersheds under the current ILRP.

[12] The locations and characteristics of these watersheds are described in the ECR.

San Joaquin River Basin

The San Joaquin River Basin is delineated into 12 ECR watersheds. Management plans (current ILRP) are required for water bodies in five of these watersheds; four of these five watersheds contain 303(d) listed water bodies impaired for waste constituents from irrigated agriculture.

Tulare Lake Basin

Of the ten ECR watersheds in the Tulare Lake Basin, only one watershed contains a water body that is 303(d) listed as impaired from irrigated agriculture; a water quality management plan is required for this same watershed under the current ILRP.

Groundwater quality data from DWR's *Bulletin 118*, California Department of Pesticide Regulation (DPR) data, USGS, and the Groundwater Ambient Monitoring and Assessment (GAMA) program were considered and summarized by groundwater subbasin in the ECR. The ECR's main groundwater quality findings follow.

> *The results of the investigations reported here are consistent with conclusions drawn in the GAMA Program of relatively localized evidence of groundwater pollution in the Sacramento Basin. This also holds true for detections of pollution in the San Joaquin and Tulare Lake Basins as well.*
>
> *Pesticide detections in groundwater in the Sacramento River, San Joaquin River, and Tulare Lake Basins are generally limited to a small number of compounds (DPR 2003). These detections are related to physical and chemical properties of soils and the specific compounds, water management, and spatial and temporal variability of pesticide application and soil-water processes and properties. Data on transport of pesticides in groundwater highlights additional issues attributable to legacy pesticides that will need to be addressed during development of the long-term irrigated lands regulatory program. There are also difficulties in assessing the effects of groundwater pollution based on the relatively long period of time before pesticides used on irrigated agriculture begin to be detected in groundwater.*

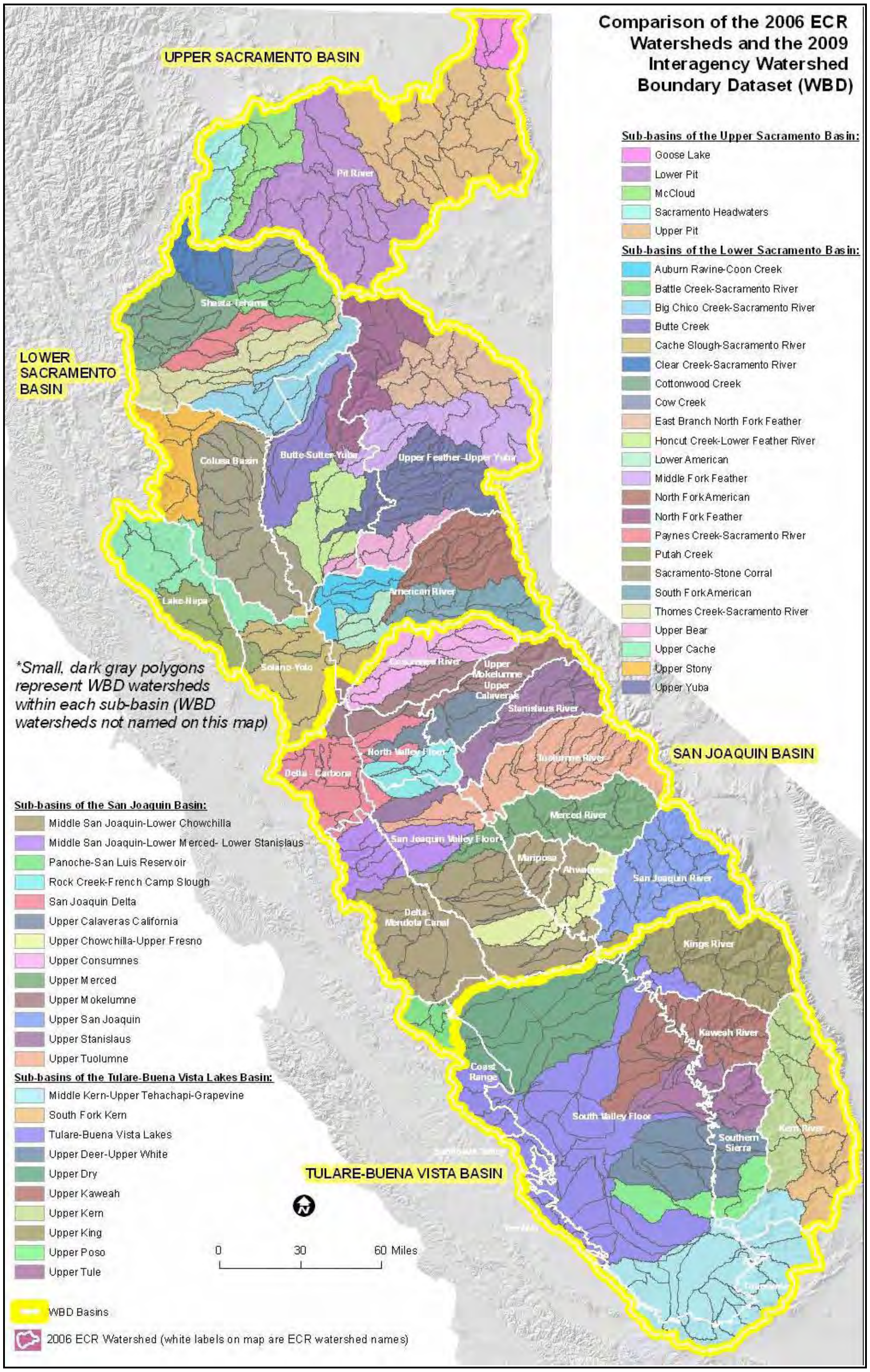
In general, data from 2006 and earlier were collected and analyzed in the ECR. Since 2006, the Central Valley Water Board has continued to collect vast amounts of surface water quality data through the current ILRP. Also, during this period of time, the GAMA program has continued to release groundwater studies for the Central Valley, concern over nitrates in groundwater has been a major concern before the State and Central Valley Water Boards,[13] and the focus of the long-term ILRP moved from primarily a surface water effort to consideration of groundwater protection requirements. In addition, the Central Valley Water Board

[13] Joint State and Central Valley Water Board meeting, Clovis, September 2007.

has, since the initiation of the ECR, significantly expanded capabilities in using geographic information systems (GIS) to evaluate and summarize large datasets.

This staff report builds on the ECR by using GIS to evaluate and summarize surface water quality data collected in the current ILRP and contracted University of California at Davis (UC Davis) water quality monitoring, and current information regarding nitrates in Central Valley groundwater.

Figure 8. Comparison of the 2006 ECR Watersheds and the 2009 Interagency Watershed Boundary Dataset



ECR findings on surface and groundwater quality are generally consistent with the findings in this report; however, additional exceedances of water quality objectives are identified in this report because it covers a longer monitoring period and additional datasets. Also, this report uses smaller, hydrologically accurate watershed areas (2009 Interagency Watershed Boundary Dataset subbasins) than the ECR to summarize information. The smaller subbasins provide a better tool to describe Central Valley areas that may or may not have water quality problems associated with irrigated agriculture. Figure 8 compares the Interagency Watershed Boundary Dataset subbasins and the ECR watersheds.

1. Surface Water Summary

Coalition Group and Irrigation District Monitoring

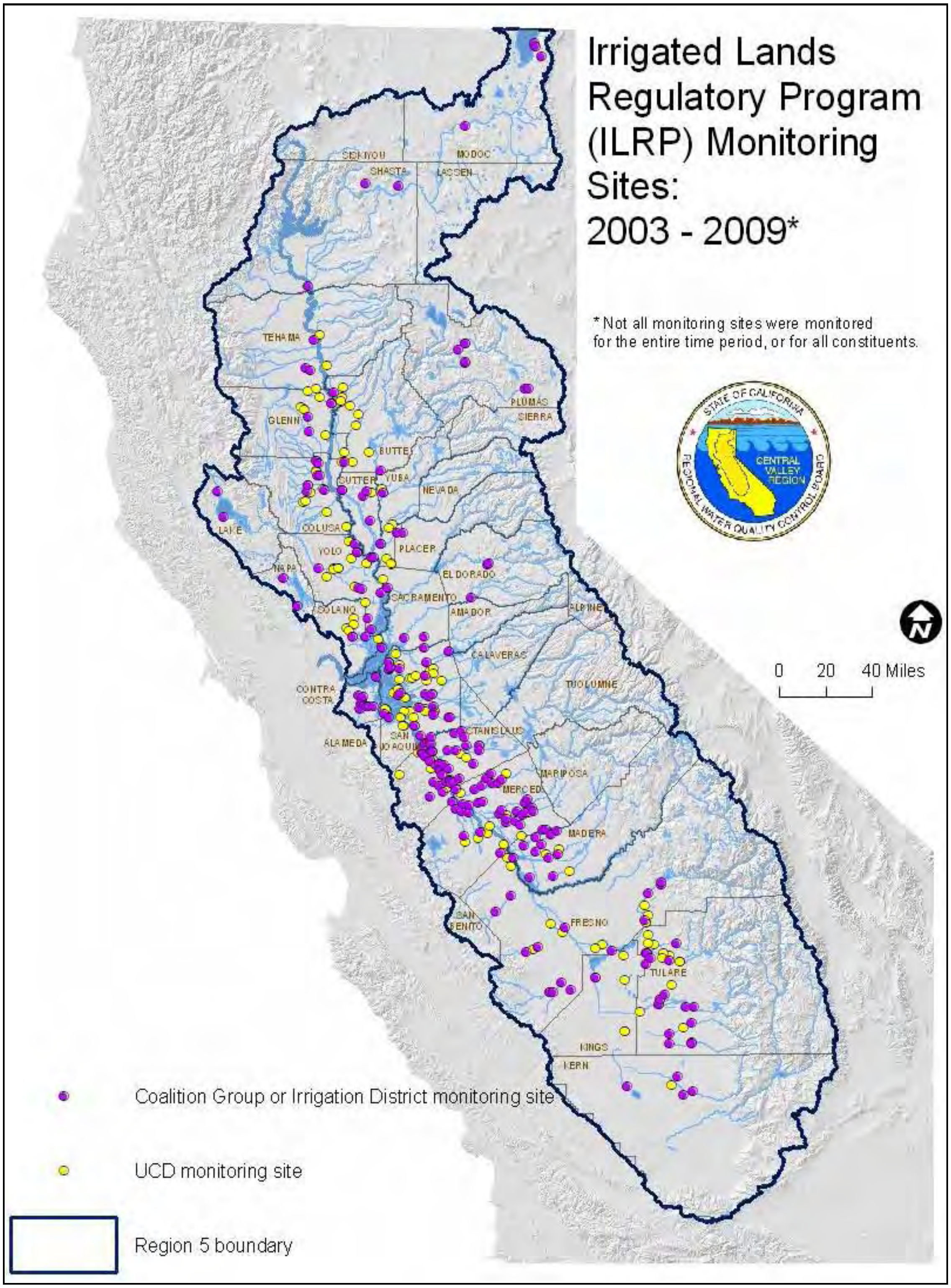
Since 2004, coalition groups and irrigation districts have collected extensive monitoring data for the ILRP at more than 240 sites. These data have been used to determine areas where management plans are needed to reduce waste runoff from irrigated agriculture, as well as areas where agricultural runoff does not appear to be negatively affecting surface water quality. See Figure 9 for monitoring site locations.

University of California at Davis Irrigated Lands Monitoring Project

In November 2002, the Central Valley Water Board executed an interagency agreement with UC Davis to conduct a water quality evaluation of the agricultural drains throughout the Central Valley. A technical advisory committee was established to assist in developing and implementing the pilot monitoring program. The advisory committee included members from the Association of Northern California Water Agencies, agricultural groups, environmental groups, DPR, Department of Fish and Game, and UC Davis.

UC Davis developed the study plan entitled Investigation of Water Quality in Agricultural Drains of the Central Valley. The objectives of this study were to: (1) evaluate water quality, primarily through use of aquatic species toxicity testing, in a limited number of agricultural drains in the San Joaquin River and Sacramento River watersheds; (2) identify the cause of any water quality impairments; (3) determine the sources of contaminants based on the identified cause of impairments; and (4) recommend water quality investigation designs and approaches for future monitoring and assessment of agricultural runoff and drainage waters based on the lessons learned from the project. The Central Valley Water Board contracted with the University of California, Davis Aquatic Toxicology Laboratory (UC Davis ATL) to conduct this investigation. The Study Plan, final investigation report, and various appendices are available on the Central Valley Water Board's website.

Figure 9. ILRP monitoring Site Locations



In December 2003, a 3-year continuation of the UC Davis project was initiated, and interagency agreements were executed. This additional investigative work was contracted to the UC Davis John Muir Institute of the Environment and to the California Department of Fish and Game. The additional investigation is known as Phase II of the UC Davis project. Phase II was designed to collect additional data to further characterize the quality of water in drains and other channels influenced by agricultural discharges in the Central Valley Region. The Phase II study includes bioassays using three water species and one sediment test species to evaluate toxicity, the analysis of water and sediment for general chemical parameters and many common agricultural chemicals, and further use of toxicity identification evaluation procedures. The project also includes the analysis of drainage samples during both irrigation and stormwater runoff events over a 2-year period to establish baseline water quality information and to allow the evaluation of seasonal and temporal changes in water quality. The Phase II quarterly status reports are available on the Central Valley Water Board's website. UC Davis samples were collected during 2003 through 2007. See Figure 9 for monitoring site locations.

Results of Monitoring: March 2003–June 2009

Coalition group and irrigation district samples discussed in this summary were collected between July 2004 and June 2009, although not all sites were monitored the entire time period, and not all monitoring constituents were collected at all sites.[14] Samples collected by UC Davis for the ILRP were collected between March 2003 and November 2007. Coalition groups and irrigation districts continue to collect monitoring data each month.

Management Plans in the Central Valley Region: An Overview

The current ILRP requires that coalition groups develop water quality management plans when monitoring shows exceedances of water quality objectives[15]. There are 51 surface water subbasins[16] in the Central Valley Region, although not all contain irrigated agricultural lands. Thirty-five subbasins have been sampled by coalition groups, and 29 of those subbasins (83 percent) have a management plan required for at least one waste constituent. Most management plans are in the San Joaquin River Basin. See Table 3 and Figure 10 for more information on management plans and monitoring sites.

Pesticides

There have been many individual analyses conducted for about 34 pesticides by coalition groups and irrigation districts since July 2004, and to date management

[14] Much of the Sacramento Valley Water Quality Coalition monitoring data that were collected in 2004 through 2006 is not included in this summary because of ongoing QA/QC review.
[15] Under the current ILRP, a management plan is required when there have been two or more exceedances of a water quality objective for a particular waste constituent at a particular monitoring site. The management plan describes how the coalition group and growers in the watershed will address the exceedances and prevent them in the future. Management plans must be approved by the Central Valley Water Board Executive Officer.
[16] Interagency Watershed Boundary Dataset, 2009. http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/

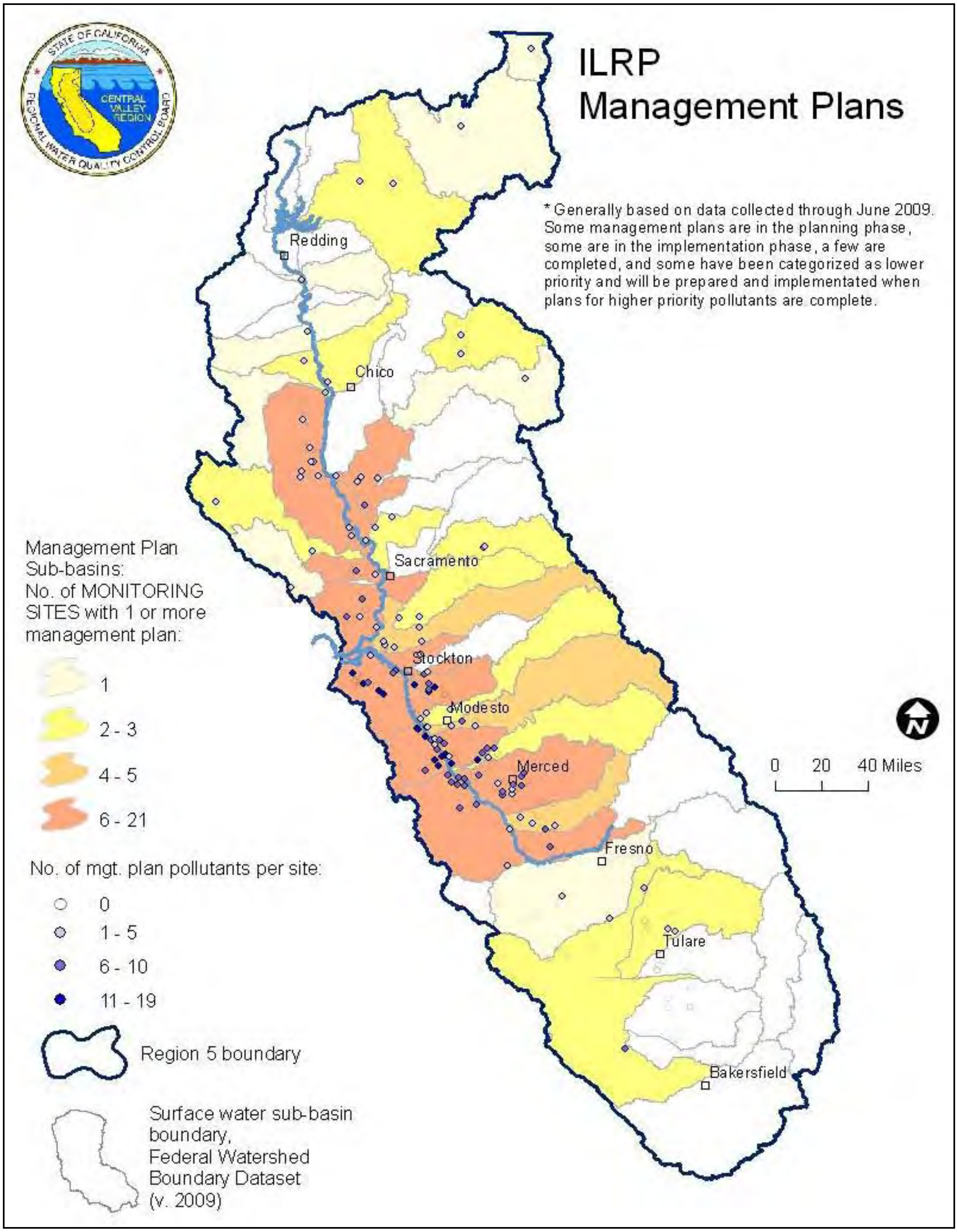
plans are required for 12 pesticides (approximately 35 percent of sampled pesticides). Other pesticides have been detected at levels both below and exceeding water quality objectives, but the requirements to develop a management plan have been triggered for only 12 of the 34 pesticides.

Table 3. Number of Management Plans by Constituent and Surface Water Basin[a]

	Sacramento River Basin	San Joaquin River Basin	Tulare–Buena Vista Lakes Basin
Metals			
Arsenic		12	1
Boron	2	9	1
Cadmium		3	1
Copper		22	
Lead		14	
Nickel		3	
Selenium	1	1	
Pesticides, Registered			
Chlorpyrifos	5	43	
Diazinon	1	8	
Dimethoate		3	
Disulfoton		1	
Diuron	1	11	
Malathion	1	1	
Methyl-parathion		3	
Simazine		2	
Thiobencarb		1	
Pesticides, Legacy			
DDD		1	
DDE	7	15	
DDT	1	7	
Dieldrin		3	
Salts, Nutrients, Bacteria, Field Parameters			
Ammonia		2	
DO	22	53	
EC/TDS	10	35	
E-coli	24	55	1
Nitrate		5	
pH	14	35	1
Toxicity			
Water Column	15	52	5
Sediment	3	27	2
Totals	**107**	**427**	**12**

[a] Management plans are water body–/waste constituent–specific.

Figure 10. Central Valley Hydrologic Subbasins with ILRP Management Plans



In the upper Sacramento River Basin, generally north of Tehama County, as well as in the foothill regions of both the Sacramento and San Joaquin River Basins, there is infrequent or no use of agricultural pesticides in most areas (CA DPR Pesticide Use Reports). Pesticide analysis frequency in most of these low-use areas reflects this. Irrigated and non-irrigated pasture is the dominant agricultural use in these areas.

Management Plan Pesticides

Of the approximately 34 pesticides sampled in surface waters by coalition groups and irrigation districts, 12 pesticides have exceeded Basin Plan water quality objectives at least twice in 3 years at one or more monitoring sites: chlorpyrifos, diazinon, diuron, malathion, thiobencarb, dimethoate, methyl-parathion, simazine, dieldrin, DDD, DDE, and DDT. Table 4 provides a monitoring summary for data collected by coalitions and irrigation districts for the 12 management plan pesticides.

Four of the 12 pesticides are considered legacy pesticides as they are no longer registered for use in California (dieldrin, DDD, DDE, and DDT)[17], leaving eight currently registered pesticides with management plan(s) required for surface water exceedances. As shown in Table 4, three of the eight pesticides (dimethoate, methyl-parathion, and thiobencarb) need management plan development in only one surface water subbasin, and two more pesticides (malathion and simazine) need management plan development in two subbasins. The remaining three pesticides (chlorpyrifos, diazinon, and diuron) have shown more widespread exceedances (12, 5, and 7 subbasins, respectively). See Figures 11–14 for maps showing locations of pesticide exceedances[18]. These maps and data summaries were created using data downloaded from the ILRP website in November 2009.

A management plan identifies the “watershed,” or area that drains to the monitoring site, in which management practices will be implemented to address the water quality problems. The figures developed, mainly as visual aids, for this discussion show surface water subbasins (i.e., watersheds) shaded in colors based on the number of sites within that subbasin that have shown two or more exceedances of water quality objectives. It is important to note that water bodies in the entire subbasin are not necessarily above water quality objectives. Also, these subbasin watershed boundaries (Interagency Federal Watershed Boundary Dataset 2009) are not necessarily the boundaries defined by a coalition where they need to address an identified problem.

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[17] There may be some ongoing new deposition of DDD and DDE as a result of use of certain currently registered pesticides that subsequently can degrade to DDD and DDE, as well as some new deposition of DDT as a result of currently registered pesticide use that may contain some DDT (such as dicofol).

[18] Pesticide maps are based on management plans required for data generally collected through June 2009. The maximum allowable pesticide concentrations (“trigger limits”) for several pesticides are currently interim limits; the ILRP Technical Issues Committee (TIC) is working on establishing permanent trigger limits which protect all beneficial uses, in collaboration with pesticide TMDLs underway.

Table 4. Management Plan Pesticides: Coalition and Water District Monitoring Data Summary for Sites with Two or More Samples Collected (Per Analyte) between July 2004 and June 2009

Pesticide	Number of Analyses (Number of Sites, Number of Subbasins [a])	Number of Exceedances (Number of Sites, Number of Subbasins)	Number (%) of Sampled Subbasins under a Management Plan	Toxicity Rank [b]	Currently Registered for Legal Use in CA?
chlorpyrifos	2,200 (155, 22)	275 (74, 17)	12 (55%)	very high	yes
diazinon	2,200 (155, 22)	28 (17, 6)	5 (23%)	very high	yes
diuron	1,730 (155, 22)	148 (60, 11)	7 (32%)	high	yes
malathion	1,865 (121, 24)	29 (21, 10)	2 (8%)	very high	yes
thiobencarb	1,376 (110, 21)	27 (12, 6)	1 (5%)	n/a [c]	yes
dimethoate	2,036 (133, 25)	35 (12, 4)	1 (4%)	high	yes
methyl-parathion	1,334 (85, 19)	18 (9, 1)	1 (5%)	n/a [c]	yes
simazine	1,720 (135, 22)	25 (16, 2)	2 (9%)	high	yes
Dieldrin	1,724 (155, 30)	32 (15, 7) [d]		–	no
DDD	1,703 (135, 27)	8 (7, 5) [d]		–	no
DDE	1,681 (134, 28)	189 (38, 12) [d]		–	no
DDT	1,730 (134, 28)	73 (32, 13) [d]		–	no

[a] Interagency Watershed Boundary Dataset, version 2009.
[b] Relative-Risk Evaluation for Pesticides Used in the Central Valley Pesticide Basin Plan Amendment Project Area, Final Staff Report, Central Valley Water Board, February 2009.
[c] These pesticides were not in the relative-risk target list because of low reported total pounds used.
[d] In almost every analysis for dieldrin, DDD, DDE, and DDT, the method detection limit (MDL) and reporting limit (RL) were 10 to 100 times higher than the water quality objective; therefore, the data do not necessarily represent all results above water quality objectives.

Chlorpyrifos, diazinon, and diuron: widespread problems

Chlorpyrifos

From July 2004 through June 2009, coalition groups and irrigation districts collected approximately 2,200 chlorpyrifos samples at 155 monitoring sites in 22 subbasins throughout the Central Valley Region. At 88 percent of these sites (136), there were anywhere from two to 63 chlorpyrifos samples collected; at the remaining sites there was one sample collected during this time period. Fifty-five percent of the subbasins sampled are now under a chlorpyrifos management plan. Sixty percent of the management plan subbasins are in the San Joaquin River Basin, stretching south from Stockton to the Madera-Fresno County line. This area also coincides with heavy chlorpyrifos use. See Figure 11 for chlorpyrifos data.

Chlorpyrifos is used in valley floor agricultural operations from Sacramento County north through Butte County, but to a lesser extent than in the San Joaquin River and Tulare Lake Basin. There is heavy reported use of chlorpyrifos in the Tulare Lake Basin, but the frequency of coalition group detections and/or exceedances was much lower than in the San Joaquin River Basin.

UC Davis sampling showed six sites in the Tulare Lake Basin, eight sites in the San Joaquin River Basin, and five sites in the Sacramento Basin with two or more samples above 0.015 micrograms per liter (µg/l) chlorpyrifos (Sacramento and San Joaquin Rivers Basin Plan numeric water quality objective).

Diazinon

Diazinon use is not as widespread in the Central Valley as is chlorpyrifos use. From July 2004 through June 2009, coalition groups and irrigation districts collected approximately 2,200 diazinon samples at 147 monitoring sites in 26 subbasins throughout the Central Valley Region. At 90 percent of these sites (132), anywhere from 2 to 63 diazinon samples were collected; at the remaining sites one sample was collected. Nineteen percent (five) of the subbasins sampled are now under a diazinon management plan, and four of these five subbasins are in the San Joaquin River Basin. See Figure 11 for diazinon data.

UC Davis monitoring data show geographic distribution of diazinon exceedances similar to ILRP program monitoring; most are in the San Joaquin River Basin.

Diuron

From June 2004 through June 2009, coalition groups and irrigation districts collected approximately 1,730 diuron samples at 155 monitoring sites in 22 subbasins throughout the Central Valley Region. At 94 percent of these sites (146), anywhere from 2 to 36 diuron samples were collected. Thirty-two percent (7) of the subbasins sampled are now under a diuron management plan; six of these subbasins are in the San Joaquin River Basin, and one is in the Lower Sacramento River Basin. See Figure 12 for diuron data.

Dimethoate, Methyl-Parathion, and Simazine: Localized Problems

Dimethoate, methyl-parathion, and simazine have shown more localized water quality objectives exceedance distributions, despite widespread sampling and analyses. Simazine and dimethoate applications appear to be fairly widespread in the Central Valley, similar to chlorpyrifos, but exceedance levels are not nearly as widespread as chlorpyrifos exceedance levels. Simazine has low water solubility, which may explain the low exceedance levels, while dimethoate has very high water solubility. They both have an average half-life in water of around 1 to 2 months. Methyl-parathion applications are not as widespread. See Figures 12 and 13 for a map of exceedance distribution for dimethoate, methyl-parathion, and simazine.

Five monitoring sites are under a management plan for both dimethoate and methyl-parathion, all in the Middle San Joaquin–Lower Merced–Lower Stanislaus Subbasin, west of the San Joaquin River. Six sites in two San Joaquin River subbasins are under a simazine management plan.

UC Davis monitoring results showed an additional site in the San Joaquin River Basin with more than one dimethoate exceedance. The UC Davis monitoring also found four additional sites with multiple methyl-parathion exceedances. Three of these sites are in the Lower Sacramento River Basin, and the fourth is in the San Joaquin River Basin.

Malathion and Thiobencarb

Six monitoring sites in four subbasins have shown two or more malathion exceedances; three sites (in two subbasins) are in the Sacramento River Basin, and three sites (in two subbasins) are in the San Joaquin River Basin. For thiobencarb, there are four coalition group monitoring sites (in two subbasins) with two or more exceedances in the San Joaquin River Basin. Thiobencarb results above the performance goals caused by rice applications in the Sacramento River Basin are addressed through the Rice Pesticide Program, rather than through an ILRP management plan. See Figure 14 for malathion and thiobencarb data.

UC Davis monitoring resulted in an additional three sites (in different subbasins from the coalition group exceedances sites) showing two or more malathion exceedances—one in the Sacramento River Basin and two in the San Joaquin River Basin (both in the same subbasin). UC Davis monitoring also resulted in five more sites with more than one thiobencarb exceedance, all in the Sacramento River Basin.

There have been no sites with two or more malathion or thiobencarb exceedances in the Tulare Lake Basin in either the coalition group or UC Davis monitoring programs.

Malathion and thiobencarb exceedances caused by rice applications in the Sacramento River Basin are addressed through the Central Valley Water Board's Rice Pesticide Program, rather than the ILRP.

Dieldrin, DDD, DDE, DDT

In almost every analysis for these pesticides, the method detection limit (MDL) and reporting limit (RL) were 10 to 100 times higher than the water quality objective. Because MDLs and RLs were higher than water quality objectives, the data do not provide precise information regarding water quality conditions for dieldrin, DDD, DDE, and DDT.

Coalition group monitoring showed 189 detections of DDE, 73 of DDT, 32 of dieldrin, and 8 of DDD. Because the MDLs are orders of magnitude higher than applicable water quality objectives, all detections were exceedances.

Turbidity and Total Suspended Solids

Although sediment often is considered one of the most common agricultural surface water inputs in the Central Valley, currently no management plans are required. While excessive sediment discharges have been observed by the

Central Valley Water Board and coalition group monitoring teams, samples are rarely flagged as exceedances of objectives because of difficulties evaluating and implementing the background-dependent sliding Basin Plan objectives for turbidity. In addition, there are currently no objectives for total suspended solids (TSS).

Water Column Toxicity

Water column toxicity is widespread throughout the Central Valley. There are currently 54 monitoring sites in 18 subbasins under water column toxicity management plans. The majority of monitoring sites exhibiting more than one water column toxicity event are in the San Joaquin River Basin (38). There have also been 11 monitoring sites in the Sacramento River Basin and five in the Tulare Lake Basin exhibiting more than one water column toxic event.

UC Davis monitoring measured water column toxicity (two or more times per site) at 16 additional sites in the Sacramento River Basin, 14 more sites in the San Joaquin River Basin, and six more sites in the Tulare Lake Basin.

See Figure 15 for a map of water column toxicity management plans and UC Davis monitoring results.

Sediment Toxicity

Sediment toxicity to the benthic invertebrate *Hyallela azteca* is widespread throughout the San Joaquin River Basin (80 percent [32 out of 40] of management plan sites occur in this basin). There are also four management plan sites in the Tulare Lake Basin and two in the Sacramento River Basin. As with water column toxicity distribution, there are currently no sediment toxicity management plan sites in surface water subbasins north of the Chico area.[19]

UC Davis monitoring measured *Hyallela azteca* toxicity (two or more times per site) at one additional site in the Sacramento River Basin, two sites in the San Joaquin River Basin, and five sites in the Tulare Lake Basin.

See Figure 15 for a map of sediment toxicity management plan locations and UC Davis monitoring results.

Nitrate

Coalition group surface water sampling to date has revealed five monitoring sites where there has been more than one exceedance of nitrate water quality objectives. All five sites are in the Middle San Joaquin–Lower Merced–Lower Stanislaus subbasin, in Stanislaus and northern Merced Counties, just east of the San Joaquin River. These results may indicate that there are not widespread

[19] Lassen Creek, in the Goose Lake Coalition Watershed, completed implementation of a management plan for water flea toxicity in 2008, and it was concluded that the toxicity was not caused by agricultural waste discharge.

elevated nitrate levels in Central Valley surface waters receiving agricultural runoff. UC Davis monitoring results are very similar to coalition group results.

See Figure 16 for a map of nitrate management plan locations and UC Davis monitoring results.

E. coli

The fecal pathogen indicator *E. coli* is the most common parameter with surface water exceedances of water quality objectives in the ILRP; it was detected in 99 percent of all samples. Fecal contamination is a concern because certain pathogenic bacteria found in feces can cause gastrointestinal illness. Most *E. coli* strains are harmless, but because *E. coli* is ubiquitous in fecal matter, can survive outside the intestine for days to weeks, and is a relatively inexpensive and reliable test, it is a good indicator organism for fecal contamination and thus potentially more harmful pathogens.

There were approximately 960 exceedances of the *E. coli* water quality criteria[20] out of the approximately 2,370 samples at 156 monitoring sites between July 2004 and June 2009[21], or about 41 percent of all *E. coli* samples. To date, there are 106 monitoring sites in 26 surface water subbasins that have shown two or more *E. coli* exceedances of water quality criteria. Refer to Figure 16 for a map of *E. coli* data in the Central Valley.

E. coli samples were not collected as part of the UC Davis monitoring effort.

Electrical Conductivity and Total Dissolved Solids

There are currently electrical conductivity (EC) and/or total dissolved solids (TDS) management plans required for 46 monitoring sites in 10 surface water subbasins. Four subbasins are in the Lower Sacramento River Basin, five are in the San Joaquin River Basin, and one is in the Tulare Lake Basin. Ten of the 46 monitoring sites are in the Sacramento River Basin, 35 are in the San Joaquin River Basin, and one is in the Tulare Lake Basin. Refer to Figure 20 for a map of EC and TDS data in the Central Valley.

Metals

Current ILRP program monitoring requires that coalition groups monitor for nine metals (arsenic, boron, cadmium, copper, lead, nickel, selenium, molybdenum, zinc). To date, there are management plans required for seven of the nine metals. Table 5 summarizes management plan information for metals.

Metal Use in Agriculture

Arsenic, boron, and copper are active ingredients in some pesticides. Boron, copper, molybdenum, selenium, and zinc are used in some fertilizer products.

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[20] EPA ambient water quality criteria, single sample maximum of 235 MPN/100 ml.

[21] Does not include samples collected 2004 through 2006 by the Sacramento Valley Water Quality Coalition because of ongoing QA/QC work.

PVC plastic irrigation pipes, as well as lead piping or other equipment used in various on-farm operations, can contain lead. Metals can be found in subsurface drainage discharge (e.g., boron, selenium) and also may be associated with sediment in tailwater discharge.

There are 15 cadmium and lead pesticides that are no longer registered for use in California. The Central Valley Water Board could not find any information on manufactured agricultural crop application products containing nickel.

Table 5. Number of Management Plans Required for Metals in Number of Subbasins

Metal	Sacramento River Basin	San Joaquin River Basin	Tulare–Buena Vista Lakes Basin	Total
Arsenic	0	13 (5)	1	14 (6)
Boron	3 (2)	9 (2)	1	13 (5)
Cadmium	0	13 (5)	1	14 (6)
Copper	0	23 (7)	0	23 (7)
Lead	0	22 (7)	0	22 (7)
Nickel	0	6 (3)	0	6 (3)
Selenium	1	1	0	1

Sewage sludge (biosolids) applied as fertilizer or soil amendment to agricultural land is another potential source of metal in agricultural runoff. Biosolids can contain arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc. There are approximately 10,000 to 50,000 acres of irrigated agricultural land in the Central Valley Region where biosolids are applied.[22]

See Figures 17–20 for the locations of metal management plan sites.

Surface Water Map Legends

Figures 11 through 20 are side-by-side maps showing the distribution of management plans and other pertinent data throughout the Central Valley. Each figure contains two legend columns (one to the left of each map). Please note that the first map legend (legend to the far left) on each page includes information that applies to both maps, so refer to both legend columns for each map.

[22] Personal communication with State Water Board biosolids program staff.

Figure 11. Chlorpyrifos and Diazinon Use, Monitoring Data, and Management Plans

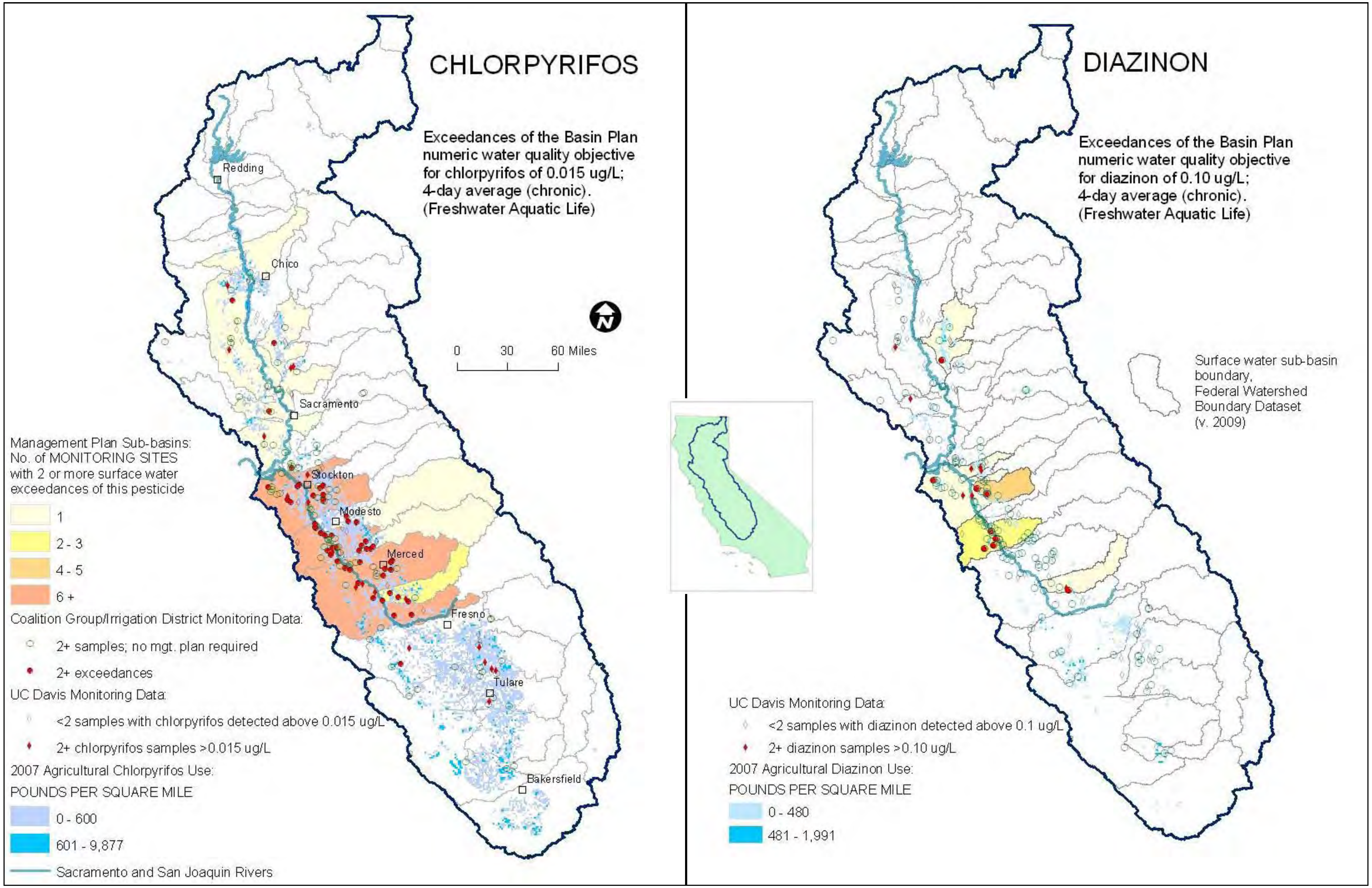


Figure 12. Diuron and Dimethoate Use, Monitoring Data, and Management Plans

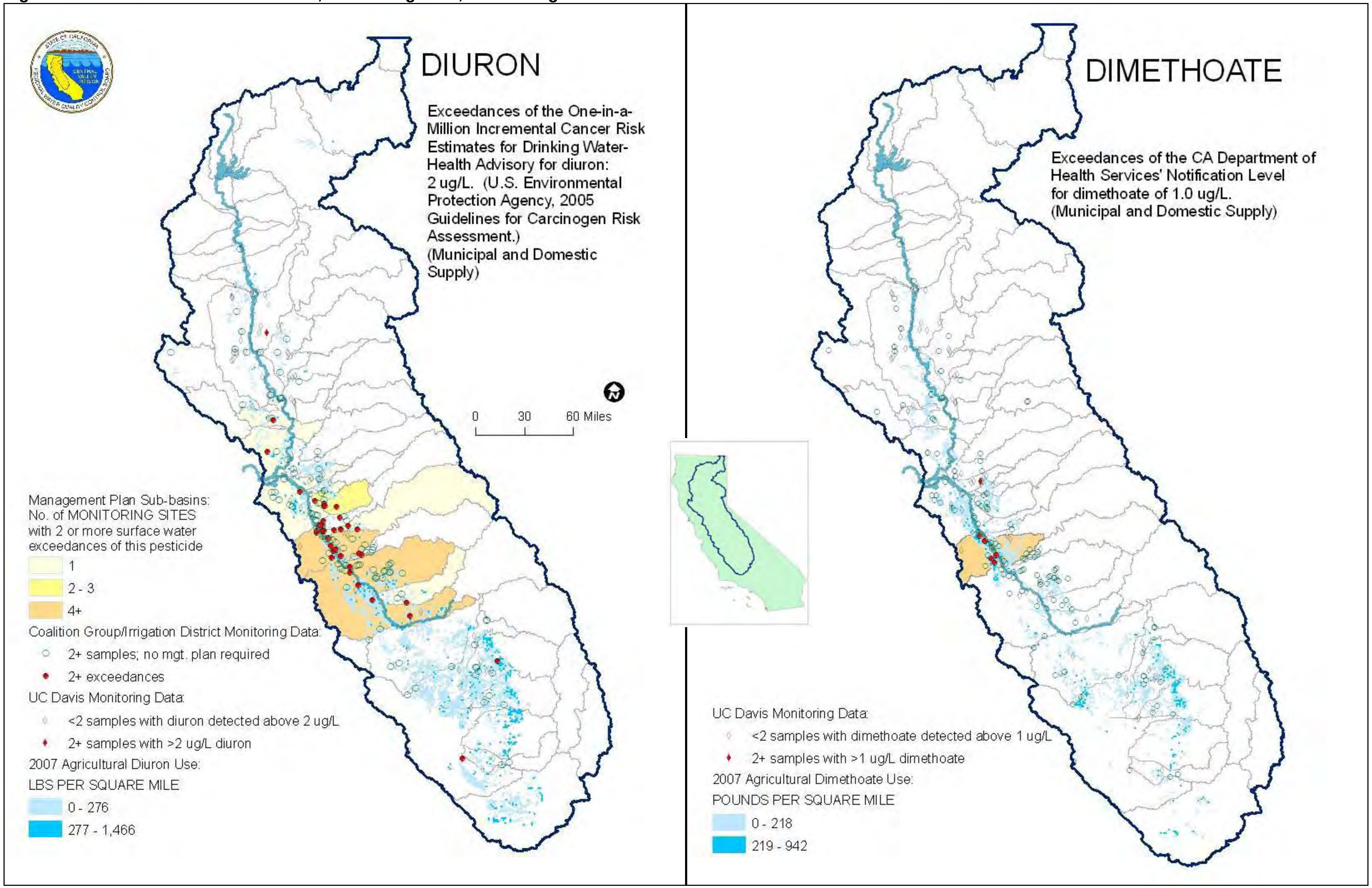


Figure 13. Methyl-Parathion and Simazine Use, Monitoring Data, and Management Plans

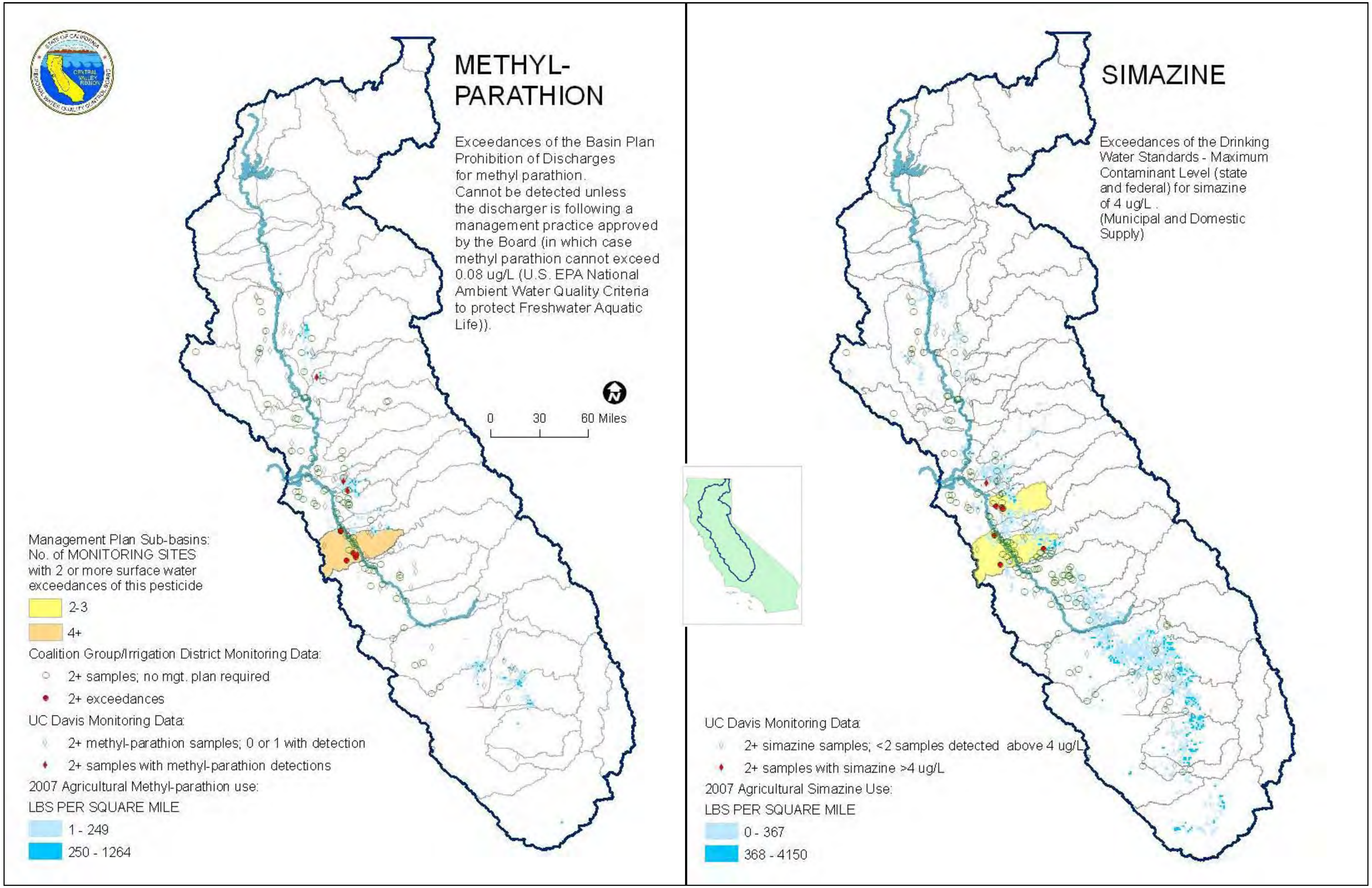


Figure 14. Malathion and Thiobencarb Use, Monitoring Data, and Management Plans

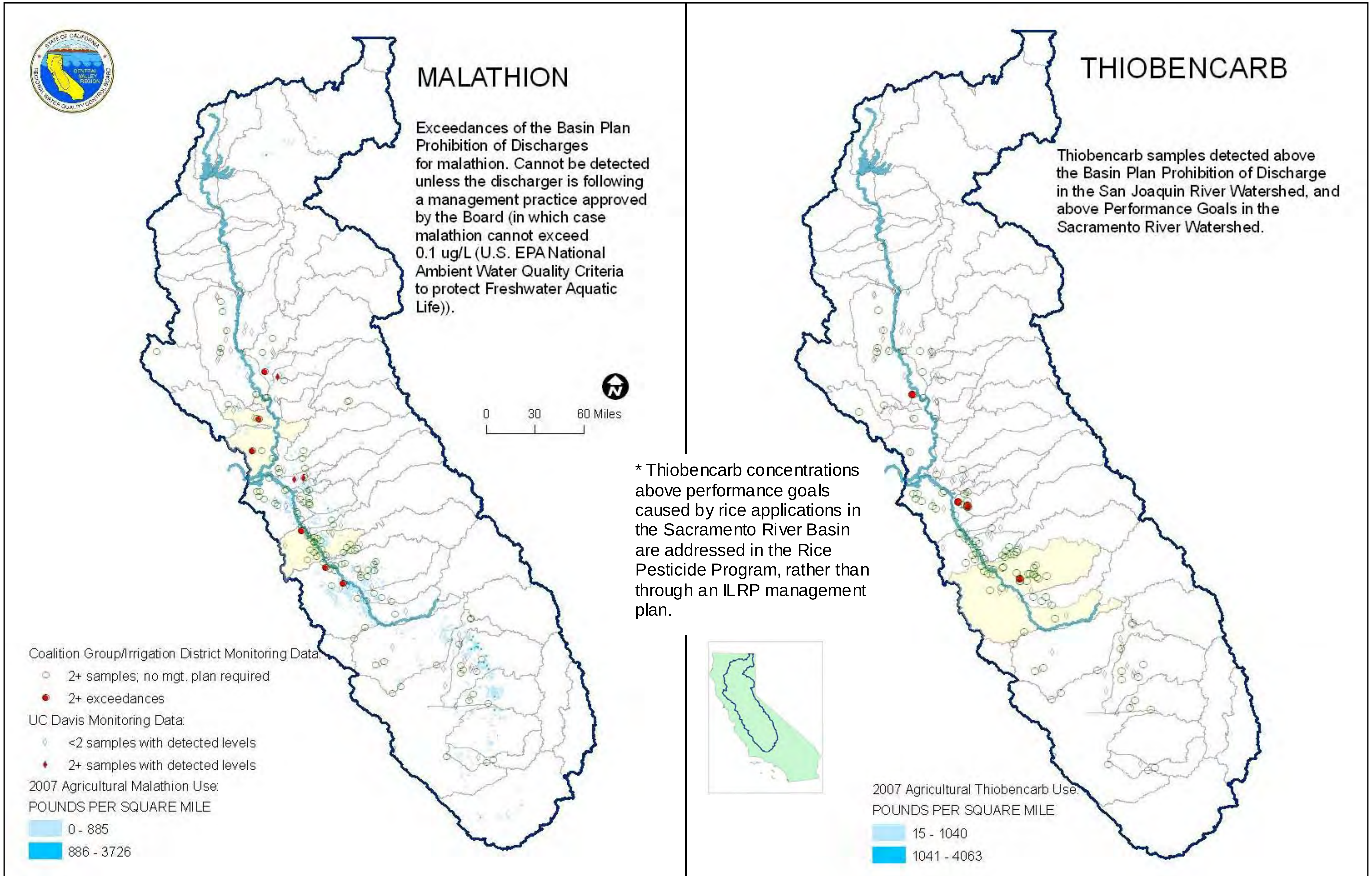


Figure 15. Water Column and Sediment Toxicity Monitoring Data and Management Plans

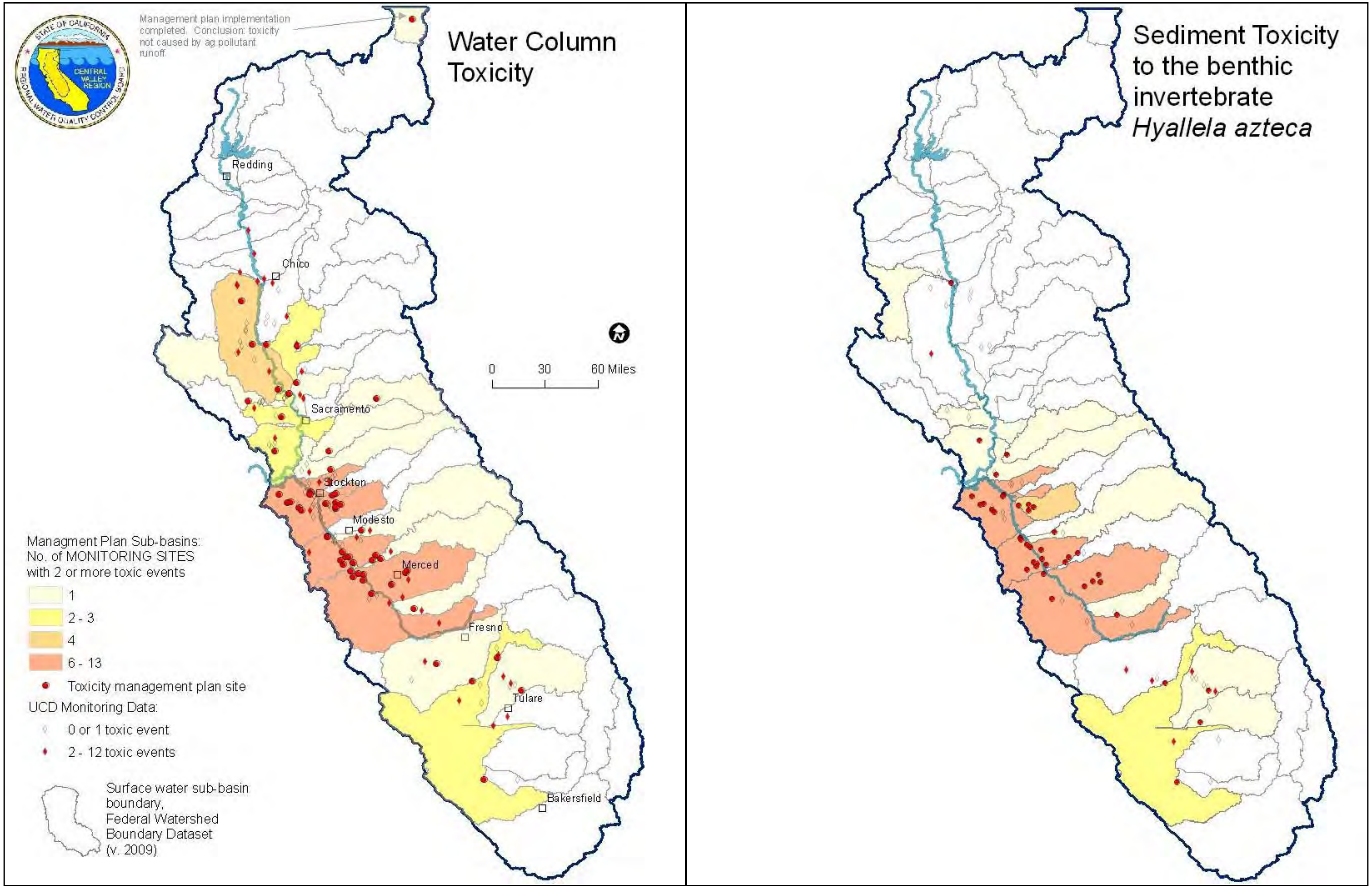


Figure 16. *E. coli* and Nitrate Monitoring Data and Management Plans

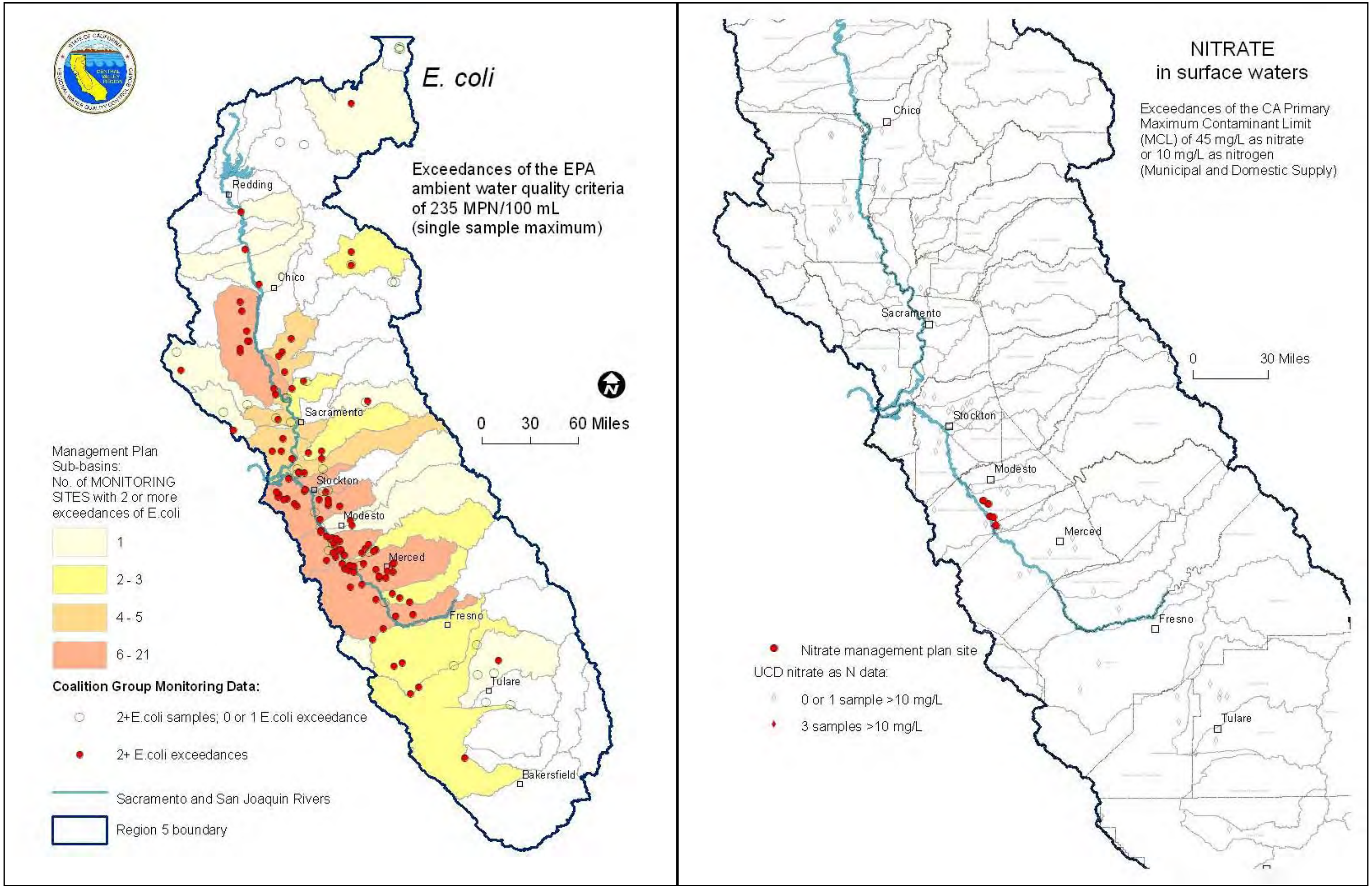


Figure 17. Arsenic and Boron Monitoring Data and Management Plans

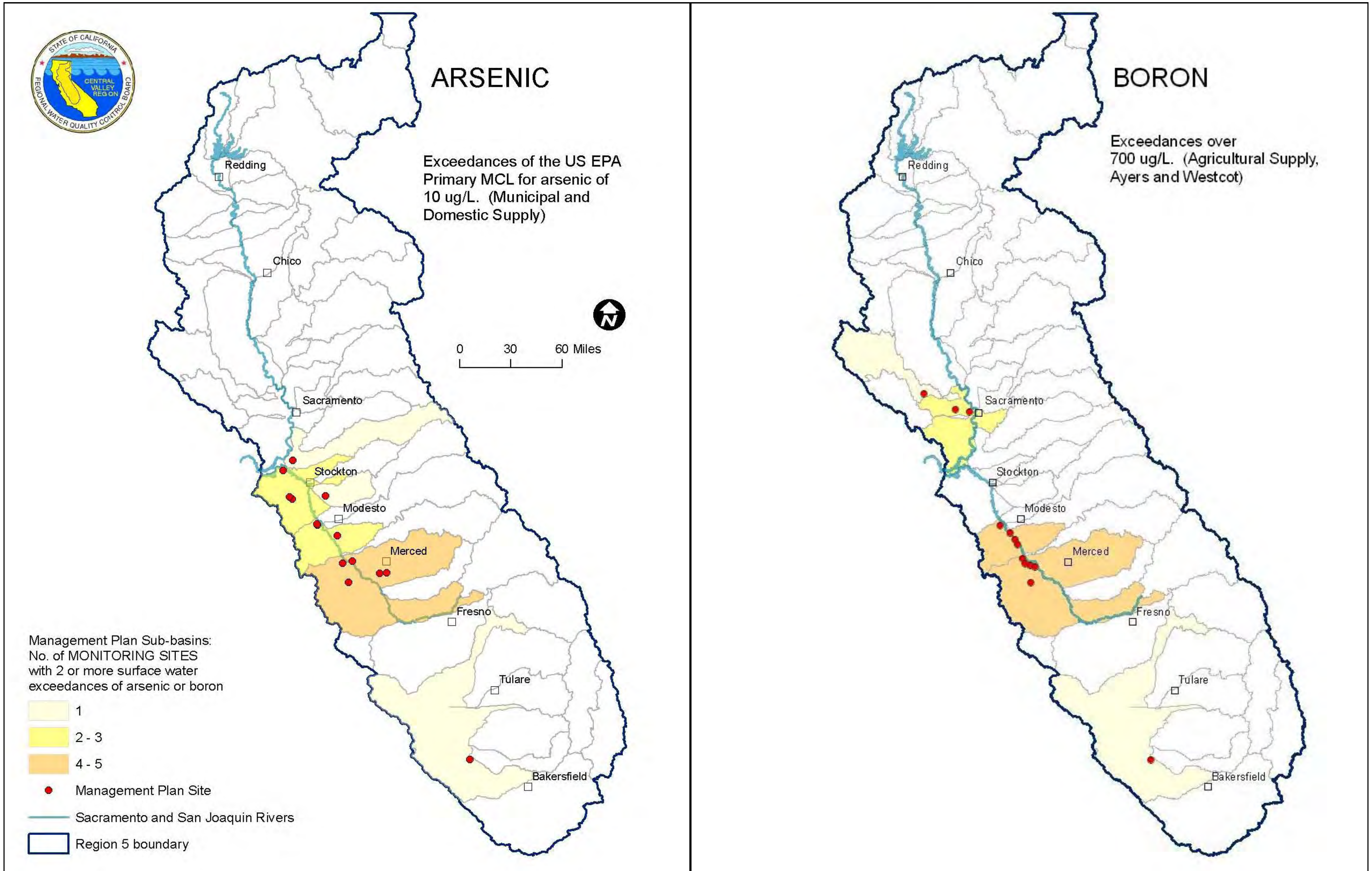


Figure 18. Copper and Cadmium Monitoring Data and Management Plans

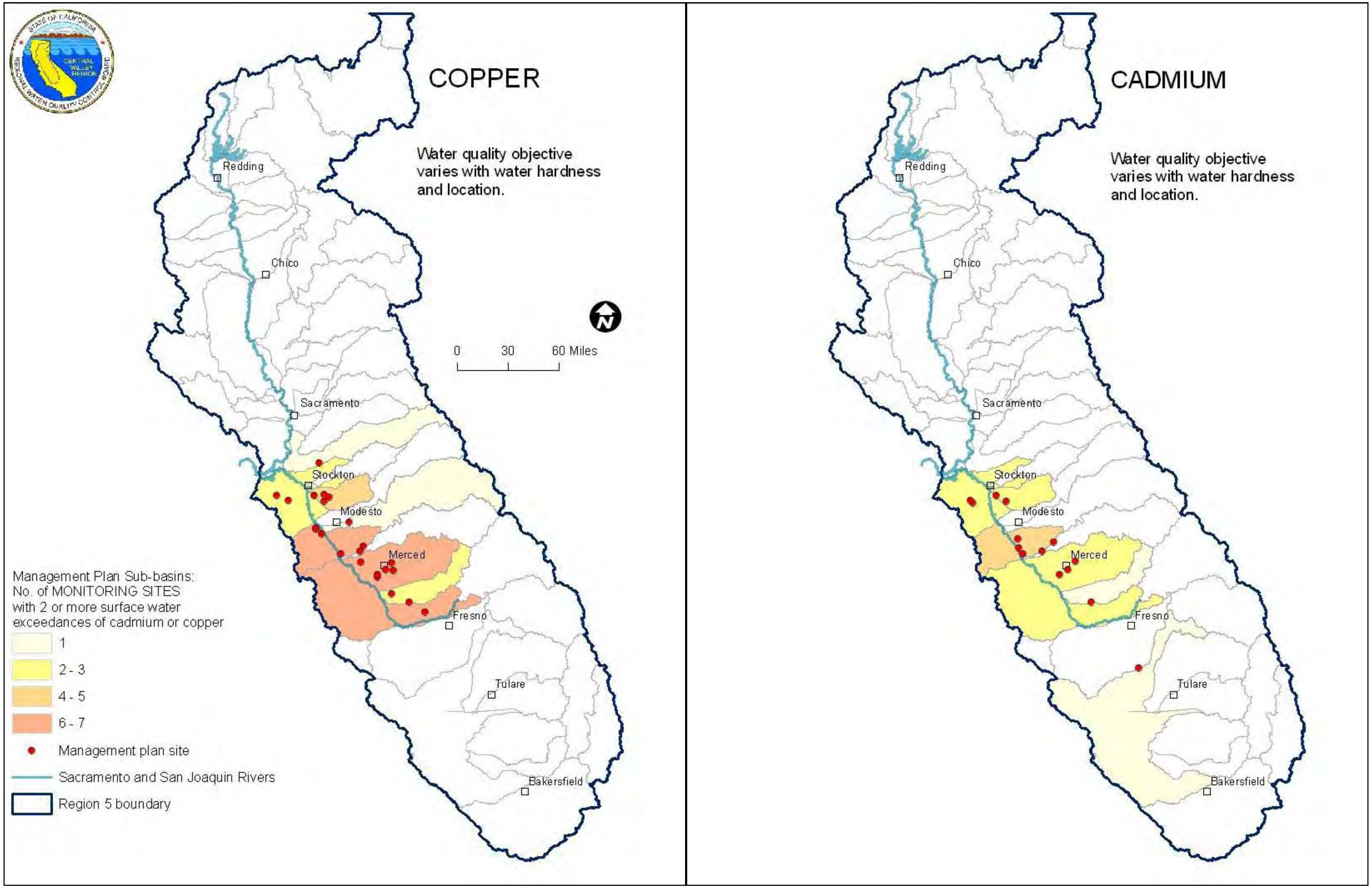


Figure 19. Lead and Nickel Monitoring Data and Management Plans

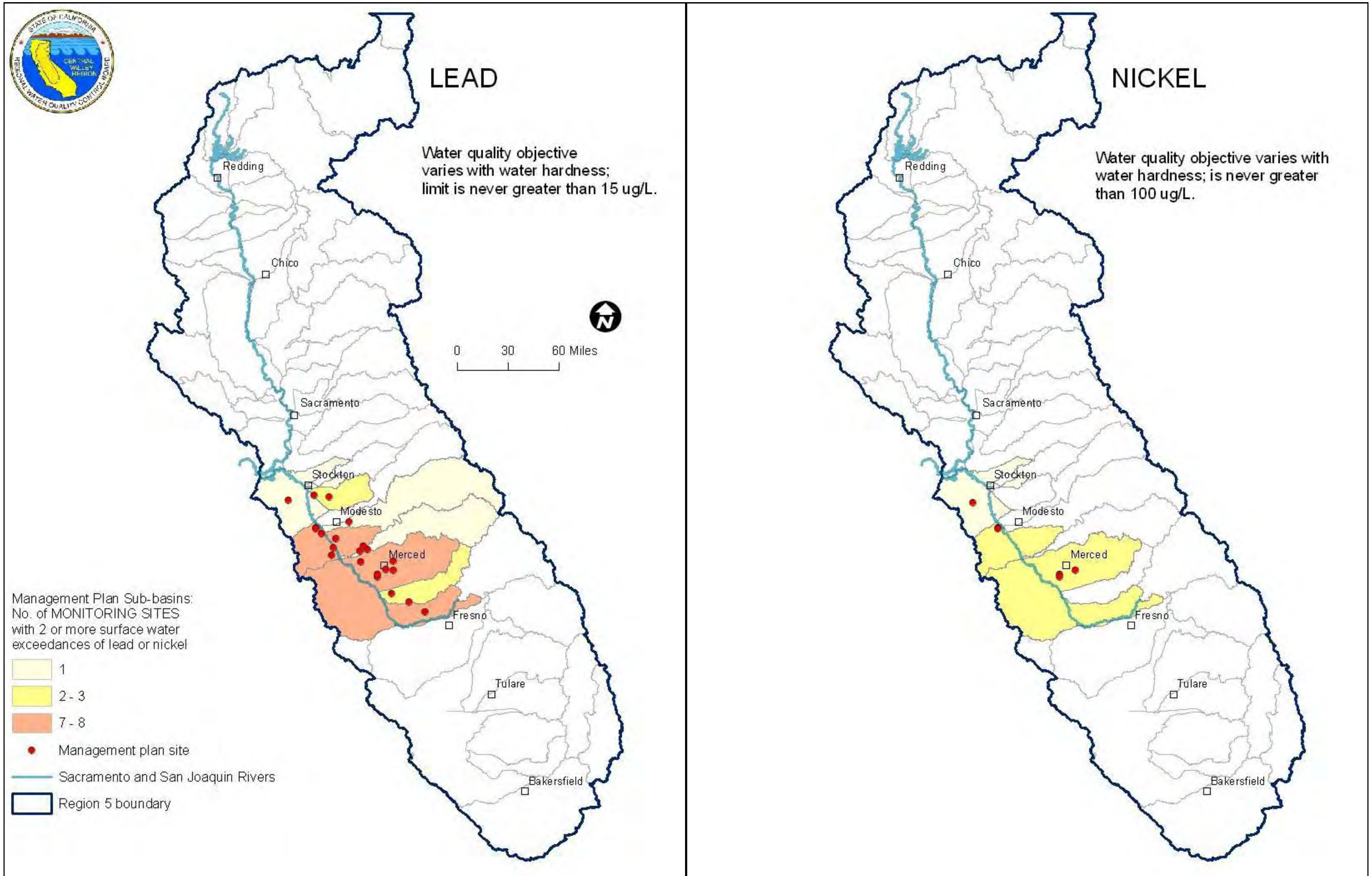
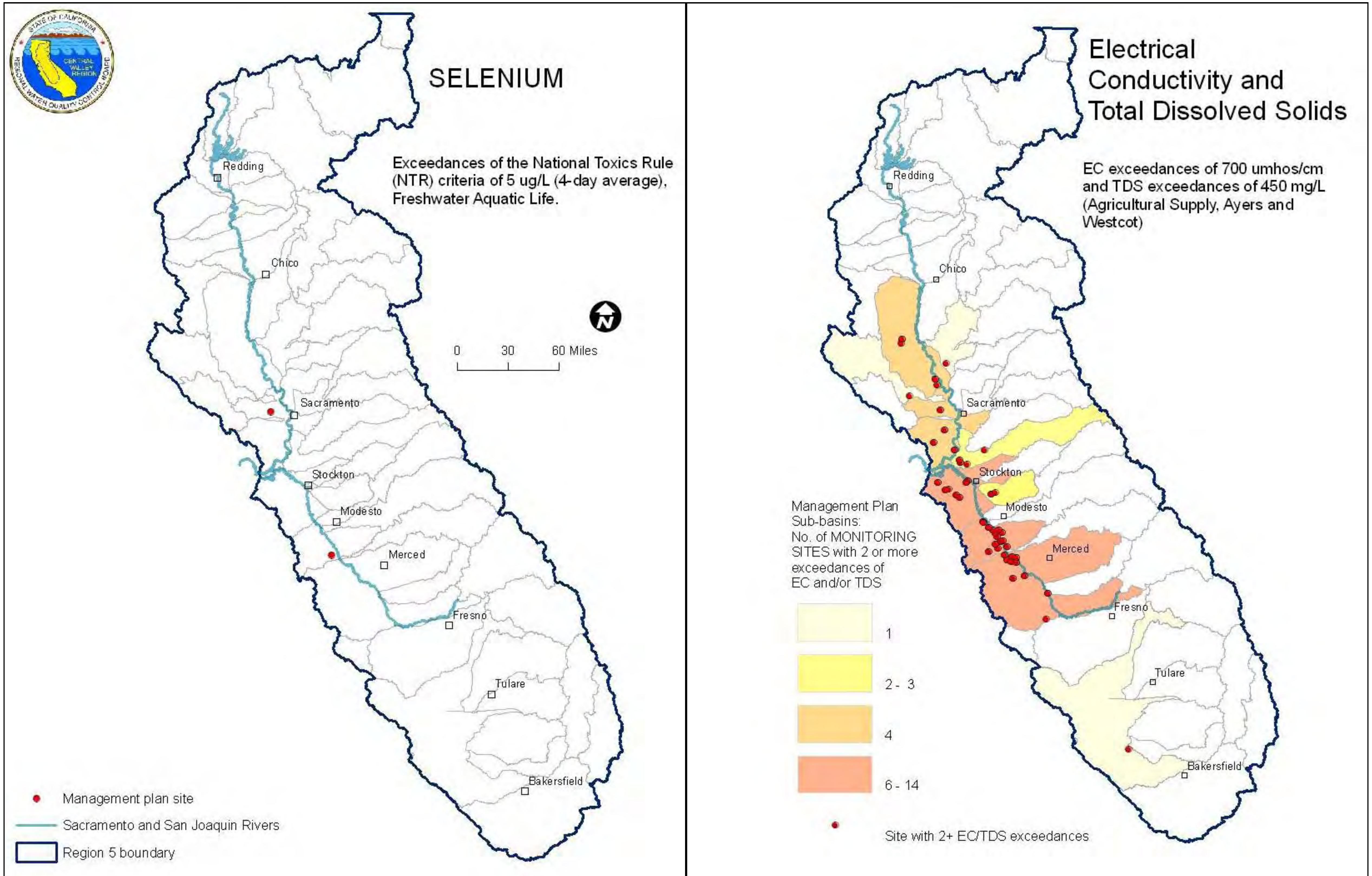


Figure 20. Selenium, Electrical Conductivity, and Total Dissolved Solids Monitoring Data and Management Plans



2. Groundwater summary

The above surface water summary section briefly discusses monitoring information collected as part of the current ILRP. Because the current ILRP does not address discharge to groundwater, this section (1) summarizes studies and other information collected for Central Valley groundwater; (2) provides more detail than the surface water section regarding potential pathways of waste discharge (i.e., how waste may move to groundwater); and (3) briefly discuses potential effects of the waste discharge (e.g., impacts on drinking water).

To inform the development of groundwater protection requirements for the long-term ILRP, the Central Valley Water Board developed the attached *Draft Groundwater Nitrate Summary Report* (Appendix B). Nitrate was used as an indicator parameter because of its widespread use in agriculture, groundwater's vulnerability to nitrate degradation, and the relatively large amount of data that has been published regarding nitrate impacts in the Central Valley. This section summarizes the main findings of *Draft Groundwater Nitrate Summary Report.*

The application of irrigation water, which may contain nutrients and pesticides as well as dissolved mineral elements (salts), can result in leaching of contaminants below the rootzone and impact on underlying aquifers. See Figure B-2 of Appendix B for a graphical depiction of potential pathways of waste to groundwater.

Nutrients

Nutrients, primarily phosphorus and nitrogen, are used to promote plant growth. Nutrients can enter groundwater through two ways: (1) run-in, and (2) leaching. Run-in transports surface water and its dissolved constituents directly to groundwater through porous or fractured bedrock, sinkholes, or poorly constructed wells. Leaching is the process by which surface water and its dissolved constituents move through the soil profile in response to percolating rain, melting snow, or irrigation water.

Although phosphorus tends to bind to soil, phosphorus leaching to groundwater has been documented to occur in the Central Valley (Bennett et al. 2005 and 2006; Dawson et al. 2008; Shelton et al. 2008;), especially in soils that are low in clay, organic carbon, iron, and aluminum; and in soils where downward flow occurs through preferential pathways (root holes, worm burrows, and desiccation cracking).

Phosphorus has not been identified as a threat to human health, and no guidelines have been set for drinking water. However, phosphorus contamination of groundwater may lead to surface water impacts. This has been documented to occur in portions of the Central Valley through discharges from subsurface tile drainage systems (San Joaquin River—Lee and Jones-Lee 2007) and through direct discharge of groundwater into surface water (Merced River—Wildman et al. 2009). In surface water, excess phosphorus can lead to excess algae and plant growth (eutrophication) of lakes, ponds, and small streams.

Nitrate derived from both agricultural and non-agricultural sources has resulted in degradation and/or pollution of groundwater beneath agricultural areas in California's Central Valley (Burow et al. 1998, 2008; Suen 2008; Green et al. 2008; Harter et al. 2005; Singleton et al. 2007; Esser et al. 2009; McNab et al. 2007). The most significant sources of non-agricultural nitrate detected in groundwater in agricultural areas include leakage from septic tanks, residential and commercial use of fertilizers, leakage from sewage pipes and mains, leakage beneath landfills, and discharges from food processing facilities (Paul et al. 2007; Central Valley Water Board 2008). Major sources of agriculturally derived nitrate consist of fertilization using natural (manure) or synthetic nitrogen sources (chemical fertilizers) and concentrated animal feeding operations (Burow et al. 1998, 2008; Suen 2008; Green et al. 2008; Harter et al. 2001; Singleton et al. 2007; Esser et al. 2009).

Nitrate impacts on groundwater beneath agricultural areas are most effectively determined by means of shallow (installed in first encountered groundwater) monitoring wells constructed with short screen lengths (Burow et al. 1998, 2007; Fuhrer et al. 1999; California GAMA Program 2008). While nitrate impacts may be detected most effectively in shallow wells, intensive pumping and recharge through irrigation can result in a vertically downward groundwater flux. This downward migration of nitrate may result in increasing concentrations in the deeper domestic and public-supply wells over time (Burow et al. 2007).

Determining the specific source(s) of nitrate contained in groundwater can be difficult. However, a variety of chemical and physical methods have been developed for this purpose. Nitrate isotopic composition, age determination of the water, presence or absence of co-contaminants, and major and trace element chemical composition of the groundwater have been used successfully to identify multiple sources of nitrate within a plume of affected groundwater (Kendall 1998; Esser et al. 2009; Buszka et al. 2006; Suen 2008).

While some disagreement exists between investigators, a common group of physical and chemical factors has been identified as affecting nitrate leaching beneath agricultural lands (CDFA 1989; State Water Board 1994; Green et al. 2007; Harter et al. 2005; Fuhrer et al. 1999; Burow and Green 2008; Burow et al. 2008; Domagalski et al. 2008; and Dinnes et al. 2002). Physical factors include nitrogen application rates, water inputs (rainfall, type of irrigation, and frequency of irrigation), leaching rates (soil type and structure), evapotranspiration, and depth to groundwater. Chemical factors include soil mineralogy, pH, bulk density, soil organic matter, and denitrification.

Nitrate vulnerability maps developed for the nation and exclusively for California depict two parallel bands of high aquifer vulnerability extending along both sides of the Central Valley from the Bakersfield area to just north of Fresno. A second discontinuous band of high aquifer vulnerability extends through the center of the Central Valley from near Merced northward to the area around Colusa. A separate area of high vulnerability is depicted near Redding (see Figures B-5, B-6, B-7, B-8 of Appendix B).

Non–nitrate vulnerability maps prepared by the State Water Board (Hydrogeologically Vulnerable Areas—Figure B-9 of Appendix B) and DPR (Groundwater Protection Areas—Figure B-10 of Appendix B) are analogous to the nitrate vulnerability maps with the exception of the southwestern portion of the Central Valley (nitrate vulnerability maps have both an eastern and western band of high vulnerability, while the State Water Board and DPR maps depict only the eastern band).

State Water Board and USGS well sampling maps depicting areas in the Central Valley where groundwater quality has been affected by nitrates are in general agreement with the vulnerability maps (see Figures B-16 and B-17 of Appendix B). Caution must be exercised, however, in using these maps to evaluate the extent of nitrate impacts in the Central Valley. Sampling-induced bias (sampling deeper waters below shallow, nitrate-affected waters or sampling wells with long screen intervals), coupled with the lack of sampling in some regions, may distort or underestimate the actual area of impact.

Studies of trends in nitrate concentrations in groundwater in the Central Valley have focused predominantly on the eastern side of the San Joaquin Valley. Nitrogen fertilizer data were compared with the results of groundwater sampling to show that increases in nitrate concentrations over time corresponded to fertilizer application rates in focused study areas (Burow and Green 2008) (see Figure B-19 of Appendix B).

Pesticides

A wide variety of pesticides is applied to commercial, residential, governmental, and agricultural properties to control weeds, insects, fungus, and disease. Numerous studies have established that pesticides, which typically are applied at the land surface, can move downward through the unsaturated zone to reach the water table at detectable concentrations (Suen 2008; Tesoriero et al. 2007; Burow et al. 2008). DPR's Groundwater Protection Program establishes requirements for use of pesticides throughout the Central Valley that are aimed to protect vulnerable groundwater from pesticides. The Groundwater Protection Program is described in Section V.B.2 of this report.

Pesticides migrate to groundwater much as nutrients do, primarily through run-in, or leaching. The most important attenuation processes for pesticides are sorption, volatilization, and degradation. These processes are most active in the soil profile because of interactions between the pesticide and particles of clay or organic matter and breakdown by active microbial processes (British Geological Survey 2009). Many factors determine whether a pesticide will leach to groundwater, including pesticide properties, soil characteristics, site conditions, and management practices. The pesticides most susceptible to leaching are those with high solubility in water, low adsorption to soil, and long-term persistence. When these pesticides are applied to sites with sandy soils, shallow depth to groundwater, and either a wet climate or extensive use of irrigation, the risk of groundwater degradation is high. Pesticide impacts on groundwater beneath agricultural areas, like nitrates, are determined most effectively by means of shallow (installed in first encountered groundwater) monitoring wells constructed with short screen lengths (Burow et al. 1998, 2007; Fuhrer et al. 1999; California GAMA Program 2008).

Pesticides are commonly detected in water quality studies (GAMA, National Water-Quality Assessment [NAWQA]), although usually at low levels (Bennett et al. 2006; Burton et al. 2008; Dawson 2001). While concentrations of pesticides rarely exceeded the standards and criteria for drinking water, two pesticides—DBCP and EDB—repeatedly have been detected throughout the State at concentrations higher than State-established maximum contaminant levels (MCLs). Both of these are soil fumigants that have long been banned, but both continue to persist in the water in many areas (2002, 305 (b) Report).

Salinity

Increasing salinity is likely the largest long-term chronic water quality impairment to surface and groundwater in the Central Valley. Salinity, including nitrate, from past and current sources impairs beneficial uses of waters throughout the valley landscape and results in pollution of drinking water sources for some communities in the Central Valley.

Irrigated agriculture often leads to increased recharge, sometimes resulting in the leaching of salts from the unsaturated zone into groundwater. In irrigated areas groundwater salinization can result from irrigation with saline water, downward movement of salts in the unsaturated zone or dissolution of saline minerals, and the concentration of salts owing to plant water uptake.

Pathogens

Groundwater in some areas is much more susceptible to bacterial contamination than groundwater in other areas. The most susceptible groundwater occurs in areas where the soils are gravelly or highly fractured. Preliminary data indicate some bacterial leaching to groundwater below areas that have been fertilized with manures. Exclusion zones that prohibit the application of certain chemicals around wells can reduce or prevent groundwater bacterial contamination.

D. Small Communities and Drinking Water

As described in Section III.A, Industry Summary, irrigated agricultural operations apply fertilizers containing nitrogen. Leaching of nitrate from fertilizer application is one of many sources of nitrate in Central Valley groundwater. Concerns regarding difficulties that small Central Valley communities have in obtaining high quality drinking water because of nitrate pollution have been expressed by residents and environmental justice groups during long-term ILRP public scoping meetings and by long-term ILRP Advisory Workgroup members.[23] Small community water systems are defined by the California Department of Public Health (DPH) as those that service populations of fewer than 12,600 individuals, have fewer than 4500 water connections, or provide water to individual public schools.

The cost of treating high nitrate levels in public drinking water is a major issue for small communities, particularly those that provide water to residents from a single domestic drinking water well. Larger community systems can blend water from multiple sources to meet water quality standards. Some Central Valley communities have been forced to address nitrate contamination by drilling new, deeper wells, consolidating with other communities, or installing nitrate treatment systems. Other communities simply do not have the financial ability to make required changes to their water systems to mitigate impacts attributable to nitrate. To address this problem, one of the goals of the long-term ILRP is to "ensure that irrigated agricultural discharges do not impair Central Valley communities' and residents' access to safe and reliable drinking water."

In order to evaluate the extent of nitrate impacts on small community water supplies, information obtained from long-term ILRP Advisory Workgroup members (environmental justice groups and DPH) has been used in conjunction with DPH's Drinking Water Source Assessment Program (DWSAP) to estimate the number of Central Valley small communities that may be having difficulties obtaining safe and reliable drinking water. The DWSAP provides information on:

- water quality impacts on public water supply wells, including a delineation of the area around a drinking water source through which contaminants might move and reach the drinking water supply;
- an inventory of possible contaminating activities (PCAs) that might lead to the release of microbiological or chemical contaminants in the delineated area; and
- a determination of the PCAs to which the drinking water source is most vulnerable.

The assessment assigns a risk ranking for each type of PCA. The assessments focus only on the source water zones or areas located around and adjacent to a drinking water source that have been identified as the PCA. ***In order to maintain the potential link to irrigated agricultural operations (as opposed to septic system or other PCAs), only communities with agricultural operations listed as one of the PCAs were considered further in this analysis.***

[23] See Central Valley Water Board's September 29, 2008 Irrigated Lands Regulatory Program Public Workshop Comments Response Summary.

Appendix C contains a combined list of the DPH and Balazs (2008) datasets for communities with nitrate MCL exceedances from 2005 to third quarter 2009. Other information included in the table is population, number of connections, PCAs, and whether the community has been approved for Proposition 84 or 50 funding.[24] Considering the information in Appendix C, it is estimated that there are 45 small community systems with high nitrate concentrations (e.g., exceeding State MCLs) that have agriculture listed as a PCA. Of these communities, 19 are currently receiving Proposition 84 and/or 50 grants and loans (Table 6).

Table 6. Small Community Systems with High Nitrate Levels with Agricultural Possible Contaminating Activities

Systems with DPH source water assessment with agriculture identified as PCA	45
Systems with DPH source water assessment with agriculture identified as PCA and receiving Proposition 84 or 50 funding	19
DPH = California Department of Public Health. PCA = possible contaminating activities.	

In conducting this analysis, the Central Valley Water Board also has made an effort to estimate a range of costs that these communities may be facing in order to obtain safe and reliable drinking water. This information is used qualitatively in Section IX of this report to evaluate long-term ILRP alternatives.

Once a nitrate MCL exceedance has occurred, responding to it can be complicated and expensive. Based on a review of the most recent list of projects being considered for funding under Proposition 84 and past Proposition 50 funding, small communities have proposed one or more of the following types of projects: (1) drilling new wells; (2) consolidating water supplies; (3) removing nitrates in existing water supplies, or (4) conducting feasibility projects/studies (DPH 2009).

If the source of drinking water is groundwater, the cost of a small drinking water system is dependent on several factors—one is well replacement. Well replacement includes, but is not limited to, factors such as the geology of the water supply area, well design and depth, well drilling, well development and pumping rate, and wellhead protection (Harter 2003). General costs for replacing a well are given in Table 7. There are also ongoing costs to maintain a well and treat a domestic drinking water supply over time (Table 8).

Based on the information in Tables 7 and 8, estimated costs for well replacement are between $76,500 and $1,085,000 with 1 year of associated operation and maintenance costs (Simmons 2010; Newkirk and Darby 2008). In order to provide a measure of confidence, the estimated costs for well replacement have

[24] State grants and low interest loans are available to help communities obtain safe and reliable drinking water sources through Propositions 84 and 50. These programs are administered by DPH.

been compared with Proposition 84 and 50 nitrate project cost ranges. A review of DPH's Proposition 84 second round project priority funding list (204 total projects, 28 of which are nitrate projects) shows a range of cost from $58,000 to $2,000,000 for small community infrastructure improvements for chemical and nitrate contaminates. Projects specifically identified by Proposition 50 (20 projects) for nitrate exceedances ranged from $324,000 to $2,000,000. There is general agreement between the actual costs of funded Proposition 84/50 projects addressing nitrate contamination and the well replacement estimate given in Tables 7 and 8.

Table 7. Well Replacement Cost Estimate

Well Size (gpm)	General Cost Assumptions
10 to 30 gpm	$25,000 to $50,000 ($37,500 average)
30 to 100 gpm	$100,000
1000 gpm to 2000 gpm	Can be as high as $1,000,000
Sources: Simmons 2010; Newkirk and Darby 2008. gpm = gallons per minute.	

Table 8. Well Operation and Maintenance Cost Estimate

Items	Cost Ranges
Labor per person	$30,000 to $60,000 per year
Power for <100 gpm size	$3,000 to $5,000
Administration/fees	$2,000 per year
Analytical costs—groundwater	$2,000 per year with no treatment or compliance issues
Maintenance—groundwater	$1000 per year if done by operator
Sources: Simmons 2010; Newkirk and Darby 2008.	

Costs beyond well replacement become very difficult to estimate (University of Minnesota 2006). Projects from the Proposition 84 funding list identify costs for nitrate treatment in the Central Valley ranging from $58,000 to $2,000,000. In this analysis, well replacement was considered the preferred method for obtaining a safe and reliable water supply in estimating costs to Central Valley communities. This is mainly because other costs are difficult to estimate without significant area-specific information (e.g., consolidation may be a good option where other supplies are nearby).

Cost Estimate

For the 19 communities receiving Proposition 84/50 funding (see Table 6), the cost estimates described below are based on the total funding amount (e.g., total project funding amounts, see Appendix C). For the 26 communities that are not listed to receive funding, estimated costs are based on the range given in Tables 7 and 8 for well replacement projects ($76,500–$1,085,000). Total Proposition 84/50 funding for the 19 communities with nitrate exceedances and agriculture listed as a PCA is $18.5 million. The potential range of costs for the remaining

26 communities to obtain safe and reliable drinking water is estimated between $2 and $29 million. Total costs for the 45 communities are estimated to fall in the range of $20.5–$47.5 million.

It is important to note that agriculture fertilizer use is only one of several potential sources of nitrate in groundwater. An effort was made in this analysis to include only systems that DPH considers vulnerable to agricultural operations. However, information is not available to characterize whether current agricultural operations are contributing nitrate to these community water systems (e.g., past operations could have caused contamination), the amount of contribution, or whether other sources are primarily responsible. This analysis was developed to ensure that the Central Valley Water Board is aware of the problems Central Valley communities are facing to obtain safe drinking water, and also to inform any decision that may affect the discharge of nitrate to groundwater supply.

IV. LEGAL AND REGULATORY REQUIREMENTS

A. California Water Code

The CWC requires that the State Water Board or Regional Water Boards adopt water quality control plans (Basin Plans). A Basin Plan must identify the beneficial uses of State ground and surface waters, establish water quality objectives for the reasonable protection of the beneficial uses, and establish a program of implementation for achieving the water quality objectives.

Section 13263 of the CWC authorizes the State and Regional Water Boards to issue WDRs for projects or activities that would discharge waste to ground or surface waters within State boundaries.

CWC, Section 13260 requires that:

> *"…any person discharging waste, or proposing to discharge waste that could affect the quality of the waters of the State, [to] file a report of discharge (an application for waste discharge requirements) along with a filing fee, in anticipation that the Regional Water Board will provide waste discharge requirements."*

In the event a discharger files a report of waste discharge, the Regional Water Board is obligated to prescribe WDRs except where the Board finds that a waiver of WDRs for a specific type of discharge is in the public interest. Waivers of WDRs are limited to 5 years in duration, carry specific conditions aimed to protect water quality, and may be terminated at any time by the Water Board.

The long-term ILRP will be implemented using Central Valley Water Board adopted WDRs, waivers of WDRs, and/or conditional Basin Plan prohibitions (hereafter referred to as "implementation mechanisms"). The CWC establishes requirements that the Water Board must consider when adopting implementation mechanisms. For example, the CWC requires that waivers and WDRs be consistent with any applicable water quality control plan. CWC requirements for the implementation mechanisms are shown in Table 9.

Table 9. California Water Code Requirements for Implementation Mechanisms

	WDR	Waiver	Conditional Prohibition
Implement any relevant water quality control plans that have been adopted *[13263, 13269]*	✓	✓	
Take into consideration the beneficial uses to be protected—past, present, and probable future *[13263, 13241]*	✓		✓
Consider the water quality objectives reasonably required to protect beneficial uses *[13263]*	✓		
Consider other waste discharges *[13263]*	✓		
Consider the need to prevent nuisance *[13263]*	✓		
Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto *[13241]*	✓		✓
Water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality in the area *[13241]*	✓		✓
Economic considerations *[13141, 13241]*	✓	✓	✓
Identification of potential sources of financing *[13141]*	✓	✓	✓
The need to develop housing in the region *[13241]*	✓		✓
The need to develop and use recycled water *[13241]*	✓		✓
The action is in the public interest *[13269]*		✓	
Monitoring to support the development and implementation of the program (may be waived where discharges do not pose a significant threat to water quality) *[13269]*		✓	
WDR = Waste discharge requirements.			

As shown in Table 9, the CWC requires that the Water Board consider the above factors when developing implementation mechanisms for the long-term ILRP. Therefore, these factors will be used to evaluate potential long-term program alternatives (see Evaluation of Long-Term Program Alternatives, Section IX).

B. California Environmental Quality Act

The basic goal of the California Environmental Quality Act (CEQA) (Pub. Res. Code, Section 21000 *et seq*.) is to develop and maintain a high-quality environment now and in the future, while the specific goals of CEQA are for California's public agencies to:

(1) identify the significant environmental effects of their actions; and, either

(2) avoid those significant environmental effects, where feasible; or

(3) mitigate those significant environmental effects, where feasible.

CEQA applies to "projects" proposed to be undertaken or requiring approval by State and local government agencies, where projects are activities that have the potential to have a physical impact on the environment.

The Central Valley Water Board's current ILRP establishes that the Board will develop a PEIR for a long-term ILRP that will protect State waters. The purpose of the PEIR is to provide State and local agencies and the general public with detailed information on the potentially significant environmental effects that proposed long-term ILRP alternatives are likely to have and to list ways in which the significant environmental effects may be minimized.

The Central Valley Water Board has developed a Draft PEIR that considers the range of alternatives described in this report. The findings of the Draft PEIR have been used in the evaluation of long-term program alternatives and development of a recommended alternative for Central Valley Water Board consideration (Section IX.D).

C. Nonpoint-Source Program

Section 13369 of the CWC requires that the State Water Board develop a nonpoint-source implementation program that includes the following elements:

- non-regulatory implementation of best management practices (BMPs),
- regulatory-based incentives for BMPs, and
- the adoption and enforcement of WDRs that will require the implementation of BMPs.

The State Water Board's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy) provides guidance to the Regional Water Boards on how to develop, structure, and enforce a nonpoint-source pollution control implementation program, which fulfills the requirements of the CWC.

Any nonpoint-source pollution control implementation program must comply with State or Regional Water Board WDRs, conditional waivers, and/or Basin Plan prohibitions. Such programs may be developed by the State or Regional Water Boards; an individual discharger; or by a coalition of dischargers in cooperation with a third-party representative, organization, or government agency.

The Regional Water Board has the primary responsibility for ensuring that an appropriate nonpoint-source pollution control implementation program is in place. Given the extent and diversity of nonpoint-source pollution discharges, the Regional Water Board needs to be as creative and efficient as possible in devising approaches to prevent or control nonpoint-source pollution. For example, the current ILRP coalition group waiver allows the Central Valley Water Board to reach multiple growers while interfacing with a single third-party group.

Before approving a nonpoint-source pollution control implementation program, the Regional Water Board must find that the program will promote attainment of water quality objectives. The nonpoint-source program also must meet the requirements of the five key structural elements described below.

1. Implementation programs must, at a minimum, address NPS pollution in a manner that achieves and maintains water quality objectives and beneficial uses, including any applicable antidegradation requirements.

2. A nonpoint-source control implementation program must include a description of the management practices and other program elements that are expected to be implemented to ensure attainment of the implementation program's stated purpose, the process to be used to select or develop management practices, and the process to be used to ensure and verify proper management practice implementation.

   The Regional Water Board must be able to determine that there is a high likelihood that the program will attain water quality objectives. This includes examining factors such as the level of discharger participation and the effectiveness of the management practices implemented.

3. Where the Regional Water Board determines it is necessary to allow time to achieve water quality objectives, the nonpoint-source pollution control implementation program must include a specific time schedule and corresponding quantifiable milestones designed to measure progress toward reaching the specified requirements.

4. An NPS pollution control implementation program must include sufficient feedback mechanisms so that the Regional Water Board, dischargers, and the public can determine whether the program is achieving its stated purpose, or whether additional or different management practices or other actions are required.

5. The Regional Water Board must make clear, in advance, the potential consequences for failure to achieve a nonpoint-source pollution control implementation program's stated objectives.

   As part of the fifth element, the Regional Water Board needs to explain how non-compliance can be addressed in third-party programs. This explanation should include information concerning the criteria for measuring program success, what constitutes failure, and the actions that may be taken in response to failure. Individual dischargers need to be informed regarding what individual discharger actions or inactions will lead to enforcement. This explanation is necessary so that participating dischargers understand the ramifications of noncompliance, even if that noncompliance is by a third party they have selected as their representative. Ultimately, the ineffectiveness of a group through which a discharger participates in nonpoint-source control efforts cannot be used as an excuse for lack of individual discharger compliance.

In cases of individual noncompliance, selective enforcement actions may be taken. In cases of third-party noncompliance, an effort to revise the third-party program is an alternative. Generally, prior to initiating major revisions to a program, informal contact with dischargers, group representatives, or other third parties would be attempted in order to redirect unsuccessful efforts. Although the direction and efforts of a particular third-party program would be undertaken as a group effort, if the group or third party fails to follow through on their commitments, Regional Water Board enforcement action would be taken against individual dischargers—not the third party.

Waste discharges from irrigated agricultural operations are considered nonpoint-source discharges. Therefore, the requirements of the NPS Policy are applicable to the long-term ILRP. The NPS Policy's five key elements will be used to evaluate potential long-term program alternatives (see Evaluation of Long-Term Program Alternatives, Section IX.A.3).

D. Central Valley Regional Water Quality Control Plans

Section 13240 of the CWC requires that the Regional Water Board formulate and adopt a water quality control plan, or Basin Plan, for all areas in the region. The Central Valley Water Board has two basin plans: one for the Tulare Lake Basin and one for the Sacramento River and San Joaquin River Basins.

The Basin Plans establish beneficial uses to be protected in Central Valley ground and surface waters (e.g., municipal supply, agricultural supply, warm and cold freshwater habitat, contact recreation); water quality objectives to protect the beneficial uses; and implementation plans to achieve the water quality objectives. Basin Plan adopted water quality objectives ensure the reasonable protection of beneficial uses in Central Valley ground and surface waters. For example, Basin Plans contain fecal coliform water quality objectives for any waters designated for contact recreation. The fecal coliform water quality objectives are designed to ensure the health and safety of people using waters for contact recreation.

All Water Board permits, WDRs, and waivers of WDRs must implement provisions of the Basin Plan. The long-term ILRP therefore must (1) require that Central Valley ground and surface waters accepting waste from irrigated agricultural operations meet applicable Basin Plan water quality objectives, and (2) be consistent with Basin Plan policies and implementation provisions, including time schedules, where applicable.

Basin Planning efforts look at all pollutant sources and identify what needs to be done to achieve water quality protection. For example, Central Valley Salinity Alternatives for Long-Term Sustainability (or CV-SALTS) has the goal of developing sustainable solutions to the increasing salt and nitrate concentrations in Central Valley surface and groundwater. The ILRP is relying on CV-SALTS to identify the actions that need to be taken by irrigated agriculture and others to address these constituents.

Recent Basin Plan amendments have addressed discharges of pesticides, oxygen-demanding substances, and salt from irrigated lands in specific portions of the Central Valley. Future Basin Plan amendments also are expected to include new requirements for waste discharges from irrigated agricultural lands. Examples of programs developing amendments include the methylmercury TMDLs, Central Valley pesticide TMDL, organochlorine pesticide TMDL, and the CV-SALTS program. The methylmercury TMDL has been approved by the Central Valley Water Board, and will be reviewed by the U.S. Environmental Protection Agency (USEPA). If approved by USEPA, the TMDL would establish new methylmercury loading limits for Central Valley surface waters.

As described above, the long-term ILRP is required to implement Basin Plan provisions, including new provisions adopted in a Basin Plan amendment. Therefore, it is important that the long-term ILRP be flexible enough to implement these and other future Basin Plan water quality requirements.

E. State Antidegradation Policy

Basin Plan water quality objectives are developed to ensure that ground and surface water beneficial uses are protected. The quality of some State ground and surface waters is higher than established Basin Plan water quality objectives. For example, nutrient levels in good quality waters may be very low, or not detectable, while existing water quality standards for nutrients may be much higher. In such waters, some degradation of water quality may occur without compromising protection of beneficial uses.

State Water Board Resolution 68-16 *Statement of Policy with Respect to Maintaining High Quality of Waters in California* (Resolution 68-16) was adopted in October of 1968 to address high quality waters in the State. Title 40 of the Code of Federal Regulations, Section 131.12—Antidegradation Policy (40 CFR 131.12) was developed in 1975 to ensure water quality necessary to protect existing uses in waters of the United States. Resolution No. 68-16 applies to discharges to all high quality waters of the State, including groundwater and surface water (CWC Section 13050[e]); 40 CFR 131.12 applies only to surface waters.

The requirement to implement the Antidegradation Policy is contained in Resolution No. 68-16 (provision 2 presented below) and in the Central Valley Water Board's Water Quality Control Plans. The Water Quality Control Plan for the Tulare Lake Basin, Second Edition (Revised January 2004) contains the statement (page IV-20),

> *"The Regional Water Board will apply the directives of Resolution No. 68-16 in considering whether to allow a certain degree of degradation to occur or remain. In conducting this type of analysis, the Regional Water Board will evaluate the nature of any proposed, existing, or materially changed discharge that could affect the quality of waters within the region. Any discharge of waste to high quality waters must apply best practicable treatment or control not only to prevent a condition of pollution or nuisance from occurring, but also to maintain the highest water quality possible consistent with the maximum benefit to the people of the State."*

The Basin Plan for the Sacramento River Basin and the San Joaquin River Basin, Fourth Edition (Revised September 2009), states that the Regional Water Board actions must conform with State Water Board plans and policies and among these policies is Resolution 68-16.

Resolution 68-16 requires that:

1. *"Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies."*

2. *"Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained."*

For discharges to surface waters only, the Federal Antidegradation Policy (Section 131.12, Title 40, CFR) requires:

1. *"Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.*

2. *Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning*

process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.

3. *When high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.*

4. *In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with section 316 of the Act."*

The State Water Board has interpreted Resolution No. 68-16 to incorporate the Federal Antidegradation Policy in situations where the policy is applicable. (SWRCB Order No. WQ 86-17.)

Administrative Procedures Update 90-004, Antidegradation Policy Implementation for NPDES Permitting, provides guidance for the Regional Boards in implementing Resolution No. 68-16 and 40 CFR 131.12, as these provisions apply to NPDES permitting. APU 90-004 is not controlling in the context of the irrigated lands long-term program because nonpoint discharges from agriculture are exempt from NPDES permitting.

1. Definitions

A number of key terms are relevant to application of Resolution No. 68-16 and 40 CFR 131.12 to the long-term ILRP. These terms are described below.

High Quality Waters

Resolution 68-16 refers to "existing quality of water [that] is better than quality established in policies as of the date such policies become effective,"[25] and 40 CFR 131.12 refers to "quality of waters [that] exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation." Such waters are "high quality waters" under the State and federal antidegradation policies. In other words, high quality waters are waters with a baseline background quality of better quality than that necessary to protect beneficial uses (the term "baseline" is

[25] Such policies would include policies such as State Water Board Resolution No. 88-63, Sources of Drinking Water Policy, establishing beneficial uses, and water quality control plans.

discussed below).[26] The CWC directs the State Water Board and the Regional Water Boards to establish water quality objectives for the reasonable protection of beneficial uses. Therefore, where water bodies contain levels of water quality constituents or characteristics that are better than the established water quality objectives, such waters are considered high quality waters.

Both State and federal guidance indicates that the definition of high quality waters may be established by constituent or parameter [State Water Board Order No. WQ 91-10; US EPA Water Quality Handbook, Chapter 4 Antidegradation (40 CFR 131.12) ("EPA Handbook")]. Waters can be of high quality for some constituents or beneficial uses but not for others.

With respect to degraded groundwater, a portion of the aquifer may be degraded with waste while another portion of the same aquifer may not be degraded with waste. The portion not degraded is high quality water within the meaning of Resolution No. 68-16. See State Water Board Order No. WQ 91-10.

Baseline Condition

The term "baseline" is not used in the State or federal antidegradation policies but is a significant concept for application of the antidegradation law. In order to determine whether a water body is a high quality water with regard to a given constituent, the quality of that water at some baseline point must be compared to the water quality objectives. That baseline is not necessarily current conditions and may be very complicated to determine. Generally, baseline quality is the best quality of the receiving water that has existed since 1968,[27] unless subsequent lowering was a result of regulatory action consistent with State and federal antidegradation policies. If poorer water quality was permitted consistent with State and federal antidegration policies, the most recent water quality resulting from permitted action is the baseline water quality to be considered in an antidegradation analysis. If degradation in the water quality was attributable to activity not permitted in compliance with the antidegradation policy, the baseline is not current conditions. Conversely, if water quality conditions have improved since 1968, baseline would be reevaluated to represent the higher water quality.

In the context of the long-term ILRP, which aims to regulate discharges to a very large number of water bodies, each with numerous constituents, determination of a baseline water quality is a near impossible task. There is no comprehensive, waste constituent–specific information for all Central Valley surface and groundwater accepting agricultural wastes available for 1968 conditions, nor are comprehensive data available on changes in water quality since 1968.

[26] USEPA Water Quality Handbook, Chapter 4 Antidegradation (40 CFR 131.12) , defines "high quality waters" as "those whose quality exceeds that necessary to protect the section 101(a)(2) goals of the Act [Clean Water Act], regardless of use designation."

[27] The year 1968 represents the year in which the State antidegradation policy was adopted. For purposes of application of the federal antidegration policy only, the relevant year would be 1975. Because the State policy applies to all waters of State, 1968 is the appropriate year in this analysis.

In some cases, current water quality may be the appropriate baseline. Trends in agricultural irrigation practices since 1968 may indicate reduction in potential waste discharge. Section III.A of this report, Industry Summary, describes a general increase in efficient irrigation practices (drip, sprinkler) from 1970 to 2000. Irrigation water provides crops with water and a means for movement of waste constituents off site in tailwater discharge. Also, application of irrigation water may move waste constituents to groundwater through leaching losses. More efficient water use would work to minimize tailwater discharge and leaching of water that could carry waste to groundwater. Trends showing more efficient water use have been motivated by increased demand on fresh water supplies. This trend likely will continue into the future with or without increased Central Valley Water Board regulation.

This analysis is qualitative in nature. However, the logic of the analysis is appropriate given that technology has advanced over time, irrigation water has become more expensive, and irrigation water is not a "waste" that irrigated agricultural operations are tasked with "discharging" (it is a purchased commodity that can cut into profits). Considering this, it makes sense that operations, over time, would use better technology to reduce costs, thereby reducing use. Nevertheless, it cannot be assumed that current water quality is always the appropriate baseline for Central Valley water bodies.

Given the complexity of determining the baseline quality in the long-term ILRP context and the significant variation in conditions over the broad areas covered by the program, any antidegradation analysis in support of an order implementing the long-term program will assume that at least some of the waters into which agricultural discharges will occur are high quality waters because unpermitted degradation has occurred since 1968. Moreover, available data show that currently existing quality of certain water bodies is better than the water quality objectives. Degradation of such waters can be permitted only consistent with the State and federal antidegradation policies.

Additionally, data collected by the Central Valley Water Board, dischargers, educational institutions, and others demonstrate that many water bodies in the Central Valley Region are already impaired for various constituents associated with irrigated agricultural activities, including pesticides (e.g., diazinon, chlorpyrifos, soil fumigants), salt, sediment, and nitrate. Many surface water bodies have been listed as impaired for these constituents pursuant to Clean Water Act Section 303(d) (see ECR and Section III.C of this report for information on surface and groundwater quality). The antidegradation policies, as interpreted in State Board Orders, require at a minimum that where a water body is already impaired, any discharge to that water body must not cause or contribute to an exceedance of water quality objectives.

Best Practicable Treatment or Control

Resolution 68-16 requires that any activity that results in discharge to existing high quality waters meet WDRs that result in best practicable treatment and control (BPTC). Neither the CWC nor Resolution 68-16 defines the term "best practicable treatment or control." The federal antidegradation provision, 40 CFR 131.12, does not contain a similar provision that would apply to nonpoint sources.[28]

Several State Water Board water quality orders have evaluated what level of treatment or control is technically achievable using "best efforts." In determining BPTC, the discharger should compare the proposed method to existing proven technology; evaluate performance data (through treatability studies), compare alternative methods of treatment or control, and consider the method currently used by the discharger or similarly situated dischargers. (SWRCB Order Nos. WQ 81-5, WQ 82-5, WQ 90-6, and WQ 2000-07).[29]

The Regional Water Board may not "specify the design, location, type of construction, or particular manner in which compliance may be had with [a] requirement, order, or decree" (CWC 13360). However, the Regional Water Board still must require the discharger to demonstrate that the proposed manner of compliance constitutes BPTC (SWRCB Order No. WQ 2000-7).

The requirement of BPTC is discussed in greater detail below.

Maximum Benefit to People of the State

Resolution 68-16 requires that where degradation of water quality is permitted, such degradation must be consistent with the "maximum benefit to people of the State." Only after "intergovernmental coordination and public participation" and a determination that "allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located" does 40 CFR 131.12 allow for degradation.

Factors considered in determining whether degradation of water quality is consistent with maximum benefit to people of the State include economic and social costs, tangible and intangible, of the proposed discharge compared to the benefits, as well as the environmental aspects of the proposed discharge.

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[28] 40 CFR 131.12(a)(2) requires that the "State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and *all cost-effective and reasonable best management practices for nonpoint source control.*" The EPA Handbook, Chapter 4, clarifies this as follows: "Section 131.12(a)(2) does not mandate that States establish controls on nonpoint sources. The Act leaves it to the States to determine what, if any, controls on nonpoint sources are needed to provide attainment of State water quality standards (See CWA Section 319). States may adopt enforceable requirements, or voluntary programs to address nonpoint source pollution. Section 40 CFR 131.12(a)(2) does not require that States adopt or implement best management practices for nonpoint sources prior to allowing point source degradation of a high quality water. However, States that have adopted nonpoint source controls must assure that such controls are properly implemented before authorization is granted to allow point source degradation of water quality." Accordingly, in the context of nonpoint discharges, the BPTC standard established by state law controls.

[29] This approach is summarized in Questions and Answers, State Water Board, Resolution No. 68-16, February 16, 1995.

Closely related to the BPTC requirement, consideration must be given to alternative treatment and control methods and whether a lower water quality can be abated through reasonable means, and the implementation of feasible alternative treatment or control methods should be considered.

USEPA guidance clarifies that the federal antidegradation provision “is not a ‘no growth’ rule and was never designed or intended to be such. It is a policy that allows public decisions to be made on important environmental actions. Where the State intends to provide for development, it may decide under this section, after satisfying the requirements for intergovernmental coordination and public participation, that some lowering of water quality in "high quality waters" is necessary to accommodate important economic or social development” (EPA Handbook for Developing Watershed Plans to Restore and Protect Our Waters, Chapter 4). Similarly, under Resolution 68-16, degradation is permitted where important economic or social factors are demonstrated.

2. Application of Antidegradation Requirements to the Long-Term Irrigated Lands Regulatory Program

Very little guidance has been provided in State or federal law with respect to applying the antidegradation policy to a program or general permit where multiple water bodies are affected by various discharges, some of which may be high quality waters and some of which may by contrast have constituents at levels that already exceed water quality objectives. It is not possible to identify all areas in a large geographic region where existing water quality may be higher than background baseline quality and ensure that the antidegradation policies are followed through a uniform set of requirements in addressing such waters. Instead, any program instituted to permit a type of discharge or category of discharge needs to be protective of beneficial uses throughout the entire geographical area to which the program applies and provide a means to evaluate and implement BPTC to minimize degradation on a site-specific basis where such degradation may be occurring.[30]

As stated, given the complexity of determining baseline background water quality and in applying the antidegradation policy to a wide set of water bodies and constituents, the long-term ILRP assumes that some of the water bodies receiving irrigated agricultural discharges are high quality waters. From a programmatic standpoint, irrigated land waste discharges have the potential to cause degradation of surface and groundwater, and the requirements of the anti-degradation policies must be followed. Moreover, existing data show that some

[30] In the context of anti-degradation analysis in Basin Planning, the State Board has stated that: “The State and Regional Boards can and should focus their attention on establishing objectives for those situations where objectives are most needed to assure protection of beneficial uses, postponing until later site-specific approvals the determination whether discharges in a particular area should be allowed to reduce water quality to the level set by these objectives.” State Water Resources Control Board, Office of Chief Counsel, October 7, 1987 Memorandum on the Federal Antidegradation Policy. This guidance is instructive in the context of the ILRP.

waters already have constituents associated with irrigated agricultural discharges in levels at or exceeding water quality objectives. Accordingly, the long-term ILRP must comply with the antidegradation policies by requiring that:

- at a minimum, irrigated agricultural waste discharges may not cause or contribute to exceedances of water quality objectives;
- because it is expected that there may be degradation of some Central Valley high quality waters receiving irrigated agricultural discharges, maximum benefit to the people of the State must be shown;
- the requirements implementing the long-term ILRP must result in use of BPTC where irrigated agricultural waste discharges may cause water quality degradation.

Any long-term ILRP must ensure that all these requirements are met.

3. Water Quality Objectives and Beneficial Uses

As described above, Resolution 68-16 and Section 40 CFR 131.12 are both site-specific evaluations that are not easily employed to address large areas or broad implementation for classes of discharges. As a floor, any regulatory program must prohibit agricultural discharges from causing or contributing to exceedances of water quality objectives to ensure that beneficial uses are protected, and that a pollution or nuisance is not caused.[31] It should be noted that, where natural background conditions exceed water quality objectives for a given constituent in a water body, the objectives do not require improvement over natural conditions. See Policy for Application of Water Quality Objectives contained in the Basin Plan for the Sacramento River and San Joaquin River Basins (IV-16 *et seq*.) and the Basin Plan for the Tulare Lake Basin (IV-21 *et seq.*).

4. Consistency with Maximum Benefit to the People of the State

Some degradation of existing high quality waters is permissible if it is consistent with maximum benefit to the people of the State. Irrigated agricultural operations provide the people of the State employment, food, fiber products, and revenue. Irrigated agricultural industry information is described in more detail in the Industry Summary, Section III.A of this document. Direct State benefits from the industry include those listed below.

- Central Valley agriculture supplies 12 percent of U.S. agricultural output by value (Great Valley Center 2009). Eight of the nation's top ten producing counties are in California.
- Central Valley agriculture supplies food for the nation.

[31] *See* SWRCB Order Nos. WQ 81-5; WQ 2000-07.

- California farmers employ about 448,000 workers with a total employee compensation of more than 5 billion dollars (USDA, National Agricultural Statistics Service, December 2009). The Central Valley accounts for approximately 50 percent of all of the farm workers in the State and approximately 49 percent of their payroll (USDA 2007).
- California's agricultural sector produces $39 billion in goods and services each year (USDA 2008).
- California accounted for 100 percent of U.S. exports of raisins, dried plums, olives, dates, kiwis, figs, almonds, walnuts, pistachios, and garlic (UC Davis 2009).
- California accounts for more than 90 percent of the nation's exports of wine, table grapes, plums, apricots, broccoli, and celery.
- California provides food for the international market, accounting for 13 to 15 percent of the nation's total agricultural export (USDA 2007).

It is important to realize that there are not only direct benefits of irrigated agriculture but also indirect benefits that should be considered. Additional industries that depend on irrigated agriculture provide employment and revenue for the people of the State, including hauling companies, equipment suppliers, distributers, consulting engineers, etc.

The numerous benefits that the people of the State enjoy from irrigated agriculture do come at a price. This price is illustrated in the Water Quality Data Summary for Ground and Surface Waters Accepting Irrigated Agricultural Waste, Section III.C of this report. From the summary, it is clear that waste discharges from irrigated agriculture can cause and have caused degradation of Central Valley surface and groundwater. In some cases the degradation has led to exceedances of water quality objectives and threatens beneficial uses.

One concern in the development of the long-term ILRP has been the safety and availability of drinking water. The Central Valley Water Board is aware of a number of small communities throughout the Central Valley that find it difficult to obtain safe and reliable drinking water because of nitrate pollution. There are pervasively high nitrate levels in groundwater throughout the Central Valley (groundwater summary, Section III.C.2). Because of the limited number of residents, small communities have to face major expense in developing safe drinking water supplies (see Section III.D). Total costs for these communities are estimated at $20.5–$47.5 million. Because of this concern, one of the goals of the long-term ILRP is to ensure that irrigated agricultural discharges do not impair Central Valley communities' and residents' access to safe and reliable drinking water.

The groundwater summary, Section III.C.2, of this report describes several sources of nitrate discharges to groundwater supplies, one of which is fertilizer application to irrigated agriculture (also see Draft Groundwater Nitrate Summary

Report, Appendix B). While irrigated agriculture is a source of nitrate, it is generally unknown whether the groundwater quality impacts have been caused by current or past practices, or whether other sources have caused the impacts. In these cases all sources of nitrate need to be determined and reduced in order to prevent further degradation and bring groundwater nitrate levels back into compliance with objectives. The long-term ILRP would work to achieve these goals for one source of nitrate (current discharges from irrigated agriculture).

In summary, while the implementation of antidegradation requirements in the long-term ILRP aims to prevent degradation, it is also assumed that there may be cases where some degradation of high quality waters would occur from irrigated agricultural waste discharge. Considering, however, that:

- Central Valley communities depend on irrigated agriculture for employment,
- the State and nation depend on Central Valley agriculture for food,
- the long-term ILRP would work to prevent further degradation of surface and groundwater, and
- the long-term ILRP would ensure that all State waters in the Central Valley meet applicable water quality objectives.

Continued waste discharge associated with irrigated agricultural operations that may cause degradation of high quality waters is consistent with the maximum benefit to the people of the State.

5. BPTC

As discussed, without site-specific information on high quality waters and each agricultural input to those waters, it is not possible to do a "site- or discharge-" specific antidegradation analysis to support the general orders/waivers for the long-term ILRP as a whole. Instead, implementation of the program must work to achieve site-specific antidegradation requirements through implementation of BPTC and representative monitoring to confirm the effectiveness of the BPTC measures in preventing or minimizing degradation. Any regulatory program adopted will rely on implementation of practices and treatment technologies that constitute BPTC, based to the extent possible on existing data, and require monitoring of water quality to ensure that the selected practices in fact constitute BPTC where degradation of high quality waters is or may be occurring.

With regard to selection of measures and practices, the Central Valley Water Board and USEPA recognize that there is often site-specific, crop-specific, and regional variability that affects the selection of appropriate management measures,[32] as well as design constraints and pollution-control effectiveness of

[32] Management Measures are defined as (40 CFR 130.2 (m)), "Best practical and economically achievable measures to control the addition of pollutants to waters of the United States through

various practices. Local officials and other practitioners need the flexibility to choose management practices that best achieve a management measure's performance expectations given their own unique circumstances. Management measures developed for agriculture are to be used as an overall system of measures to address nonpoint-source pollution sources on any given site. In most cases, not all of the measures will be needed to address the nonpoint sources at a specific site. Operations may have more than one source to address and may need to employ two or more of the measures to address the multiple sources. Where more than one source exists, the application of the measures should be coordinated to produce an overall system that adequately addresses all sources for the site in a cost-effective manner.

Available State and federal guidance on management practices may serve as informational sources and recommended approaches for addressing nonpoint-source irrigated agricultural discharges for the long-term ILRP.

The State Water Board, California Coastal Commission, and other State agencies have identified seven management measures to address agricultural nonpoint sources of pollution that affect State waters. The agricultural management measures include practices and plans installed under various NPS programs in California, including systems of practices commonly used and recommended by the USDA as components of resource management systems, water quality management plans, and agricultural waste management systems. (<http://www.waterboards.ca.gov/water_issues/programs/nps/docs/guidance/agricmms.pdf>)

The National Management Measures to Control Nonpoint Source Pollution from Agriculture (EPA 841-B-03-004, July 2003; <http://www.epa.gov/nps/agmm/>), *" is a technical guidance and reference document for use by State, local, and tribal managers in the implementation of nonpoint source pollution management programs. It contains information on the best available, economically achievable means of reducing pollution of surface and ground water from agriculture."*

Additionally, in order to guide the proper selection of management measures, the Central Valley Water Board will establish goals for the selection of management measures. The selection of appropriate management measures must include analysis of site-specific conditions, waste types, discharge mechanisms, and crop types. Considering this, as well as CWC 13360's mandate that the Regional Water Board not specify the manner of compliance with its requirements, selection must be done at the local or farm level. The goals for local selection of management measures include:

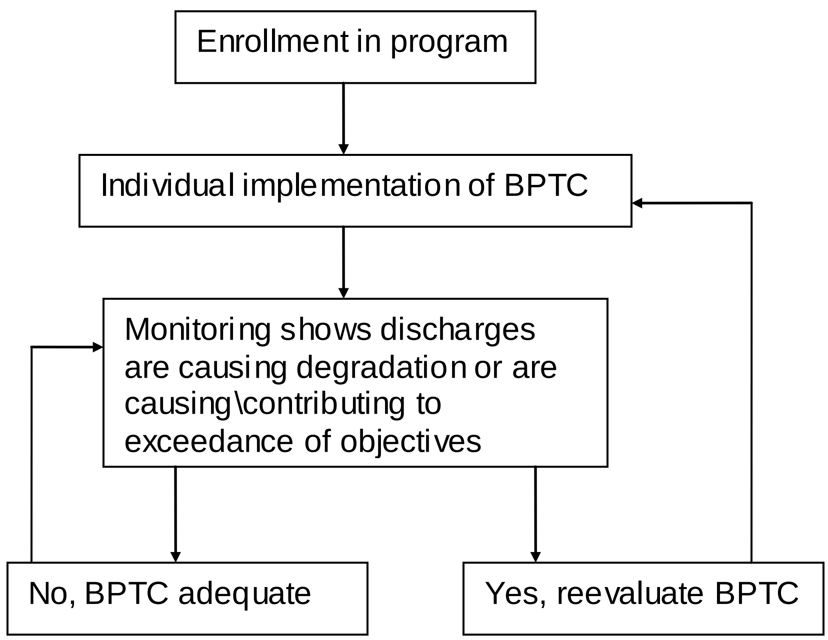
- minimize waste discharge off site in surface water,
- minimize erosion,

the application of nonpoint pollution control practices, technologies, processes, siting criteria, operational methods, best management practices, or other alternatives."

- minimize percolation of waste to groundwater,
- work to match nutrient application to predicted crop uptake, and
- implement wellhead protection measures.

Implementation of management measures that meet the above goals would be expected to constitute BPTC. However, where degradation is occurring, irrigated agricultural operators must *demonstrate* that any set of practices proposed for implementation represents BPTC and will be required to consider existing water quality data or conduct monitoring in support of this demonstration. It is expected that this will be an iterative process whereby the effectiveness of any set of practices in minimizing degradation will be periodically reevaluated as necessary and/or as more recent and detailed water quality data become available. Figure 21 is a logic flow diagram summarizing the antidegradation approach for the long-term ILRP.

Figure 21. Flow Diagram for Long-Term ILRP Antidegradation Approach



The iterative process shown in Figure 21 is intended, over time, to bring all water bodies accepting agricultural wastes into compliance with water quality objectives (where agriculture is the source of exceedance) and evaluate and prevent degradation.

F. Enforcement Policy

The State Water Board's 2009 Water Quality Enforcement Policy (Enforcement Policy) describes how the State and Regional Water Boards will conduct enforcement activities. Water Code Section 13000 grants the State and Regional Water Boards the authority to implement and enforce water quality laws, regulations, policies, and plans to protect groundwater and surface waters of the State.

The goal of the Enforcement Policy is to protect and enhance the quality of the waters of the State by defining an enforcement process that addresses water quality problems in the most efficient, effective, and consistent manner.

The Enforcement Policy states that a good enforcement program relies on well-developed compliance monitoring systems designed to identify and correct violations, help establish an enforcement presence, collect evidence needed to support enforcement actions where there are identified violations, and help target and rank enforcement priorities. Compliance with regulations is critical to protecting public health and the environment. The Enforcement Policy aims to ensure that the most effective and timely methods be used to ensure that the regulated community stays in compliance. The Enforcement Policy also states that tools such as providing assistance, training, guidance, and incentives are commonly used by the Water Boards and work very well in many situations; however, there is a point at which this cooperative approach should make way for a more forceful approach.

Without a strong enforcement program to back up the cooperative approach, the entire regulatory framework would be in jeopardy. Enforcement is a critical ingredient in creating the deterrence needed to encourage the regulated community to anticipate, identify, and correct violations. Appropriate penalties and other consequences for violations offer some assurance of equity between those who choose to comply with requirements and those who violate them. It also improves public confidence when government is ready, willing, and able to back up its requirements with action.

The Enforcement Policy requires that the Water Boards strive to be fair, firm, and consistent in taking enforcement actions. This includes ensuring the fair treatment of people of all races, cultures, and income levels, including minority and low-income populations, consistent with the goals in California Environmental Protection Agency's (Cal-EPA's) Intra-Agency Environmental Justice Strategy, August 2004.

V. OTHER REGULATORY PROGRAMS

A. U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Title 7, United States Code Section 136, establishes pesticide regulation and use requirements to protect applicators, consumers, and the environment.

FIFRA requires that all new pesticides undergo registration requirements to asses the materials' efficacy, toxicity, and dose requirements. Manufacturers are required to gather the data to evaluate pesticides for registration. Pesticide information gathered during the registration process then is used to develop pesticide use labels that instruct users on the proper use of the material. Pesticide use labels are regulatory requirements, and if the instructions are not followed, users are subject to enforcement under the law.

Because of safety or toxicity concerns, some pesticides are allowed only for "restricted use" under FIFRA. Restricted use pesticides can be used only by, or under the direct supervision of, a certified applicator. In California, DPR administers the certification program for restricted use pesticide applicators.

B. California Department of Pesticide Regulation Programs

DPR is responsible for regulating the registration, sale, and use of pesticides in California. The State's pesticide statutes and regulations are in addition to the federal statutes and regulations for pesticide use pursuant to FIFRA (described above). In general, State regulations establish a system of tracking and reporting pesticide use; permit requirements for the use of restricted pesticides; regulations for the application of certain pesticides, including restrictions on the time and place of use; and requirements for licensing and training applicators. The regulations aim to avoid the overuse of pesticides, protect surface water and groundwater supplies, and minimize worker and other human exposure. These requirements are embodied in Title 3 of the CCR, commencing with Section 6000. DPR relies on County Agricultural Commissioners (CACs) to carry out permitting and inspection functions under these regulations.

In addition, DPR is charged with collaborating with CACs and manufacturers to:

1. provide for the proper, safe, and efficient use of pesticides essential for production of food and fiber and for protection of the public health and safety;

2. protect the environment by prohibiting, regulating, or ensuring proper use of pesticides;

3. ensure agricultural and pest control workers of safe working conditions where pesticides are present;

4. permit agricultural and structural pest control by competent and responsible licensees and permittees under strict control of the director and commissioners;

5. ensure that pesticides are properly labeled and are appropriate for the use designated by the label, and that State or local governmental dissemination of information on pesticide uses of any registered pesticide product is consistent with the uses for which the product is registered; and

6. encourage development and implementation of pest management systems, stressing application of biological and cultural pest control techniques with selective pesticides when necessary to achieve acceptable levels of control with the least possible harm to nontarget organisms and the environment.

DPR's requirements aimed at protecting waters from pesticides work toward some of the same general goals as the Central Valley Water Board's programs (e.g., protecting beneficial uses of waters by reducing pesticide discharge associated with agricultural operations). Because of this similarity, it is important to consider how DPR and the long-term ILRP can work together to achieve the missions of both agencies while minimizing duplication of regulatory requirements. DPR's surface and groundwater programs are described in more detail below.

1. Surface Water Protection Program

The Surface Water Protection Program addresses both agricultural and nonagricultural sources of pesticide residues in surface waters. It has preventive and response components that work to reduce the presence of pesticides in surface waters. The preventive component includes user outreach to promote compliance with label requirements and management practices that reduce pesticide runoff. Prevention also relies on DPR's registration process in which pesticide environmental fate and potential adverse effects on surface water quality are evaluated.

The response component includes the development and implementation of mitigation options to meet water quality goals, recognizing the value of self-regulating efforts to reduce pesticides in surface water as well as regulatory authorities of DPR and the Water Boards. DPR's Surface Water Protection Program also conducts numerous investigations on a wide range of research topics related to the identification of pesticides in surface water and sediment, their sources, and the validation of management practices that reduce off-site transport. In the past, DPR's investigations have assisted the Water Boards in the development of TMDLs and other basin planning activities.

To promote cooperation to protect water quality from the adverse effects of pesticides, DPR and the State Water Board signed a Management Agency Agreement (MAA) in 1997. The MAA, and its companion document, "The

California Pesticide Management Plan for Water Quality," strive to coordinate interaction, facilitate communication, promote problem solving, and ultimately ensure the protection of water quality.

Under the California Pesticide Management Plan for Water Quality, DPR will investigate pesticides of concern and help develop recommended use practices designed to reduce or eliminate the impact of pesticides on surface water quality. Management practices designed to reduce contamination usually will be implemented initially through voluntary and cooperative efforts. Depending on the source of the residue problems, mitigation may include outreach programs to educate residential and professional users on ways to reduce pesticides in urban waters as well as programs targeted at modifying use practices among agricultural pesticide users. If the revised use practices (which are voluntarily adopted by pesticide users) do not adequately mitigate the impacts, DPR can use its wide-ranging regulatory authority to impose use restrictions. DPR may modify the use of pesticides by regulation or permit conditions to prevent excessive amounts of residues from reaching surface water. DPR has the role of evaluating the feasibility of these modifications and conditions, and of promulgating any necessary regulations. Although the State and Regional Water Boards independently could use their authorities to regulate the discharge of pesticides, they often will work with DPR first to address these issues.

2. Groundwater Protection Program

Under general authority and the specific provisions of the Pesticide Contamination Prevention Act, as amended (PCPA) (Food and Agricultural Code [FAC] Sections 13142 *et seq*.), DPR has developed a program to prevent contamination of groundwater from the legal applications of pesticides. The PCPA requires:

- pesticide manufacturers to submit environmental fate data for agricultural use pesticides;
- DPR to establish in regulation a list of pesticides with the potential to pollute groundwater;
- DPR to conduct monitoring to determine whether these pesticides are present in groundwater;
- DPR to develop and maintain a Statewide database of wells sampled for pesticides and publish an annual report on the contents of the database;
- State and local agencies to report to DPR all results of wells sampled for pesticides;
- DPR to investigate reports of pesticides detected in groundwater and determine whether these detections are a result of legal agricultural use;
- DPR to formally review pesticides detected in groundwater, with the assistance of the State Water Board and the Office of Environmental

Health Hazard Assessment, to determine whether continued use can be allowed; and

- DPR to adopt regulations to prevent further contamination of groundwater.

In addition to the above mandated activities, DPR's Groundwater Protection Program has incorporated scientific approaches to:

- provide a spatial analysis to identify areas vulnerable to movement of pesticide residues to groundwater,
- understand the pathways for movement of residues from agricultural applications to groundwater,
- develop mitigation measures to prevent pesticide contamination of groundwater that are matched to the specific pathway of movement to groundwater,
- develop an approach that identifies pesticide products with a high risk to move to groundwater during the registration process before they are allowed for use in California, and
- track the effectiveness of regulations through annual monitoring of domestic drinking water wells located in groundwater protection areas.

Pesticide Contamination Prevention Act–Mandated Activities

Require Pesticide Manufacturers to Submit Environmental Fate Data

The PCPA required registrants of agricultural use pesticides to submit data for physical and chemical properties that describe persistence and mobility of pesticide products (FAC Section 13143). Data initially are received and reviewed for consistency by DPR and entered into the pesticide chemistry database. DPR scientists analyze these data using models developed to identify pesticides with a potential to move to groundwater. These data are available to the public upon request.

Groundwater Protection List

As prescribed in the PCPA, DPR scientists developed a procedure to identify and then list in regulation pesticide active ingredients with the potential to pollute California's groundwater. The PCPA identified physical and chemical properties associated with either mobility or persistence. Using the data collected in the Pesticide Chemistry Data Base, specific trigger values were identified for water solubility, soil adsorption coefficient normalized to organic carbon content (Koc), hydrolysis half-life, soil aerobic metabolism half-life, and soil anaerobic half-life. The procedure used to determine these trigger values, denoted as the specific numerical values (SNVs), compared the distribution for each chemical property between a list of pesticides that were known to contaminate groundwater as a result of legal agricultural use and a list of pesticides that had been sampled but not detected in groundwater. This procedure was first reported by Wilkerson and

Kim (1986) and is available at: <http://www.cdpr.ca.gov/docs/emon/ pubs/ehapreps/eh8602.pdf>.

The current SNVs, reported by Johnson (1991), are available at: <http://www.cdpr. ca.gov/docs/emon/pubs/ehapreps/eh9106.pdf>.

Pesticides that are identified as having the potential to leach to groundwater according to the SNV process are placed on a list called the “b-2” list. In accordance with the PCPA, an annual report for this list is produced that:

- identifies pesticides with data gaps for environmental fate properties,
- lists the active ingredients that meet the SNV trigger values, and
- reports the sale and use of the listed active ingredients.

The current report is available at: <http://www.cdpr.ca.gov/docs/ emon/pubs/ehapreps/eh0902.pdf>.

The final step in identifying a pesticide active ingredient with the potential to pollute groundwater is to place it on the groundwater protection list (GWPL). The GWPL, denoted as the Section 6800 list in Title 3 of the California Code of Regulations, contains active ingredients from the b-2 list with certain application characteristics, as specified on the product label. The PCPA requires that pesticide active ingredients on the b-2 list be added to the GWPL if their product labels indicate they are “intended to be applied to or injected into the soil by ground-based application equipment or by chemigation, or the label of the pesticide requires or recommends that the application be followed, within 72 hours, by flood or furrow irrigation” (FAC Section 13145(d)). Each active ingredient has many products, so each label is reviewed for the prescribed uses. If any one label indicates a prescribed use, the active ingredient is placed on the GWPL.

Monitoring

The purpose of developing the GWPL was to provide a method to increase the efficiency and reduce cost of monitoring, ensuring the best use of State resources. There are approximately 90 registered pesticide active ingredients on the GWPL. This represents about a third of all pesticide active ingredients used in agriculture. Analytical methods are usually not available to measure each one at the low concentrations normally encountered in well water, so a lengthy analytical method development is required prior to well monitoring. The GWPL list has been further prioritized using a combination of data on:

- detections in groundwater in the United States or other countries,
- amount of pesticide used in California, and
- results from a calibrated model using environmental fate data that compares pesticide movement among active ingredients.

The result is a prioritized list of active ingredients, identifying the order for analytical method development and, subsequently, well water monitoring. DPR scientists also have developed spatial information that allows targeted sampling that produces the highest probability of detecting residues in wells. Spatial databases used to determine sites for sampling include pesticide use, soil properties, depth to groundwater, and previous detections.

Standard operating procedures have been developed to ensure the integrity of the sample and the well site selected. Pertinent procedures are available at the DPR website at: <http://www.cdpr.ca.gov/docs/emon/pubs/sopfield.htm>. The criteria for well selection include ensuring that the wellheads are protected from direct contamination so that any measured pesticides are the result of legal pesticide use. These standards have been developed to support regulatory actions that have been taken. Scientifically based regulations require data of the highest quality for validation.

Statewide Database of Wells Sampled for Pesticides

The PCPA requires State and local agencies to report the results of all wells sampled for pesticides to DPR. The law also requires DPR to maintain a Statewide database of well monitoring results. The database is entitled the 'well inventory database' (WIDB). An annual report on data included in the database is also required in law. This annual report contains:

- number of wells sampled,
- number of wells with detections,
- location of the wells reported by county,
- agencies responsible for sampling and analyzing samples,
- an analysis to determine the probable source of detection, and
- actions taken by the DPR Director and the State Water Board to prevent pesticides from migrating to groundwater.

The principal agencies that submit pesticide monitoring results to DPR are public health agencies that sample public drinking water wells for pesticides. In addition to the PCPA requirement that all State and local agencies report results of well monitoring for pesticides to DPR, DPR has requested data from all known sources of groundwater monitoring data, such as the USGS. As of May 2009, the WIDB contains more than 1.8 million separate records for analyses conducted from approximately 23,000 unique public water system and rural domestic and irrigation wells. Data are available for approximately 350 unique pesticide active ingredients, including both parent and breakdown products, and for all of California's 58 counties. The analyses are from pesticides currently registered, no longer registered, and never registered in California. The number of wells sampled for pesticides varies from three in rural mountainous Alpine County, with little reported pesticide use, to more than 4,000 wells in Fresno County. The median number of wells that have been sampled per county to date is 150.

Although the greatest number of well samples is received from public drinking water well systems, data generated from DPR sampling, which targets rural domestic, drinking-water wells, have a much higher rate of detection. The higher rate of detection is attributable to a combination of the targeted sampling approach taken by DPR, the relative shallowness of domestic wells sampled by DPR compared to the depth of municipal wells, and the proximity of domestic wells to agricultural use sites.

Investigate Reports of Detections

When a pesticide is detected in groundwater, the following actions are taken.

1. Quality control and assurance data are reviewed to determine the quality of the analytical methodology.

2. DPR confirms the detection by analyzing a backup sample or re-sampling the well.

3. Once a detection is confirmed, additional wells are located and sampled in the area near the original detection to determine the extent of contamination and whether the detection was a result of legal agricultural use.

4. DPR determines whether the detected concentration poses an immediate threat to public health, and if so, may immediately suspend the use of the pesticide.

5. If residues do not pose an immediate threat to public health, DPR follows the response process outlined in the PCPA (FAC Sections 13149 and 13150) with respect to determination of agricultural use and notification of the pesticide registrant; convenes the subcommittee of the Pesticide Registration and Evaluation Committee (PREC), which is composed of staff from the Office of Environmental Health Hazard Assessment, the State Water Board, and DPR; and takes action to prevent further contamination.

Essentially, where a pesticide has been detected in groundwater and the detection is confirmed as a result of legal agricultural use (i.e., no evidence of illegal pesticide use or point sources), the pesticide is regulated by DPR specifically to prevent further contamination; see discussion below on Groundwater Protection Areas (GWPAs) and 6800(a) list.

Regulations to Prevent Contamination (Groundwater Protection Areas)

DPR has adopted regulations on use of all active ingredients found in California's groundwater as a result of legal agricultural use. The first set of regulations targeted only sections of land where residues had been detected in well water. Since then, a new set of regulations enacted in 2004 provided an additional layer of prevention by including areas of land that had soil and depth to groundwater properties similar to sections of land where residues previously had been found. These vulnerable areas are denoted as GWPAs. GWPAs are 1–square mile sections of land that are identified in regulation as a vulnerable soil condition with a 10-year average depth to groundwater of 70 feet or less. GWPAs are shown in Figure B-10 of Appendix B.

An important aspect of GWPAs is that they are designated with respect to the pathway for movement of residues to groundwater. Areas designated as 'leaching' have coarse-textured, sandy soil where residues move directly down from sites of application with water as it recharges groundwater. GWPAs have been designated as 'runoff' areas where residues move in runoff water generated by rainfall or irrigation to sensitive sites that facilitate rapid movement of surface water to subsurface soils. Description of the method to describe GWPAs, the management practices specific to each condition, and their geographic location are available at DPR's website at: <http://www.cdpr.ca.gov/docs/emon/grndwtr/gwp_regs.htm>.

To date, DPR has reviewed eight pesticide active ingredients under the formal review process and adopted regulations to prevent their continued movement and the movement of their breakdown products to groundwater. The eight active ingredients are atrazine, simazine, bromacil, diuron, prometon, aldicarb, bentazon, and norflurazon. Regulations were adopted to limit the maximum application rates of aldicarb by crop, and to prohibit aldicarb use on cotton, potatoes, sugar beets, dried beans, citrus, and field-grown ornamentals from September 1 to March 1 of each year (CCR Section 6458). The other seven pesticides are listed in Section 6800(a) and are designated "restricted materials." Issuance of a permit from the CAC is required before a product containing a 6800(a) listed active ingredient can be used within a GWPA. CACs are required to enforce pesticide laws and regulations in each county. There are currently more than 3,500 GWPAs that cover approximately 2.3 million acres in California.

Before application of a restricted material (which requires a permit), the permit holder must submit a notice of intent to the CAC generally 48 hours before the application occurs. This allows the CAC time to review the proposed application, to make sure conditions of the permit are appropriate for the time and site of application, or need to be modified, and allows the CAC to plan any inspection of the application. In GWPAs, growers are required to select one of the management practices specified in regulation for the 6800(a) listed materials and the practice is specified as an enforceable condition of the permit. Applicability of management practices is based on soil characteristics. For example, in a runoff area, the applicator could be required to retain all irrigation and rainfall drainage/runoff through the field for 6 months following the application. CACs have the authority to conduct inspections to determine whether permit conditions have been met.

In addition to groundwater protection regulations described above, these regulations apply.

- Prohibit pesticide use below the high water line in areas that recharge groundwater basins.
- Prohibit pesticide use below the high water line in canals.
- Regulate uses for roadside applications.
- Prevent backflow of pesticide residues into wellheads during mixing and loading, and chemigation—CACs inspect backflow prevention equipment.
- Protect wellheads from exposure to agricultural runoff by making sure wellheads are above the grade of drainage or protected by a berm, or by prohibiting the mixing, loading, storage, and rinsing of application equipment and containers within 100 feet of an unprotected wellhead and prohibiting the application of all preemergent herbicides listed in Section 6800 within 100 feet of an unprotected wellhead—CACs inspect wellhead protection.

Additional Groundwater Protection (Non-Mandated)

Understand Pathways of Movement to Groundwater

Investigations of the pathways of movement to groundwater were initiated in the 1980s. The first major DPR groundwater study measured the effect of the amount of water applied and irrigation method on the movement of bromide (a tracer for water movement) and atrazine, an herbicide detected in wells. The results of this study led to an understanding of the importance of irrigation control in coarse-textured, sandy soils. Additional studies have been conducted to determine the pathway in soils with a hardpan layer where runoff water predominates and also in cracking clay soils.

Develop Mitigation Measures

Upon the discovery that there were multiple pathways for pesticide movement to groundwater, a logical extension was to provide guidance on mitigation measures based on each pathway. Mitigation measures are based on the major profiling soil property. In coarse-textured soils, control of irrigation percolation water is of paramount importance. In contrast, for soils where runoff is the pathway of off-site movement, one key option is the incorporation of residues from the surface application into the soil matrix.

Develop an Approach to Identify Potential Leaching before Registration

The regulations DPR has adopted to protect groundwater apply after pesticides have been registered. To enhance the groundwater protection program, DPR also assesses the groundwater contamination potential of new pesticide products before they are registered for use. A modeling approach has been developed that uses the environmental fate data submitted by the pesticide companies to determine whether the new product is likely to leach to groundwater. Using this modeling approach, DPR has identified new products with high potential to move to groundwater. For these pesticides, DPR may request the pesticide company to add restrictive mitigation measures on the label and/or conduct additional studies on the fate of the product under California conditions. If mitigation is not deemed possible, DPR also could decide not to register the pesticide for use in California.

Monitoring Well Network to Track Effectiveness of Regulations

The ultimate measure of the effectiveness of DPR's regulations to prevent movement of pesticide residues to groundwater will be observation of decreasing trends in concentrations in wells where residues previously have been measured. Decreases in concentration in domestic drinking water wells directly relate to a decrease in exposure to residues. In 1999, a monitoring program was initiated to monitor the concentration of pesticide residues in wells known to be contaminated. Permission to sample domestic wells was obtained from approximately 35 owners located in coarse-textured soils in Fresno County, and from approximately 35 owners in soils containing a hardpan layer, a predominant condition in Tulare County; these areas correspond to leaching and runoff pathways to groundwater, respectively. DPR plans to conduct and make available an in-depth statistical analysis of these data during 2010.

Coordination of Groundwater Programs

Throughout the development of the long-term ILRP, the Central Valley Water Board has been asked to coordinate closely with DPR and CACs to ensure that there is no overlap of groundwater regulations, imposing unnecessary burden on both the State and irrigated agricultural operations. In response to this concern, one of the objectives of the long-term ILRP is to coordinate with other regulatory programs.

This section provides recommendations for coordination of groundwater protection components of the long-term ILRP and DPR's Groundwater Protection Program.

Regulatory Authorities

In general, DPR has regulatory authority to establish requirements on the *use* of pesticides in order to protect human health and the environment. The Water Board has regulatory authority to establish requirements on the *discharge* of any type of wastes to surface and groundwater to protect human health and the environment. While DPR has authority to require management practices, the Water Board cannot require specific practices. In fact, the CWC prohibits the Water Board from requiring specific technologies or practices [13360]. Instead, the Water Board establishes requirements on the waste discharge (e.g., waste constituent limitations). This gives the discharger freedom in choosing appropriate technology or practices to meet the WDRs.

The difference in Water Board and DPR regulatory authorities highlights the need for coordination between programs. For example, reported detection of pesticide residues in groundwater by either the Water Board or DPR would initiate an investigation. DPR would collect additional information to support the current regulatory process. While DPR proceeds with regulatory actions for the new detections, the long-term ILRP could immediately review the data and inform growers using the pesticide in the affected area of the need to implement practices to prevent further degradation of groundwater. The information collected (monitoring data and practices implemented) could be integrated into DPR's geographic approach to require management practices in other areas of the State with similar vulnerable characteristics.

Groundwater Monitoring

DPR conducts groundwater monitoring for pesticides to review the effectiveness of the Groundwater Protection Program and also to determine whether pesticides are reaching groundwater. DPR does not sample for all pesticides or their breakdown products, nor is sampling conducted in all areas where pesticides may reach groundwater. DPR's monitoring is targeted using geophysical models in order to maximize efficiency of samples collected. Over the years, DPR has developed vast knowledge and expertise in modeling and sampling for pesticides in groundwater. If the ILRP were to include a groundwater monitoring component, DPR and the Central Valley Water Board could coordinate on development of monitoring plans and sampling efforts to provide information necessary for both programs. In this coordination, the ILRP could make use of DPR's experience and knowledge in devising appropriate monitoring plans and groundwater models to reduce the amount of sampling needed, and also share well monitoring results to avoid duplication of sampling efforts.

Wellhead Protection

DPR has developed wellhead protection requirements for pesticide use. CACs enforce these requirements. The Central Valley Water Board is concerned that other wastes (e.g., nutrients, pathogens) could be discharged to groundwater through unprotected wellheads. Also, there is potential for backflow into unprotected wellheads during fertigation. As described above, the Central Valley Water Board does not have the authority to require specific practices to protect wellheads. However, the Board could require that operations protect wellheads from waste discharge. If the ILRP were to require wellhead protection, the Central Valley Water Board and DPR could coordinate on education programs and CAC review of practices during inspections.

C. Grassland Bypass Project

Before the Grassland Bypass Project began in 1996, drainage water from farms in the 97,000-acre Grassland Drainage Area was discharged into Salt Slough and other channels used to deliver water to wetland areas. This drainage water contains high concentrations of selenium, salts, and other constituents that are harmful to wildlife.

The project prevents discharge of subsurface agricultural drainage water into wildlife refuges and wetlands in central California. The drainage water is conveyed instead through a segment of the San Luis Drain to Mud Slough, a tributary of the San Joaquin River.

The Central Valley Water Board issued WDRs to the Bureau of Reclamation and the San Luis and Delta-Mendota Water Authority (Authority). The WDRs specify maximum monthly and annual loads of selenium that may be discharged into Mud Slough and the San Joaquin River. The WDRs include monthly monitoring for molybdenum and nutrients (nitrate, ammonia, total kjeldahl nitrogen, total phosphate, and orthophosphate); weekly analyses of salinity, selenium, boron, and other parameters; and chronic toxicity testing. The WDRs also outline a program to monitor stormwater releases from the Grassland Drainage Area into the Grassland wetland supply channels, should they occur.

The project improves water quality in the wildlife refuges and wetlands, sustains the productivity of 97,000 acres of farmland, and fosters cooperation between area farmers and regulatory agencies in drainage management reduction of selenium and salt loading. Since implementation of the project, all discharges of drainage water from the Grassland Drainage Area into wetlands and refuges have been eliminated. The project has reduced the load of selenium discharged from the Grassland Drainage Area by 61percent (from 9,600 lbs to 3,700 lbs). The load of salts has been reduced by 39 percent (from 187,300 tons to 113,600 tons). Prior to the project, the monthly mean concentration of selenium in Salt Slough was 16 parts per billion. Since October 1996, the concentration has been less than the water quality objective of 2 parts per billion.

The Grassland Bypass Project WDRs are a successful example of where the Central Valley Water Board has been able to interface with one primary entity, while establishing goals for a large group of growers. In this situation, the Bureau of Reclamation and the Authority have taken legal responsibility for the project's waste discharge. These entities are responsible for ensuring that growers using the bypass achieve the goals of the WDRs. This framework, where an entity takes legal responsibility for a shared waste discharge, has been considered in the development of the long-term ILRP.

D. Central Valley Regional Water Board Dairy Order

Waste Discharge Requirements General Order No. R5-2007-0035 for Existing Milk Cow Dairies (Dairy General Order) is an example of where the Central Valley Water Board has developed a program applicable to a large number of operations (approximately 1,400 Central Valley dairies). Also, some of the waste discharge concerns facing dairy operations are similar to irrigated agricultural operations (e.g., nutrient and pesticide leaching to groundwater). For these reasons, the framework of the Dairy General Order has been considered in the development of the long-term ILRP. In fact, one of the alternatives considered in this report (Alternative 5) is modeled after the Dairy General Order. The requirements of the Dairy General Order are described below.

California regulations governing discharges from confined animal facilities are contained in Title 27 of the California Code of Regulations (CCR), Division 2, Subdivision 1, Chapter 7, Subchapter 2, Article 1 (Title 27). Confined animal facilities are defined as "… any place where cattle, calves, sheep, swine, horses, mules, goats, fowl, or other domestic animals are corralled, penned, tethered, or otherwise enclosed or held and where feeding is by means other than grazing." Designation as a confined animal facility under these State regulations is not based on facility size. CWC Section 13260 requires that any person who owns and/or operates any confined animal facility in the Central Valley must file a report of waste discharge (ROWD) with the appropriate Regional Water Board.

The Central Valley Water Board adopted the Dairy General Order in May 2007. The Dairy General Order implements the CWC and regulations relevant to confined animal facilities and serves as general WDRs for discharges of waste to land from existing milk cow dairies. Approximately 1,400 dairies currently are regulated under the Dairy General Order and 16 dairies are regulated under individual WDRs.

1. Required Reports and Notices

The Dairy General Order requires that the dairy operations prepare and submit reports for a variety of issues or conditions as discussed below.

Existing Conditions Report

The Existing Conditions Report (this is not the ECR associated with the ILRP) provided additional information on existing conditions at the dairy, not contained in the ROWD originally submitted for coverage under the Dairy General Order. The Existing Conditions Report requires the operation to complete a Preliminary Dairy Facility Assessment, which includes a whole farm nitrogen balance and a ratio of nitrogen applied to nitrogen uptake by crops.

Waste Management Plan

The Waste Management Plan requires a description and an evaluation of the existing milk cow dairy's design, construction, operation, and maintenance for flood protection and waste containment. The Waste Management Plan also requires the discharger to propose modifications and a schedule for modifications necessary to bring the dairy facility into compliance with the Dairy General Order's specifications and prohibitions.

Nutrient Management Plan

A dairy operation that applies manure, bedding, or process wastewater to land for nutrient recycling is required to develop and implement management practices that control nutrient losses and describe these in a Nutrient Management Plan. The Nutrient Management Plan must be certified by a certified specialist (Professional Soil Scientist, Professional Agronomist, or Crop Advisor) maintained at the dairy, submitted to the Central Valley Water Board upon request, and ultimately provided for protection of both surface water and groundwater. Groundwater monitoring will be used to determine whether implementation of the Nutrient Management Plan is protective of groundwater quality.

Proposed Interim Facility Modifications

If an operation's Preliminary Dairy Facility Assessment shows that the whole farm nitrogen balance ratio is greater than 1.65 and/or that the existing retention pond(s) total storage capacity is less than the total storage capacity required, the operation is required to submit Proposed Interim Facility Modifications as necessary to balance nitrogen and/or Proposed Interim Facility Modifications as necessary to improve storage capacity, respectively.

Salinity Report

The dairy operation is required to submit a report that identifies sources of salt in waste generated at the dairy, evaluates measures that can be taken to minimize salt in the dairy waste, and certifies that the operation will implement the approved measures identified to minimize salt in the dairy waste. If a third party (for example, the California Dairy Quality Assurance Program) produces an industry-wide report that is acceptable to the Central Valley Water Board, the dairy operation may refer to that report rather than generating an individual report, but must certify that the appropriate measures will be implemented to reduce salt in waste discharged.

2. Monitoring and Reporting Program

The Dairy Monitoring and Reporting Program (MRP) includes: monitoring, record-keeping, and reporting requirements. Monitoring requirements include monitoring of discharges of manure and process wastewater, stormwater, and tailwater from the production area and land application areas and groundwater monitoring in order to determine whether the dairy is in compliance with the Dairy General Order.

Monitoring requirements include monitoring of nutrients applied to (both process wastewater and manure) and removed from (using plant tissue analyses) land application areas in order for the dairy to develop and implement a Nutrient Management Plan that will minimize leaching of nutrients and salts to groundwater and transport of these constituents to surface water. Monitoring requirements also include periodic visual inspections of the dairy to ensure the dairy is being operated and maintained to ensure continued compliance with the Dairy General Order.

Surface Water

The Dairy General Order requires monitoring of any discharges to surface water, including surface water upstream and downstream of the discharge and discharges of tailwater to surface water to ensure that no unforeseen impacts are occurring.

Storm water may contain dairy wastes if the stormwater is allowed to contact manured areas or commingle with wastewater from the dairy. The Dairy General Order prohibits discharges of stormwater from the production area to surface water and any discharge of stormwater to surface water from the land application areas being used for nutrient utilization, unless that discharge is from land that has been managed consistent with a certified Nutrient Management Plan. The application of waste to lands not owned, leased, or controlled by the permittee without written permission from the landowner or in a manner not approved by the Central Valley Water Board, is prohibited.

Consistent with Title 27, the Dairy General Order prohibits the direct or indirect discharge of waste from the production area to surface water except when authorized by an NPDES permit. The Dairy General Order also prohibits discharges of: (1) wastewater to surface waters from cropland, and (2) waste to surface waters that causes pollution or nuisance, or that causes or contributes to an exceedance of any applicable water quality objective. Irrigation supply water that comes into contact or is blended with waste or wastewater is considered wastewater. The land application of manure or process wastewater to cropland for other than nutrient recycling also is prohibited.

Manure and process wastewater cannot be applied closer than 100 feet to any down-gradient surface waters, open tile line intake structures, sinkholes, agricultural or domestic well heads, or other conduits to surface waters, unless a 35-foot-wide vegetated buffer or physical barrier is substituted for the 100-foot setback, or alternative conservation practices or field-specific conditions will provide pollutant reductions equivalent to or better than the reductions achieved by the 100-foot setback.

Groundwater

The Dairy General Order requires dairies to monitor groundwater to ensure that groundwater protection is being achieved. Groundwater monitoring at existing dairies is required to determine background groundwater quality; determine existing groundwater conditions near retention ponds, corrals, and land application areas; and determine the effect of the improved management practices required in the Dairy General Order on groundwater quality.

Many of the existing milk cow dairies covered under the Dairy General Order have been operating for many years, and it was expected that groundwater quality already may be affected at many of these dairies because of the past operations. For example, groundwater samples collected from 425 water supply wells (domestic and agricultural—stock watering and irrigation) on 88 dairies in

Tulare County between August 2000 and June 2006 showed that approximately 39 percent of the wells sampled had nitrate concentrations greater than the State MCL for drinking water.

It was deemed impractical to require all existing dairies to install monitoring wells within a short time period because of the limited number of professionals available to design and install groundwater monitoring systems and the limited Central Valley Water Board staff to review monitoring well installation and sampling plans. To determine the existing groundwater conditions at each dairy within the shortest time period requires establishment of priorities. The Dairy General Order requires each dairy to immediately begin sampling of each on-site domestic and agricultural well and discharges from any subsurface (tile) drains. The Dairy General Order also requires installation of groundwater monitoring wells to determine whether a dairy is in compliance with the groundwater limitations of the order. Currently, facilities are being required to install monitoring wells based on an evaluation of the threat to water quality at each site. It was anticipated that this will occur in phases of approximately 100 to 200 dairies per year, unless the Central Valley Water Board determines that an alternative method of groundwater monitoring is appropriate. The dairy industry is developing a proposed alternative method of groundwater monitoring for Central Valley Water Board review.

3. RecordKeeping and Reporting Requirements

The Dairy General Order requires that the dairy maintain records for 5 years and make available to the Central Valley Water Board, upon request, any reports or records required by the Dairy General Order.

Priority Reporting of Significant Events

Dairies are required to report any noncompliance that endangers human health or the environment or any noncompliance with listed prohibitions contained in the Dairy General Order, within 24 hours of becoming aware of the occurrence. A written report must be submitted to the Central Valley Water Board office within 2 weeks of becoming aware of the incident.

Annual Reporting

An annual monitoring report is due each year. The annual report consists of a general section, groundwater reporting section, and stormwater reporting section.

E. State Water Board Stormwater Program

The federal Clean Water Act (CWA) provides that discharges from point sources to waters of the United States are prohibited, unless authorized by NPDES permits (CWA Section 301[a]). In 1987, the CWA was amended to specify the requirements for NPDES permits for stormwater discharges (CWA Section 402[p]). California's Stormwater Program is administered by the State and Regional Water Boards. The Stormwater Program has three main focus areas:

construction, industrial, and municipal. These focus areas are described in more detail below.

In general, the Stormwater Program requires that industrial, construction, and municipal entities develop and implement management practices to reduce waste discharge associated with stormwater runoff. Operations are required to develop plans outlining the types and locations of management practices that must be implemented on site to reduce waste discharge. Monitoring includes self-monitoring (visual inspection, sampling), reporting, and a Water Board inspection program.

Even though stormwater waste discharge is considered a point source, there are similarities between the Stormwater Program and the ILRP. These similarities include: concern with waste discharges associated with runoff from land areas and coverage of vast numbers of operations and land area. The Stormwater Program was considered when evaluating potential long-term ILRP alternatives.

1. Construction Stormwater Program

Construction projects disturbing one or more acres are required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 99-08-DWQ). Effective July 1, 2010, all construction projects are required to obtain coverage under the Construction General Permit Order 2009-0009-DWQ adopted on September 2, 2009. Construction activity subject to this permit includes clearing, grading, and disturbances to the ground such as stockpiling or excavation but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

The Construction General Permit requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP should contain a site map(s) that shows the construction site perimeter, existing and proposed buildings, lots, roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the project. The SWPPP must list BMPs the discharger will use to minimize wastes in stormwater runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program, a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs, and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

2. Industrial Stormwater Program

The Industrial Stormwater General Permit Order 97-03-DWQ (General Industrial Permit) is an NPDES permit that regulates discharges associated with ten broad categories of industrial activities. Stormwater discharges associated with industrial activity are required to meet technology-based standards and water quality–based standards. Applicable technology-based standards require that discharges of conventional pollutants achieve the best practicable control technology currently achievable (BCT) and that discharge of toxic pollutants achieve the best available technology economically achievable (BAT). The applicable water quality–based technology is that discharges meet water quality objectives.

USEPA regulations and guidance documents, and applicable decisions by federal courts, clarify that industrial stormwater permits must contain requirements that ensure that discharges of stormwater associated with industrial activity must achieve BCT for conventional pollutants and BAT for toxic pollutants and must not cause or contribute to exceedance of water quality standards in receiving waters. These permits are not required to include numeric effluent limitations (except for effluent limitation guidelines adopted for specified industries by USEPA) or to require monitoring except for annual visual inspections. Instead, USEPA recommends that permit requirements be stated as BMPs.

The State Water Board's Industrial Stormwater Program requires that operations:

1. develop and implement SWPPPs that include BMPs;

2. implement BMPs that will achieve BAT and BCT and will comply with water quality standards;

3. eliminate unauthorized non-stormwater discharges; and

4. conduct monitoring, including visual and analytical stormwater monitoring.

The Industrial Stormwater Program contains minimum BMPs that all operations must incorporate into their SWPPPs. The purpose of the minimum BMPs is to ensure that this General Permit will result in compliance with BAT and BCT and that facilities will have uniform practices. In light of the great diversity of industrial activities throughout the State, however, the program also requires that all facilities develop additional site-specific BMPs.

The Industrial Stormwater Program requires that operations achieve strict compliance with water quality standards, with the incorporation of receiving water limitations into the permit. Where there is a violation of the limitation, operations must revise their SWPPPs and improve BMPs within a short time period.

Program monitoring includes monitoring for a spectrum of indicator parameters and also for additional parameters associated with specified industries. In addition, the program requires a one-time suite of monitoring for metals, chemical oxygen demand (COD), and semi-volatile organic compounds (SVOC). The purpose for the monitoring of indicator parameters and industry-specific parameters is to evaluate the runoff from individual sites. The purpose for the metals, COD, and SVOC screening is to develop a database of the constituents of concern and the levels at which they are generally found in runoff. The State Water Board intends to use this database to develop numeric effluent limitations.

3. Municipal Stormwater Program

The Municipal Storm Water Program regulates stormwater discharges from municipal separate storm sewer systems (MS4s). MS4 program requirements were developed in two phases. Under Phase I, which started in 1990, the Water Boards adopted NPDES permits for medium (serving between 100,000 and 250,000 people) and large (serving more than 250,000 people) municipalities. Most of these permits are issued to a group of co-permittees encompassing an entire metropolitan area. There are 26 Water Board Phase I MS4 permits throughout California, covering over 1,000 entities. There is also one Statewide permit for Caltrans.

As part of Phase II, the State Water Board adopted a general permit for the discharge of stormwater from small MS4s (WQ Order No. 2003-0005-DWQ). This general permit provides coverage for smaller municipalities, including nontraditional small MS4s, which are governmental facilities such as military bases, public campuses, prisons, and hospital complexes.

The MS4 permits require the municipalities to develop and implement a Storm Water Management Plan/Program with the goal of reducing the discharge of pollutants from their stormwater system to the maximum extent practicable (MEP). MEP is the performance standard specified in Section 402(p) of the CWA. The management programs specify what BMPs will be used to address certain program elements. The program elements include public education and outreach; illicit discharge detection and elimination; construction and post-construction runoff control; and pollution prevention/good housekeeping for municipal operations. In general, medium and large municipalities are required to conduct water quality monitoring, while small municipalities are not.

F. Local Groundwater Management Plans

There are local programs in place that provide varying degrees of groundwater management and oversight in some areas of the Central Valley. A brief description of local groundwater management programs follows.

Assembly Bill 3030, which is codified in CWC Section 10750, authorizes local agencies in groundwater basins to prepare and adopt groundwater management plans with the following recommended components.

1. Control of saline water intrusion

2. Identification and management of wellhead protection areas and recharge areas

3. Regulation of the migration of contaminated groundwater

4. The administration of a well-abandonment program

5. Mitigation of conditions of overdraft

6. Replenishment of groundwater extracted by water producers

7. Monitoring of groundwater levels and storage

8. Facilitating conjunctive use operations

9. Identification of well construction policies

10. The construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects

11. The development of relationships with State and federal regulatory agencies

12. The review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination

Senate Bill 1938 imposed additional groundwater management program requirements on local agencies seeking State funds, administered by DWR, for construction of groundwater projects. These requirements include a groundwater management plan that includes components relating to the monitoring and management of groundwater levels in the basin, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality.

Local agencies throughout the Central Valley have developed groundwater management programs pursuant to CWC Section 10750. However, there are areas throughout the Central Valley not covered by local agency groundwater management plans; participation in these plans is voluntary, and local agencies that administer the programs do not have authority to require implementation of management practices or participation in monitoring programs.

G. Programs Developed by Other Regional Water Boards

1. Central Coast Water Board

The Central Coast Regional Water Board adopted a conditional waiver of WDRs for irrigated lands operations (Order R3-2004-0117). Commercial irrigated farming operations that discharge waste (nutrients, salts, pesticides) to surface or groundwaters are required to submit an application to the Central Coast Water Board for enrollment under the Central Coast Irrigated Lands Conditional Waiver.

The Central Coast Irrigated Lands Conditional Waiver requires that growers:

- conduct water quality monitoring or join a cooperative monitoring program developed by the Central Coast Water Board (Central Coast Water Board monitoring requirements for irrigated lands operations are described in Monitoring and Reporting Program R3-2004-0117);
- comply with applicable water quality standards, protect beneficial uses, and prevent nuisance;
- develop an individual farm water quality management plan (FWQMP); and
- attend farm water quality training.

The strategy for protecting water quality described in the waiver includes controlling pollutants at the source through the development and implementation of pollutant minimization management practices.

2. Los Angeles Water Board

The Los Angeles Water Board adopted a conditional waiver of WDRs for irrigated lands operations (Order R4-2005-0080). Irrigated lands operations that discharge waste to surface waters or groundwaters must be covered by the Los Angeles Water Board Irrigated Lands Waiver or submit an application for WDRs.

The Los Angeles Water Board Irrigated Lands Waiver requires that growers:

- submit a notice of intent to comply with the waiver or participate in a discharger group that submits a notice of intent to comply with the waiver;
- conduct individual or participate in group water quality monitoring (Los Angeles Water Board monitoring requirements for irrigated lands operations are described in Monitoring and Reporting Programs CI-8835 for individual operations, and CI-8836 for groups under the Los Angeles Regional Water Board Irrigated Lands Waiver);
- comply with applicable water quality standards (e.g., Basin Plan); and
- if necessary, develop and implement a water quality management plan to reduce pollutant loading to surface waters.

3. Colorado River Basin Water Board

Because agricultural discharges, primarily irrigation return flows, constitute the largest volume of pollution entering surface waters in the Colorado River Basin, the Colorado River Basin Water Board established priorities for dealing with the agricultural drain systems based on a watershed approach. Drainage entities (e.g., water districts) were identified in each watershed, and the Colorado River Basin Water Board is working closely with these entities to implement agricultural pollution controls.

4. Lahontan Water Board

The Lahontan Water Board adopted a waiver of WDRs for grazing operations, or Grazing Waiver, in the East Walker River watershed (Resolution R6T-2007-0019). The Grazing Waiver covers waste discharges from grazing operations in the Bridgeport Valley and East Walker Tributaries that are in existence as of June 2007.

The waiver requires that operations submit an application and a ranch water quality management plan to reduce fecal coliform discharges so that Lahontan Basin Plan objectives are achieved. The ranch quality management plan is then reviewed and accepted by the Lahontan Water Board.

Grazing operations must conduct visual inspections and submit annual reports to the Lahontan Water Board. However, if ranch operators attend a ranch water quality training course every 4 years, the annual reporting requirement is relaxed to one report every 2 years. The waiver also requires watershed-based fecal coliform monitoring during the irrigation season (April 15–October).

5. San Diego Regional Water Board

The San Diego Water Board adopted a waiver of WDRs for agricultural and nursery operations. The San Diego Water Board waiver covers potential pollutant discharges from agricultural and nursery operations to ground and surface waters.

The San Diego Regional Water Board agricultural and nursery waiver requires:

1. implementation of water quality management practices,
2. enrollment by January 2011,
3. annual self-assessment,
4. 2-hours of water quality management practices education every year, and
5. regional (group) or individual monitoring and annual reporting of results.

6. San Francisco Bay Water Board

The San Francisco Bay Water Board adopted a conditional waiver of WDRs for grazing lands in the Tomales Bay Watershed. This waiver requires that grazing operations encompassing 50 acres or more: (1) submit a notice of intent to comply with the requirements of the waiver, and (2) complete a ranch water quality plan.

VI. LONG-TERM PROGRAM DEVELOPMENT PROCESS

In fall 2008, the Central Valley Water Board convened the Stakeholder Advisory Workgroup to provide staff with input on the development of the long-term ILRP. The Workgroup reflected a range of stakeholder interests representing local government, industry, agricultural, and environmental coalitions throughout the Central Valley.

The main goal of the Workgroup was to provide staff with input on the development of the long-term ILRP. Central Valley Water Board staff and the Workgroup developed long-term program goals and objectives and a range of proposed alternatives for consideration in a PEIR and economics analysis. In August 2009 the Workgroup approved a series of long-term ILRP goals and objectives and a range of proposed alternatives for the long-term ILRP. The Workgroup process, long-term ILRP goals and objectives, and range of alternatives are included in the December 2009 "Proposed Long-Term Irrigated Lands Regulatory Program Alternatives" document (Alternatives Document—Appendix A). The economic and environmental impacts of these alternatives have been considered in a Draft PEIR and Draft ILRP Economics Report.

In this report, (1) the alternatives are evaluated for policy considerations and whether the alternatives meet established goals and objectives, (2) the results of the Draft PEIR and Draft ILRP Economics Report are summarized and considered, and (3) a Central Valley Water Board staff–recommended long-term ILRP is developed using the evaluation process.

VII. GOALS AND OBJECTIVES OF THE LONG-TERM IRRIGATED LANDS REGULATORY PROGRAM

A. Irrigated Lands Definition

Irrigated agricultural lands include lands where water is applied to produce crops, fiber, or livestock for commercial sale or use. For the purposes of this ILRP, irrigated agricultural lands also include managed wetlands and nurseries.

B. Program Goals and Objectives

The overall goals of the ILRP are to (1) restore and/or maintain the highest reasonable quality of State waters[33] considering all the demands being placed on the water, (2) minimize waste discharge from irrigated agricultural lands[34] that could degrade the quality of State waters, (3) maintain the economic viability of agriculture in California's Central Valley, and (4) ensure that irrigated agricultural discharges do not impair Central Valley communities' and residents' access to

[33] California Water Code section 13050 defines State waters as any surface water or groundwater, including saline waters, within the boundaries of the state.
[34] See definition under section VII.A.

safe and reliable drinking water. In accordance with these goals, the objectives of the ILRP are to those listed below.

- Restore and/or maintain appropriate beneficial uses established in Central Valley Water Board Water Quality Control Plans by ensuring that all state waters within the Central Valley meet applicable water quality objectives.
- Encourage implementation of management practices that improve water quality in keeping with the first objective without jeopardizing the economic viability for all sizes of irrigated agricultural operations in the Central Valley or placing an undue burden on rural communities to provide safe drinking water.
- Provide incentives for agricultural operations to minimize waste discharge to state waters from their operations.
- Coordinate with other Central Valley Water Board programs, such as the Grassland Bypass Project waste discharge requirements for agricultural lands, total maximum daily load development, CV-Salts, and waste discharge requirements for dairies.
- Promote coordination with other regulatory and non-regulatory programs associated with agricultural operations (e.g., the California Department of Pesticide Regulation [DPR], the California Department of Public Health [DPH] Drinking Water Program, the California Air Resources Board, the California Department of Food and Agriculture, Resource Conservation Districts, the University of California Extension, Natural Resource Conservation Service, National Organic Program, California Agricultural Commissioners, State Water Resources Control Board Groundwater Ambient Monitoring and Assessment program, United States Geological Survey, and local groundwater programs [SB 1938, AB 3030, Integrated Regional Water Management Plans]) to minimize duplicative regulatory oversight while ensuring program effectiveness.

VIII. ALTERNATIVES FOR THE LONG-TERM IRRIGATED LANDS PROGRAM

The five alternatives evaluated in this report were developed by Central Valley Water Board staff and the Stakeholder Advisory Workgroup. These alternatives are described in detail in the Alternatives Document (Appendix A).

The five alternatives share common programmatic elements. Understanding of these elements and how they may be used to build the program alternatives is essential because the evaluation and associated staff recommendation developed in this report are described in terms of the common programmatic elements. These common elements are described below.

Program organization: dictates how the requirements for the long-term program will be applied. Program requirements could apply to all irrigated lands or be tailored for different geographical locations, crop types, or based on relative threat to water quality.

Lead entity: describes the mechanism for Water Board interaction with growers. The Water Board could (1) work through third-party groups that do not have direct responsibility for the waste discharge, but represent the growers, (2) work directly with growers, or (3) work with an entity that includes multiple growers and has legal responsibility for the discharge (e.g., some water districts or a joint powers authority).

1. *Third-party*—A number of growers are represented by a single entity. Under this option, the "single entity" is not responsible for the discharge of waste, but takes responsibility for meeting program requirements that apply to a broader region. This is analogous to the current coalition-based program.

2. *Direct Water Board administration*—In this approach, the Central Valley Water Board would work directly with growers. Growers would directly enroll in a waiver or WDRs. This approach is similar to the point source and stormwater permitting programs at the Water Board.

3. *Third party with Joint Powers Authority (JPA)*—This approach would be mechanically similar to the third-party approach. The main difference would be that the third party in this case would form a JPA, which would take responsibility for compliance with program requirements and managing the discharge of waste. An example of this type of program is the Grassland Bypass Project (described above).

Monitoring: Requirements must be established to ensure that a regulatory program is having the intended effects and to ensure that regulated entities are discharging waste in accordance with established requirements. While monitoring is a requirement in any Central Valley Water Board regulatory program, the type of monitoring could differ greatly, depending on the specific problems the regulatory program is addressing. Options for monitoring in the ILRP include watershed-based/regional, farm-based, and watershed+farm–based.

1. *Watershed-based/regional:* In this monitoring scheme, water bodies or groundwater basins are monitored for compliance with water quality objectives or limitations. Watershed-based/regional monitoring can be used effectively to determine whether there is a problem in the watershed or groundwater basin, but has significant limitations when it comes to the determination of problem sources, especially where there are non-agricultural waste sources in the watershed/basin (e.g., natural sources, municipalities, septic systems). Navigating the confounding influences of additional waste sources can add significant costs to watershed-based monitoring programs,

and there are questions regarding how the costs of such monitoring will be shared among other potential waste sources in addition to irrigated agriculture. Benefits of watershed or regional monitoring include the ability to spread monitoring costs to all agricultural waste sources; the absence of the need for individual growers to sample and report field discharge events; and potential cost savings if the monitoring is effectively coordinated with other waste sources.

2. *Farm-based:* Farm-based monitoring would require that each grower conduct water quality monitoring. For surface water discharge, the waste discharge characteristics of runoff from each farm would be determined. However, with this approach, it will be difficult characterize the actual effects agricultural waste discharges are having on receiving water bodies. A good example is where a farm discharges to a large river. Farm-based monitoring would not necessarily provide enough information to tell whether the discharge is affecting the river's water quality. The cost is likely to be significant for growers with multiple fields and multiple discharge points. For groundwater, a farm-based approach could determine whether a grower is affecting groundwater quality. However, the cost of this type of analysis likely will be significant (e.g., drilling several wells, analyzing background concentrations).

3. *Watershed-based/regional+farm–based:* This type of monitoring is some combination of watershed-based/regional and farm-based monitoring. An example would be requiring photographic monitoring of installed management practices in addition to watershed-based/regional monitoring.

Implementation mechanism: Long-term program requirements will need to be established in an enforceable regulatory mechanism. Options include conditional waivers of WDRs (waiver), WDRs, and conditional prohibitions of discharge. While all three mechanisms are enforceable and could be applied to a wide variety of discharges, there are some differences that should be considered.

1. *Waivers [CWC 13269]:* can be applied to a type or class of discharges. Waivers can contain enforceable discharge conditions and monitoring requirements. To enroll in a waiver, the enrollee must meet the conditions of the waiver, including any specified management measures. Under a waiver, the Water Board has the option of waiving the requirement to submit a report of waste discharge and any program fees.

2. *WDRs [CWC 13263]:* can be issued for individual waste discharges or for a general class of waste discharges. WDRs can contain enforceable waste discharge limitations and monitoring requirements. WDRs cannot be used to require specific management practices. Instead, WDRs can be used to establish discharge limitations or a requirement to develop management plans and practices that will minimize waste discharge. In order to obtain WDRs, an individual must file a report of waste discharge, or equivalent application (e.g., notice of intent to comply with general WDRs), with the

Water Board. The Water Board will use the submitted information to establish WDRs or enroll operations into general WDRs.

3. *Conditional Prohibition of Discharge [CWC 13243]:* can be established in the Basin Plan for any type of discharge. The Basin Plan would need to be amended to include a conditional prohibition of discharge. Conditional prohibitions can contain enforceable limitations and monitoring requirements. Conditional prohibitions also can be used to require specific types of management practices. A report of waste discharge or other application is not required to discharge under a conditional prohibition.

Table 10 summarizes the long-term ILRP alternatives in terms of the above common elements. For detailed descriptions of the alternatives, see Appendix A.

Table 10. Summary of Proposed ILRP Alternatives

Number	Alternative	Lead Entity[a]	WQ Plans[b]	Monitoring
1	No change	Third party	Yes, regional[c]	Regional
2	Third-party lead entity	Third party	Yes, regional[c]	Regional
3	Individual fwqmp	CVWB[d]	Yes, farm	Farm
4	Direct oversight with regional monitoring	Responsible legal entity[e]; CVWB	Yes, farm	Regional
5	Direct oversight with farm monitoring	CVWB	Yes, farm	Farm

[a] Describes Central Valley Water Board interaction with growers.
[b] Water Quality Management Plans (WQ Plans)—could be on the farm or regional level.
[c] Water quality management plans are required only where water quality problems have been identified.
[d] CVWB = Central Valley Regional Water Quality Control Board.
[e] Legal entity assuming responsibility for waste discharge (e.g., Joint Powers Authority).

IX. EVALUATION OF LONG-TERM PROGRAM ALTERNATIVES

In this section each alternative is evaluated for consistency with the goals of the long-term program and applicable laws and policies. The evaluation measures are summarized below.

- Program goals and objectives
- CWC
- NPS Policy
- State Antidegradation Policy

In this analysis, a qualitative system is used to establish a measure of how well the alternatives fulfill the above evaluation measures. The qualitative system is based on whether alternatives are expected to meet existing requirements (i.e., would the alternative be consistent with goals/policy/laws).

The qualitative system provides a method for succinctly summarizing the overall results of the evaluation. Overall results of the ranking system are summarized below in Table 11. Table 11 classifies each alternative as consistent, partially consistent, or not consistent. The overall classification is taken from the results of each specific evaluation (described in the sections below). When an alternative is evaluated as consistent for every measure of a complete set of measures (e.g., all NPS Policy measures—Key Elements 1–5), it is rated "consistent." Alternatives that receive a mixture of consistent/partially consistent are classified overall as "partially consistent." Where an alternative is evaluated as not consistent with any one measure, it is rated "not consistent."

Table 11. Overall Summary of Evaluation Results

	Alternatives		
	Consistent	**Partially Consistent**	**Not Consistent**
Goals and Objectives	2	3,4	1,5
California Water Code	2,3,4,5		1
Nonpoint Source Policy	4,5	2,3	1
Antidegradation	4,5	2,3	1

In addition to the evaluation described above, Sections IX.B–D provide discussions of (1) how effectively the Central Valley Water Board could administer each alternative, (2) overall results of the economics report, and (3) overall results of the Draft PEIR, respectively. While the results of these analyses have not been qualitatively rated, they are considered in the development of the recommended long-term ILRP (Section X.A).

A. Consistency with Program Goals and Objectives and Policies

The qualitative scoring system for the goals and objectives and policy evaluation measures uses the following factors.

- Alternative is consistent with the requirement.
- Alternative is partially consistent with the requirement.
- Alternative is not consistent with the requirement.

1. Program Goals and Objectives

In this section, each alternative is evaluated against the goals and objectives of the long-term program. Goals 1 and 2 and Objectives 1 and 2 are similar in nature and have been evaluated together; Goals 3 and 4 have been evaluated separately, and Objectives 4, 5 have been evaluated together. Table 12 summarizes the results of the program goals and objectives evaluation.

Table 12. Summary of Program Goals and Objectives Evaluation

	Goals 1,2 Objectives 1,2	Goal 3	Goal 4	Objective 3	Objectives 4,5
Alternative 1					
Consistent		✓			✓
Partially Consistent	✓				
Not Consistent			✓	✓	
Alternative 2					
Consistent	✓	✓	✓	✓	✓
Partially Consistent					
Not Consistent					
Alternative 3					
Consistent	✓		✓	✓	
Partially Consistent		✓			✓
Not Consistent					
Alternative 4					
Consistent	✓	✓	✓	✓	
Partially Consistent					✓
Not Consistent					
Alternative 5					
Consistent	✓		✓		
Partially Consistent					✓
Not Consistent		✓		✓	

Consideration of Goals 1, 2 and Objectives 1, 2

Goals:

(1) Restore and/or maintain the highest reasonable quality of State waters considering all the demands being placed on the water

(2) Minimize waste discharge from irrigated agricultural lands that could degrade the quality of State waters

Objectives:

(1) Restore and/or maintain appropriate beneficial uses established in Central Valley Water Board Water Quality Control Plans by ensuring that all State waters meet applicable water quality objectives

(2) Encourage implementation of management practices that improve water quality in keeping with the first objective without jeopardizing the economic viability for all sizes of irrigated agricultural operations in the Central Valley or placing an undue burden on rural communities to provide safe drinking water

[Objective 2 requires that alternatives encourage the implementation of management practices that improve water quality without jeopardizing economic viability of irrigated agriculture or placing an undue burden on rural communities to provide safe drinking water. Maintaining economic viability of agriculture and ensuring communities have access to safe and reliable access to drinking water have been evaluated as part of Goals 3 and 4, respectively. The remaining portion of this objective, “encourage implementation of management practices that improve water quality,” is evaluated in this section.]

The key to achieving the above goals and objectives in the long-term program will be successful implementation of management practices that will minimize waste discharge from agricultural operations. The minimization of waste discharge will work toward restoring and/or maintaining water quality, beneficial uses, and ensuring that drinking water supplies are not affected further by agricultural waste discharge.

Each of the five alternatives requires that growers: “Prevent nuisance conditions and/or exceedance of water quality objectives in State waters associated with waste discharge from their irrigated agricultural lands.” This requirement establishes that irrigated agricultural operations would need to work toward preventing exceedance of water quality objectives caused by their discharge. To comply with this requirement, operations would be expected to implement management measures to control sources of waste discharge that could be leading to exceedances of water quality objectives.

As stated above, successful implementation of management measures will work to achieve Goals 1, 2 and Objectives 1, 2. There are some key differences between the alternatives that will help in the evaluation of these goals and objectives. These differences are whether the alternatives require implementation of management measures for surface and groundwater. Alternatives requiring that growers develop and implement the most effective management measures would best meet Goals 1, 2 and Objectives 1, 2.

Alternative 1

Under Alternative 1, the current surface water program would be continued. In this configuration, third-party groups would develop regional surface water management plans in response to identified water quality problems. Irrigated agricultural operations would be required to implement management measures identified in the plans. The implementation of the identified management measures would work toward reducing waste discharge to surface waters.

Alternative 1 would not establish any new Central Valley Water Board requirements for discharges to groundwater from irrigated agricultural lands.

As described in Section III.C.2 of this report, a considerable number of wells in the Central Valley have high levels of nitrate (also see the Draft Groundwater Nitrate Summary Report, Appendix B). The use of chemical nitrogen-based fertilizers has been found to be a potential cause of nitrate contamination of groundwater in agricultural areas [Suen 2008]. There are no requirements currently in place to address potential non-pesticide waste discharges (e.g., nitrate, salts) from irrigated agricultural operations to groundwater. Many management measures that would benefit surface water quality also would benefit groundwater quality. Examples would include irrigation efficiency, nutrient management, and cover crops. However, focusing only on surface water quality management practices could lead to additional discharge to groundwater (e.g., encouraging percolation of waste into groundwater).

Alternative 1 would not work to implement management measures to protect groundwater from irrigated agricultural waste discharges. *Considering that there are significant groundwater nitrate impacts in the Central Valley, and that irrigated agricultural operations have the potential to contribute nitrates to groundwater, Alternative 1 is partially consistent with Goals 1, 2 and Objectives 1, 2.*

Alternative 2–5

Under Alternative 2, third-party groups would develop regional surface and groundwater management plans. These plans would specify management measures that would work to restore and/or maintain the highest reasonable surface and groundwater quality. Growers would be required to implement management measures identified in the plans.

Under Alternatives 3, 4, and 5 growers would develop individual FWQMPs. These plans would specify management measures that would minimize waste discharge to surface and groundwater. Growers would be required to implement the practices identified in their plans.

The implementation of management measures to protect surface and groundwater would work to reduce waste discharge associated with agriculture. *Alternatives 2–5 are consistent with Goals 1, 2 and Objectives 1, 2.*

Consideration of Goal 3

Goal 3

(3) Maintain the economic viability of agriculture in California's Central Valley.

Goal 3 requires that the Central Valley Water Board consider the economic impacts of each alternative on the overall viability of agriculture throughout the Central Valley. The Board contracted an economic analysis in order to evaluate whether alternatives are consistent with this goal. Section IX.C (Economic Impacts) of this report discusses costs and considers how well the alternatives meet this goal.

Consideration of Goal 4

Goal 4

(4) Ensure that irrigated agricultural discharges do not impair Central Valley communities' and residents' access to safe and reliable drinking water

As described in Section III.D of this report, there are a number of wells throughout the Central Valley with high levels of nitrate (Draft Groundwater Nitrate Summary Report, Appendix B). There are also Central Valley communities with groundwater supplies that exceed the State MCL for nitrate. Many of the residents of these communities must search elsewhere for reliable sources of water (purchasing bottled water, higher treatment costs, etc.). There are a number of communities identified in this report (Section III.D) facing significant costs to obtain a reliable source of drinking water. The use of nitrogen-based fertilizers is a source of nitrogen in the Central Valley [Suen 2008, Ruddy 2006]. Other agricultural waste products that could affect drinking water sources are salts, pesticides, and pathogens.

Considering the number of wells with nitrate levels above the State drinking water MCL and communities with affected drinking water, key factors in evaluating the alternatives for consistency with Goal 4 include whether groundwater quality management measures would be required.

Alternative 1

Alternative 1 would not require the implementation of management measures to protect groundwater. In particular, the alternative would not address waste discharges to groundwater potentially causing or contributing to existing nitrate pollution conditions described in Section III.C.2 of this report (also see the Draft Groundwater Nitrate Summary Report, Appendix B). Without requirements to address waste discharge to groundwater, the alternative may lead to further loss of reliable Central Valley drinking water supplies. *Alternative 1 is not consistent with the requirements of Goal 4.*

Alternatives 2–5

Under Alternative 2, third-party groups would develop regional surface and groundwater management plans. These plans would specify management measures that would work to restore and/or maintain the highest reasonable surface and groundwater quality. Alternatives 3–5 would require each irrigated agricultural operation to develop and implement FWQMPs to minimize discharge to surface and groundwater. Operations would be required to implement management practices identified in the plans. Alternatives 2–5 would include requirements to implement management measures to protect surface and groundwater quality and ultimately work to promote reliable drinking water sources for Central Valley communities. *Alternatives 2–5 are consistent with Goal 4.*

Consideration of Objective 3

Objective 3

(3) Provide incentives[35] for agricultural operations to minimize waste discharge to State waters from their operations.

Alternatives 1 and 5

In Alternatives 1 and 5, all irrigated agricultural operations would be subject to the same requirements. The incentive to minimize waste discharge to State waters ultimately would be connected to whether the grower is complying with the established requirements. These alternatives do not provide additional incentives for irrigated agricultural operations to minimize waste discharge voluntarily, such as reduced monitoring. *Alternatives 1 and 5 are not consistent with Objective 3.*

Alternatives 2–4

Alternatives 2–4 provide incentives for irrigated agricultural operations to minimize waste discharge. These incentives are summarized below.

- Alternative 2: Reduced water quality monitoring for operations participating in an area or watershed management objectives plan.
- Alternative 3: Central Valley Water Board certification that operations are implementing practices that are protective of surface and groundwater quality.
- Alternative 4: Tiered system that would establish reduced requirements and/or monitoring for operations with low-threat nutrient and/or pesticide use.

Alternatives 2–4 are consistent with Objective 3.

Consideration of Objectives 4, 5

Objectives:

(4) Coordinate with other Central Valley Water Board programs, such as the Grassland Bypass Project WDRs for agricultural lands, total maximum daily load development, CV-Salts, and WDRs for dairies.

(5) Promote coordination with other regulatory and non-regulatory programs associated with agricultural operations (e.g., the California Department of Pesticide Regulation [DPR], the California Department of Public Health [DPH] Drinking Water Program, the California Air Resources Board, the California Department of Food and Agriculture, Resource Conservation Districts, the University of California Extension, Natural Resource Conservation Service,

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[35] Incentives could include financial, monitoring reductions, certification, or technical help.

National Organic Program, California Agricultural Commissioners, State Water Resources Control Board Groundwater Ambient Monitoring and Assessment program, United States Geological Survey, and local groundwater programs [SB 1938, AB 3030, Integrated Regional Water Management Plans]) to minimize duplicative regulatory oversight while ensuring program effectiveness.

Objectives 4, 5 essentially require that alternatives promote coordination with Central Valley Water Board programs and other regulatory and non-regulatory agencies. One important distinction in the alternatives that will help with this evaluation is the size of the management unit that would be used in program implementation. The range of alternatives includes management units at the field, farm, and regional levels. Management at the regional level would likely better facilitate coordination with other programs and agencies. For example, management at the watershed level would promote coordination with other agencies and programs that have waste discharges to the same watershed (e.g., municipal wastewater discharges). Management at the farm level would not work to promote coordination with other Water Board programs and regulatory and non-regulatory agencies. For example, rather than trying to coordinate at the regional level, coordination potentially would need to take place on thousands of individual farms.

Alternatives 1 and 2

These alternatives would be managed at the regional level. Management at the regional level would promote coordination with other programs and regulatory and non-regulatory agencies. The regional configuration for water quality plans and monitoring would facilitate efficient coordination with other programs operating at the regional level (e.g., Water Board watershed-based loading limits, local groundwater programs, air quality management districts). *Alternatives 1 and 2 are consistent with Objectives 4, 5.*

Alternatives 3–5

These alternatives would be managed at the farm level. The Central Valley Water Board would work directly with irrigated agricultural operations in program implementation. In the farm-level configuration, the Central Valley Water Board would be able to coordinate with other programs and regulatory and non-regulatory agencies, but the farm-level management would not *promote* this coordination. The Central Valley Water Board would be required to provide coordination and management between individual growers and other programs/agencies. *Alternatives 3–5 are partially consistent with Objectives 4, 5.*

2. California Water Code

Table 13 summarizes CWC requirements for developing a long-term program for irrigated agricultural waste discharge. As shown in the table, requirements vary depending on the regulatory mechanism the Central Valley Water Board adopts to establish program requirements. The Central Valley Water Board could choose to adopt a waiver of WDRs, WDRs, a Basin Plan conditional prohibition of discharge, or a mixture of these to establish the long-term program. Because the Board may choose to adopt any of the three mechanisms, program alternatives are evaluated against each of the CWC requirements regardless of the mechanisms for which it would apply.

The qualitative ranking system described in the above section is used in this evaluation (e.g., consistent, partially consistent, not consistent with requirements). Table 13 summarizes the results of the CWC evaluation.

Table 13. Summary of California Water Code Evaluation

	13263 13269	13241	13141
Alternative 1			
Consistent		✓	✓
Partially Consistent			
Not Consistent	✓		
Alternative 2			
Consistent	✓	✓	✓
Partially Consistent			
Not Consistent			
Alternative 3			
Consistent	✓	✓	✓
Partially Consistent			
Not Consistent			
Alternative 4			
Consistent	✓	✓	✓
Partially Consistent			
Not Consistent			
Alternative 5			
Consistent	✓	✓	✓
Partially Consistent			
Not Consistent			

Consideration of California Water Code Sections 13263 and 13269

CWC Section 13263 requires that the following factors be considered when developing WDRs:

- requirements shall implement any relevant water quality control plans that have been adopted, and
- shall take into consideration the beneficial uses to be protected, the water quality objectives reasonably required for that purpose, other waste discharges, the need to prevent nuisance, and
- the provisions of Section 13241.

CWC Section 13269 requires that conditional waivers of WDRs be consistent with any applicable State or regional water quality control plan and in the public interest. Waivers of WDRs also must include the performance of individual, group, or watershed-based monitoring unless the Board waives the monitoring because the discharge(s) do not pose a significant threat to water quality.

In the long-term ILRP, WDRs or conditional waivers of WDRs would be established for waste discharges from irrigated agricultural operations to State waters. Each of the five alternatives requires that irrigated agricultural operations: "Prevent nuisance conditions and/or exceedance of water quality objectives in State waters associated with waste discharge from their irrigated agricultural lands." This requirement establishes that irrigated agricultural operations would need to work toward preventing exceedance of water quality objectives caused by their discharge.

Alternative 1

Alternative 1 would not establish requirements for waste discharges to groundwater. This alternative therefore would not consider Basin Plan beneficial uses for groundwater that need to be protected or water quality objectives reasonably required. There are Central Valley communities with groundwater supplies that exceed State MCLs for nitrate (10 milligrams per liter [mg/l] nitrate as nitrogen or 45 mg/l nitrate nitrogen); therefore, beneficial uses have been affected and general nuisance conditions exist. In general, irrigated agricultural operations discharge waste to groundwater (pesticides, nitrates, salts leaching). Considering that this alternative would not implement requirements to prevent nuisance and protect beneficial uses for groundwater, it is reasonable to assume that it would not be in the public interest. *Therefore, Alternative 1 is not consistent with these sections of the CWC.*

Alternatives 2–5

Through the development and implementation of ground and surface water quality management plans (SQMPs), Alternatives 2–5 would consider surface and groundwater beneficial uses to be protected, the water quality objectives reasonably required for that purpose, and the need to prevent nuisance. These alternatives also establish water quality and/or visual/management practice monitoring programs as required by Section 13269[36]. Considering that these alternatives would work to prevent nuisance and protect beneficial uses, it is reasonable to assume that they would be in the public interest.

[36] Alternative 3 establishes monitoring to evaluate the effectiveness of implemented management practices (e.g., monitoring that an installed tailwater return system is preventing off-site discharge, review of erosion prevention practices after storm events, visual monitoring of turbidity in field discharge, review of nutrient applications and estimated crop uptake). This monitoring is intended to fulfill CWC section 13269 requirements: "…The conditions of the waiver shall include, but need not be limited to, the performance of individual, group, or watershed-based monitoring…Monitoring requirements shall be designed to support the development and implementation of the waiver program, including, but not limited to, verifying the adequacy and effectiveness of the waiver's conditions."

The means by which each alternative would work toward protecting beneficial uses would be through development and implementation of water quality management plans. CWC Section 13263 requires that "other waste discharges" be considered in WDRs. Other waste discharges would be considered in the development of management plans. In the alternatives, the lead entity (third party or Central Valley Water Board) would be responsible for coordinating management plan requirements with other discharges.

Alternatives 2–5 exhibit the aspects necessary to be consistent with these sections of the CWC.

Consideration of California Water Code Section 13241

CWC Section 13263 requires that six factors listed under Section 13241 be considered in the development of those components of the long-term ILRP relying on WDRs. These factors are:

(a) Past, present, and probable future beneficial uses of water

(b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto

(c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality in the area

(d) Economic considerations

(e) The need for developing housing in the region

(f) The need to develop and use recycled water

These factors will need to be considered not for the full program, but for any WDRs developed to implement the long-term ILRP, regardless of the regulatory alternative. *Since any WDRs for the long-term ILRP will incorporate a consideration of Section 13241 factors, the alternatives are considered to be consistent with Section 13241 of the CWC.*

Consideration of California Water Code Section 13141

CWC Section 13141 requires that:

> *"…prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of financing, shall be indicated in any regional water quality control plan."*

The set of regulatory actions under the long-term ILRP could include a Basin Plan amendment. The estimated total cost of each alternative and potential sources of financing are described below in the Economic Impacts section of this report. *Therefore, the alternatives are consistent with Section 13141 of the CWC.*

3. NPS Policy

The long-term ILRP would regulate waste discharges from irrigated agricultural lands to State waters as an NPS program. Accordingly, the long-term ILRP must meet the provisions of the State Water Board's NPS Policy. Under the NPS Policy, the Regional Water Board must find that the program will promote attainment of water quality objectives. The nonpoint-source program also must meet the requirements of five key structural elements. The NPS Policy is described in Section IV.C of this document. In this section, each of the alternatives is evaluated against the requirements of the NPS Policy.

The qualitative ranking system described in the above section is used in this evaluation (e.g., consistent, partially consistent, not consistent with requirements). Table 14 summarizes the results of the NPS Policy evaluation.

Table 14. Summary of Nonpoint Source Policy Evaluation

	Element 1	Element 2	Element 3	Element 4	Element 5
Alternative 1					
Consistent	✓				✓
Partially Consistent			✓		
Not Consistent		✓		✓	
Alternative 2					
Consistent	✓	✓	✓		✓
Partially Consistent				✓	
Not Consistent					
Alternative 3					
Consistent	✓	✓	✓		✓
Partially Consistent				✓	
Not Consistent					
Alternative 4					
Consistent	✓	✓	✓	✓	✓
Partially Consistent					
Not Consistent					
Alternative 5					
Consistent	✓	✓	✓	✓	✓
Partially Consistent					
Not Consistent					

Consideration of Key Element 1

Key Element 1

"An NPS control implementation program's ultimate purpose shall be explicitly stated. Implementation programs must, at a minimum, address NPS pollution in a manner that achieves and maintains water quality objectives and beneficial uses, including any applicable antidegradation requirements."

Element 1 can be broken into three components: (1) statement of the program's purpose, (2) achievement and maintenance of water quality objectives and beneficial uses, and (3) compliance with antidegradation requirements. Because the latter two components of this key element are primary aspects of other applicable regulation, they will be analyzed in separate sections of this report: consideration of Goals and Objectives and CWC, Sections IX.A.1–2 (component 2) and Antidegradation Policy, Section IX.A.4 (component 3).

The first component of NPS Policy Key Element 1 states that the NPS control implementation program's ultimate purpose shall be explicitly stated. The purpose of the long-term program is explicitly stated in the Goals and Objectives. As given in the Goals and Objectives, the ultimate purpose of all program alternatives is the same. *All program alternatives are consistent with this requirement.*

Consideration of Key Element 2

Key Element 2

"An NPS control implementation program shall include a description of the MPs [management practices] and other program elements that are expected to be implemented to ensure attainment of the implementation program's stated purpose(s), the process to be used to select or develop MPs, and the process to be used to ensure and verify proper MP implementation."

Successful implementation of water quality management measures will work toward achieving the Goals and Objectives of the long-term program. The Draft PEIR and Draft ILRP Economics Report discuss the types of management practices that may be implemented for all of the alternatives. The discussion below evaluates how the specific management practices to be implemented will be identified under each alternative.

Alternative 1

Alternative 1 would require the development and implementation of SQMPs where there are exceedances of Basin Plan water quality objectives. The management plans would describe practices that would be implemented to work toward achievement of applicable water quality objectives and preventing nuisance conditions. The process used to select or develop management practices would include third-party groups working with irrigated agricultural operations and technical experts. Management plans also would need to be approved by the Central Valley Water Board. Proper management practices implementation would be verified using water quality monitoring and management practices tracking.

This alternative would not establish any new Central Valley Water Board requirements for discharges to groundwater from irrigated lands; rather, it would rely on DPR's Groundwater Protection Program and existing local groundwater programs. DPR's Groundwater Protection Program does not address discharges of nitrates or salts to groundwater. Local groundwater programs do not cover all areas accepting waste discharges from irrigated agricultural operations and provide varying degrees of groundwater management and oversight. The Goals and Objectives of the long-term program require protection of State waters, which include surface and groundwater. Irrigated agricultural operations may discharge waste to groundwater. Alternative 1 would not require implementation of groundwater quality management measures to protect groundwater from irrigated agricultural waste discharges. *Alternative 1 is not consistent with Key Element 2 of the NPS Policy.*

Alternative 2

Alternative 2 is similar to Alternative 1, except that it includes requirements to protect groundwater, and it would allow reduced surface water monitoring in lower threat circumstances.

This alternative would require that third-party groups develop groundwater quality management plans (GQMPs), with the possibility of existing local groundwater management plans being substituted for GQMPs with Central Valley Water Board approval. GQMPs would be consistent with Key Element 2 as they would use groundwater data and other information to develop required water quality management practices in high-priority areas. Under this alternative, management practice tracking would be used to verify proper management practices implementation. Where existing local groundwater management plans would be substituted for GQMPs, monitoring for nitrates and salts would be required. Local groundwater management plans would have a process for recommending management practices for growers. *Alternative 2 is consistent with Key Element 2.*

Alternatives 3–5

Alternatives 3–5 are consistent with Key Element 2, which requires the program to describe (a) management practices that will be implemented, (b) the process used to select or develop practices, and (c) the process to be used to ensure and verify proper implementation. Alternatives 3–5 require individual FWQMPs for each enrolled operation, which would describe the measures to be implemented as well as those already in use (meets item (a) above). Water Board staff and/or another entity would be conducting a specified number of grower site inspections annually, aimed at verifying proper management practice implementation (item (c) above).

Consideration of Key Element 3

Key Element 3

"Where an RWQCB determines it is necessary to allow time to achieve water quality requirements, the NPS control implementation program shall include a specific time schedule, and corresponding quantifiable milestones designed to measure progress toward reaching the specified requirements."

It must be noted that nitrates, salts and other constituents found in groundwater may be naturally occurring or elevated by agricultural, non-agricultural, or a combination of sources. It is also possible that the elevated conditions were caused by past conditions or land uses. Agricultural use of fertilizers is one of several sources that can cause degradation of groundwater quality (see Section III.C.2 above).These issues make evaluation of causes of groundwater degradation difficult and widen the potential responsibility for protection of groundwater quality. For example, irrigated agriculture may be one of several sources, and bringing elevated groundwater waste levels down may require a concerted effort by all sources. Also, it must be acknowledged that groundwater moves at a relatively slow rate; therefore, implementation of management practices will take months to years to effect any measurable change in groundwater quality.

For waste discharge to surface water, it is less difficult to determine sources of elevated waste constituents. However, there are cases where elevated waste conditions exist, and irrigated agriculture is one of several potential sources (e.g., fecal coliform, sediment).

Considering that irrigated agriculture is not the only source of waste affecting Central Valley surface and groundwater, time schedules should include goals for the implementation of measures to minimize discharge of waste from irrigated agricultural operations that would work toward meeting applicable water quality objectives. Consequently, the evaluation of alternatives for consistency with Element 3 is based on whether management plans or other aspects would provide these goals and time schedules.

Alternative 1

For surface water quality aspects, Alternative 1 is consistent with Element 3 because it requires that management plans include a time schedule for implementation of management practices to achieve water quality requirements (see current program requirements for management plans).

There are a number of wells throughout the Central Valley with nitrate levels above the State MCL for drinking water (see Section III.C.2 and Draft Groundwater Nitrate Summary Report, Appendix B). In general, irrigated agricultural operations discharge waste (e.g., nitrate) to groundwater. This alternative would not establish a time schedule to reduce waste discharge from agricultural operations in order to work toward reducing groundwater nitrate levels (i.e., ultimately work to restore and/or maintain the municipal beneficial use). *Alternative 1 is partially consistent with Element 3.*

Alternative 2

For surface water quality aspects, Alternative 2 is consistent with Element 3 because it requires that management plans include a time schedule for implementation of management practices to achieve water quality requirements (see current program requirements for management plans). For groundwater, GQMPs would be developed within 4 years of adoption of the new program and evaluated every 5 years and updated if needed. Although not explicitly stated, it is assumed that GQMPs, similar to SQMPs for this alternative, would include a time schedule for management measures implementation and other goals aimed at working toward meeting water quality objectives in groundwater. *Alternative 2 is consistent with Element 3.*

Alternatives 3–5

In Alternatives 3–5, irrigated agricultural operations would be required to develop and implement an individual FWQMP within 2 years of enrollment in the program. The "implementation" of the FWQMP within 2 years would provide the specific date and quantifiable milestones required by Element 3.

Alternatives 3–5 also require that the Central Valley Water Board:

> *"In an iterative process, require additional monitoring, information, and/or management measures where applicable water quality objectives are not being met."*

Where water quality objectives are not being met, this requirement establishes that irrigated agricultural operations may need to implement additional management measures. In the implementation of this requirement, it is assumed that the Central Valley Water Board would require that irrigated agricultural operations provide a time schedule for implementation of additional practices.

Alternatives 3–5 are consistent with Element 3.

Consideration of Key Element 4

Key Element 4

"An NPS control implementation program shall include sufficient feedback mechanisms so that the RWQCB, dischargers, and the public can determine whether the program is achieving its stated purpose(s), or whether additional or different MPs [management practices] or other actions are required."

The goals of the program include restoring and/or maintaining the highest reasonable quality of State waters, minimizing waste discharge from irrigated agricultural lands, and restoring and/or maintaining appropriate Basin Plan beneficial uses. Agricultural operations would work to achieve these goals through implementation of water quality management measures. Feedback mechanisms for determining whether these goals would be met include water quality monitoring and tracking of practices implemented.

Alternative 1

The surface water component of Alternative 1 would be consistent with Element 4 because it includes feedback mechanisms to determine whether the program is achieving its stated purpose. Coalition groups would be required to (1) track existing management measures and the progress of additional practice implementation required in management plans; (2) collect water quality data over time and use the date to determine whether management plans are effective at achieving water quality requirements. All of this information would be reported to the Central Valley Water Board at least annually.

The goals of the long-term ILRP include maintaining the highest reasonable quality of State waters. State waters include groundwater. *Considering that Alternative 1 does not include feedback mechanisms for waste discharge to groundwater, it is not consistent with Element 4.*

Alternative 2

Alternative 2 is similar to Alternative 1, except that it includes requirements to protect groundwater and it would allow reduced surface water monitoring in lower threat circumstances. As described in Alternative 1, the surface water aspects of Alternative 2 would provide feedback mechanisms consistent with Element 4. These mechanisms would include tracking of management practices and watershed-based surface water quality monitoring.

The groundwater component of this alternative would require the development of GQMPs, or the use of existing local groundwater management plans. GQMPs would be evaluated for efficacy every 5 years, which would serve as a feedback mechanism. Additionally, limited groundwater quality monitoring data (collected under local groundwater management plans) as well as results of management practice tracking (required under GQMPs) would serve as feedback mechanisms. Under coalition-developed GQMPs, feedback mechanisms would not include groundwater quality monitoring to determine whether practices implemented would be maintaining and/or restoring beneficial uses or the highest reasonable groundwater quality. *Considering that Alternative 2 would require management practices tracking without monitoring to provide feedback on the efficacy of the practices, it is partially consistent with Element 4.*

Alternative 3

Under Alternative 3, irrigated agricultural operations would be required to submit an annual report to the Central Valley Water Board on the status of FWQMP implementation and an evaluation of the performance of those practices. In addition, Central Valley Water Board staff or another entity would be conducting a specified number of grower site inspections annually. This alternative would not require surface or groundwater quality monitoring. The results of inspections and grower reporting would provide feedback for Board staff, growers, and the public on whether the program is working toward achieving the goals and objectives.

The individual FWQMP and associated annual reports do not require water quality monitoring, but do require evaluation of management practice effectiveness. For some pollutants, visual inspection of management practices may effectively determine whether the practices are effective. Examples would include: (1) if no visible amounts of sediment are being discharged, it is a reasonable assumption that sediment is not being discharged at levels exceeding water quality objectives and hydrophobic pesticides that bind to soil particles are not being discharged at high levels; and (2) the absence of any runoff means no waste is being discharged to surface waters. However, there could be waste constituents exceeding water quality objectives that visual management practice evaluation would be unable to quantify (e.g., colorless, odorless hydrophilic pesticides).

Considering that grower reporting on management practices and visual inspections will not be able to fully quantify whether management practices are achieving water quality goals, Alternative 3 is partially consistent with Element 4.

Alternatives 4 and 5

These alternatives include the feedback mechanisms that Alternative 3 includes, as well as water quality monitoring programs for surface and groundwater. *Alternatives 4 and 5 are consistent with Element 4.*

Consideration of Key Element 5

Key Element 5

"Each RWQCB shall make clear, in advance, the potential consequences for failure to achieve an NPS control implementation program's stated purposes."

Compliance with this element is the responsibility of the Central Valley Water Board. The potential consequences for failure to achieve the long-term ILRP's stated purpose would be the same regardless of the chosen program alternative and would include the following steps:

1. require, in an iterative process, additional monitoring information and/or management practices where water quality objectives are not being met;

2. impose enforcement action where iterative process is unsuccessful, program requirements are not met, or time schedules are not met; and

3. require submittal of an ROWD to work individually with the Central Valley Water Board.

Central Valley Water Board staff will ensure consistency with Key Element 5 by including the above potential consequences in the adopted long-term ILRP alternative.

4. Antidegradation

The long-term ILRP must meet the provisions of State and federal antidegradation policies. Applicable antidegradation provisions are described in Section IV.E of this document. Antidegradation provisions are aimed at site-specific analyses. The long-term ILRP would be applied Central Valley–wide. At this time, it is not feasible to conduct a conventional analysis of waste loadings, assimilative capacities, and socioeconomic concerns to determine consistency with maximum public benefit for every Central Valley irrigated agricultural waste discharge. Instead, the following programmatic approach has been developed for practically applying antidegradation provisions for a Central Valley wide ILRP:

> ***Implementation of the program must work to achieve site-specific antidegradation requirements through iterative implementation of BPTC and representative monitoring (i.e., where monitoring indicates degradation, BPTC would evolve to prevent such degradation).***

This iterative process (shown graphically in Figure 21) is intended, over time, to bring all water bodies accepting agricultural wastes into compliance with water quality objectives (where agriculture is the source of exceedance) and evaluate and prevent degradation from occurring. In this section, each of the alternatives is evaluated against the above approach for implementing antidegradation requirements.

The qualitative ranking system described in the above sections is used in this evaluation (e.g., consistent, partially consistent, not consistent with requirement). Table 15 summarizes the results of the antidegradation evaluation.

Table 15. Summary of Antidegradation Evaluation

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Consistent				✓	✓
Partially consistent		✓	✓		
Not consistent	✓				

Alternative 1

This alternative would rely on watershed-based surface water monitoring to determine whether exceedances of water quality objectives are occurring in agriculturally dominated waterways. Where monitoring shows two or more exceedances in a 3-year period, coalition groups would be required to develop SQMPs. These plans would identify management practices necessary to work toward achieving surface water quality objectives.

Alternative 1 would establish a regional surface water monitoring program that could evaluate trends and determine whether water quality objectives are being met. The alternative would not establish a groundwater monitoring program to evaluate whether current agricultural discharges are causing degradation of groundwater quality or whether water quality objectives are being met. There are existing groundwater monitoring programs that can provide information on existing water quality, but the programs (with the exception of DPR's Groundwater Protection Program) are not geared to determine whether agricultural discharges are affecting groundwater quality.

Alternative 1 would not establish requirements for operations to implement BPTC where trends in surface or groundwater monitoring show degradation attributable to agricultural waste discharges. The alternative would require management plans to work toward mitigating agriculturally related exceedances of surface water quality objectives.

Alternative 1 would not implement the iterative BPTC and monitoring process for addressing degradation to groundwater. Through development and implementation of SQMPs, Alternative 1 would partially implement the iterative process for addressing degradation to surface waters (i.e., proposed process is geared toward identifying exceedances and not degradation). *Alternative 1 is not consistent with the proposed antidegradation approach.*

Alternative 2

Alternative 2 is similar to Alternative 1, except that it includes requirements to protect groundwater and it would allow reduced surface water monitoring in lower threat circumstances.

For addressing potential degradation in surface waters, Alternative 2 would be similar to Alternative 1 (partially consistent with the proposed antidegradation approach). Alternative 2 also proposes the development of GQMPs that would identify priority areas, potential sources of waste discharge to groundwater, and management practices that would work to prevent groundwater degradation. The alternative would allow substitution of local groundwater management plans where plans have goals consistent with Basin Plan objectives, establish monitoring and reporting, recommend groundwater quality management practices, evaluate effectiveness of existing practices, and have the ability to amend the plan.

Under local groundwater management plans, management practices could be recommended based on information collected. Where degradation is occurring, antidegradation provisions require management practices implementing BPTC. Under third-party-developed GQMPs, groundwater quality management practices would be identified and implemented to the "maximum extent practicable." Groundwater quality monitoring would not be required under GQMPs to determine whether degradation is occurring and/or evaluate BPTC effectiveness. *Alternative 2 is partially consistent with the proposed antidegradation approach.*

Alternative 3

Alternative 3 would require all operations to develop individual FWQMPs. FWQMPs would be certified by the Central Valley Water Board or authorized certifying entity. Implementation of certified FWQMPs would be considered BPTC. Surface and/or groundwater quality monitoring would not be required under Alternative 3 to determine effectiveness of BPTC and whether degradation is occurring. *Consequently, Alternative 3 is partially consistent with the proposed antidegradation approach.*

Alternative 4

Alternative 4 would require all operations to develop individual FWQMPs. The alternative also would require individual and/or regional surface and groundwater monitoring. Implementation of FWQMPs would constitute BPTC. Results of surface and groundwater quality monitoring could be used to determine effectiveness of BPTC and/or whether discharges are causing degradation. *Alternative 4 is consistent with the proposed antidegradation approach.*

Alternative 5

Alternative 5 would require all operations to develop individual FWQMPs. The alternative also would require individual surface and groundwater monitoring. Implementation of FWQMPs would constitute BPTC. Results of surface and groundwater quality monitoring could be used to determine effectiveness of BPTC and/or whether discharges are causing degradation. *Alternative 5 is consistent with the proposed antidegradation approach.*

B. Predicted Effectiveness of Administration Based on Existing Programs

This section discusses how effectively the Central Valley Water Board could administer the alternatives. This discussion is based on information collected from similar existing programs. For example, where alternatives would allow for third-party group lead entities, this discussion uses information on existing third-party run programs. This evaluation is conducted irrespective of current program funding, as costs are evaluated below in the Economic Impacts section.

Alternative 1

Alternative 1 would be continuation of the current program. Under the current program, third-party water quality coalition groups have organized, enrolled growers, collected fees, collected water quality data, and reported to the Central Valley Water Board. In the current program, coalition groups have worked with the Central Valley Water Board to develop SQMPs where applicable water quality objectives have not been met. These plans have been developed for watersheds throughout the Central Valley. Currently, coalition groups are implementing management plans. It will take time to evaluate whether the plans are effective at improving water quality.

The current program also requires management practice verification and efficacy evaluation. Coalition groups have attempted to track the progress of management practice implementation through the results of periodic surveys sent to growers. In general, coalition groups have had difficulty gathering and analyzing information from enrolled growers. This is attributable in part to a lower return rate than expected on surveys, as coalition groups do not have regulatory authority to require that growers provide responses to information requests. The lack of regulatory authority also may hinder expeditious implementation of management practices in areas where management plans have been developed. This is a concern for the Central Valley Water Board because the implementation of practices is the chief means for improving water quality.

Enforcement of program requirements is the Board's responsibility. The authorities of the Central Valley Water Board are directly linked to individual discharging entities, e.g., growers with tailwater discharges. The Central Valley Water Board does not have any direct enforcement authority over a third-party group that is not responsible for the waste discharge (i.e., the Board cannot take enforcement against the coalition). Also, in the current program, the Central Valley Water Board does not have access to information linking individual growers to implemented management practices, operations, or specific discharge information. This makes enforcement of program requirements difficult, as the Board does not have a direct relationship with individual growers (e.g., practices in place, distances to water bodies).

Alternative 2

Alternative 2 would continue the current program's established third-party (coalition) framework for regulating irrigated agricultural lands.

Alternative 3

Alternative 3 proposes a significantly different administrative framework from Alternatives 1 and 2. Under Alternative 3, growers would apply for enrollment and submit individual FWQMPs and monitoring information directly to the Central Valley Water Board. The current third-party framework would not continue to administer the program, but could continue as third-party certification entities. The third-party certification entities would be approved by the Central Valley Water Board to review and certify grower-developed FWQMPs. The third parties also could conduct grower site inspections.

The type of individual attention required to administer this alternative—enrolling individual growers, reviewing and certifying plans, inspection, negotiating individual monitoring, and review of monitoring—s a concern, considering that there are an estimated 34,000 (see Section III.A.2, Industry Summary) growers in the Central Valley. The Central Valley Water Board or certification entity would need to review, certify, and negotiate monitoring for more than 560 FWQMPs per month to certify all plans within 5 years. The Board also would need to review up to 34,000 individual monitoring reports annually and inspect 5 percent (1,700) of growers annually.

Administration and individual certification of FWQMPs, negotiation of monitoring, inspection, and review of individualized monitoring would be similar to the certification and inspection program for organic farms. Third-party certification agencies such as California Certified Organic Farmers (CCOF) provide certification, monitoring, and inspection for organic farms. To do this CCOF employs one individual per 23 clients[37] (or organic growers). CCOF takes an average of 3 to 6 months to review and certify an organic farm once the application has been received. If the Central Valley Water Board or other third-party entity were to implement this alternative, a staffing ratio similar to the organic certification program may be necessary to negotiate and certify FWQMPs, review monitoring, and conduct inspections in a timely manner (up to 1,500 personnel based on the CCOF ratio). However, this staffing ratio is considered a significant overestimate because CCOF's program includes a higher inspection/review frequency than Alternative 3 (comprehensive annual inspection frequency versus 5 percent annual inspection frequency). Staffing requirements for Alternative 3 likely would be between that described for Alternative 5 (see below) and the estimate based on CCOF's staffing ratio.

Alternative 4

Administration and implementation of Alternative 4 would be similar to Alternative 3, where growers would apply for enrollment directly with the Central Valley Water Board and develop individual FWQMPs. The current third-party framework would not continue to administer the program but would conduct regional monitoring, provide grower education, and potentially conduct grower site inspections. Key differences of Alternative 4 are listed below.

- Individual FWQMPs would be developed by growers, but would not be certified (FWQMPs would be reviewed as part of an inspection process).
- The alternative would implement a tiering system using monitoring data and other information (e.g., geophysical parameters, pesticide/fertilizer use) to prioritize requirements.
- 15 hours of farm water quality training is required for irrigated agricultural owners/operators.
- Regional and/or individual surface and groundwater monitoring would be required.

The administration framework of Alternative 4 is similar to the Central Coast Water Board's ILRP, where growers enroll directly with the Water Board and third-party entities conduct regional monitoring for growers. However, the Central Coast Water Board's program is not similar in scope to the Central Valley Water Board's program. Table 16 provides a summary of the differences between the programs.

[37] Estimate based on discussion with CCOF representatives.

Table 16. Scope of Central Coast and Central Valley Water Board ILRPs

	Central Valley	Central Coast
Estimated irrigated acres	7,529,621[a]	591,000
Estimated operations	34,000	2,500
Current staff members (PY)	17.75	3.5
Operations:staff ratio	1915	714
Irrigated acres:staff ratio	424,204	168,857

[a] Total irrigated agricultural acreage calculations range from 6.5 million (2007 USDA Agricultural Census) to more than 8 million (2006–2008 CA Department of Conservation's Farmland Monitoring and Mapping Program, ECR). Seven million acres is cited here as a measure of the most current information. The ECR, which is the baseline for environmental and economic review (Draft PEIR/Economics Report), estimates approximately 8 million acres of irrigated agricultural lands in the Central Valley.

Central Coast Water Board staff and Central Coast coalition representatives have indicated, in discussion with Central Valley Water Board staff, that program difficulties include:

- working with the numerous growers under the program to identify specific sources of water quality problems;
- donducting necessary follow-up and organizing implementation of effective management practices to address identified water quality problems;
- evaluating individual compliance with program requirements; and
- monitoring progress toward improving water quality over time.

These would be chief concerns for Central Valley Water Board implementation because of the numerous growers and large land area in relation to the smaller Central Coast program. It is estimated that 48 staff members would be necessary to administer in the Central Valley a program similar to that of the Central Coast Water Board. This approximation was developed using the ratio of Central Coast Water Board staff to estimated growers (3.5:2500). This is a low estimate considering that the Central Coast Water Board's current program does not establish a tier system, inspection program, groundwater monitoring, or certified nutrient management plan requirements.

Alternative 5

Under Alternative 5, growers would apply for enrollment with the Central Valley Water Board, develop individual FWQMPs, conduct individual monitoring, and submit data and reports directly to the Central Valley Water Board. The current third-party framework would not continue to administer the program, conduct monitoring, or provide other support.

Alternative 5 is based on the Central Valley Water Board's Dairy Program. There are approximately 1,400 Central Valley dairies enrolled under the Dairy Program.

The Central Valley Water Board employs 15 staff members to administer and enforce the Dairy Program. It is estimated that 360 staff members would be necessary to administer Alternative 5. This approximation was developed using the ratio of Dairy Program staff to the estimated number of dairy operations (15:1400).

The Dairy Program has effectively enrolled Central Valley dairies (over 90 percent compliance), implemented individual monitoring, and required the development of nutrient management at the farm level.

C. Economic Impacts

The CWC and goals of the long-term ILRP require that costs, economic impacts, and sources of funding be considered when developing a new regulatory program for agriculture. The Central Valley Water Board's contractor, ICF International, and subcontractors Mark Roberson, Ph.D., TCW Economics, and Stephen Hatchett, Ph.D., conducted an analysis of these issues (ICF International 2010). Overall, the analysis estimates the costs and associated economic effects of each alternative on irrigated agricultural operations and the State. To consider the complexities of the five programmatic alternatives, including the potential for multiple direct and indirect economic effects, the analysis relies on the application of analytical tools (models) to estimate potential effects of the estimated costs to agriculture and affected regional economies.

In this summary, the overall findings of the Draft ILRP Economics Report are discussed in light of evaluating the alternatives. The reader is directed to the Draft ILRP Economics Report for additional information concerning the methods, assumptions, and results of the economic analysis. The evaluation of each alternative, to determine consistency with Goal 3 of the Program, is based on a measure of change from the current program (Alternative 1) because many of the costs of Alternative 1 have already been incurred. This also permits a degree of consistency with the baseline for the PEIR analysis because that baseline is the existing conditions as determined in the ECR at a point where the current ILRP requirements were already in place.[38]

1. Estimated Costs

Estimated total annual costs for each alternative are summarized in Table 17 (from Tables 2-18 through 2-22 of the economics report). (As indicated above, the reader is directed to the economics report for more detailed information on costs.) Most of the costs for the alternatives are attributable to the estimated cost of implementing management practices. In Alternatives 1, 2, and 4 the estimated

[38] Costs associated with Alternative 1 admittedly include both costs that already have been incurred since the program was implemented in the early 2000s and incremental costs that have not yet been realized. These incremental costs would be associated with implementing water quality management practices to achieve current program goals. Consideration is given to the impact of these incremental costs in the discussion of Alternative 1 that follows.

costs for implementing management practices are more than 90 percent of the total costs. In Alternatives 3 and 5, the estimated costs for implementing management practices are 82 and 72 percent of the total costs, respectively.

Because the ILRP would not specify a set of required management practices, estimating the costs of management practices for the long-term ILRP is complex and imprecise. The CWC, in fact, prohibits the Water Board from specifying the manner of compliance with water quality requirements [Section 13363]. As a consequence, the Central Valley Water Board had to make a set of assumptions about the types of water quality management practices that irrigated agricultural operations would likely implement to solve existing water quality problems. For example, in areas with multiple surface water quality problems, it is assumed that aggressive source control measures (e.g., pressurized irrigation, tailwater return) would be implemented. It is unknown, however, whether the assumed types of practices actually would be needed. To illustrate how this uncertainty may affect the economic analysis, Appendix A of the economics report indicates that estimated costs for pasture lands would be reduced by 61 percent if tailwater return systems were not implemented—as assumed in the current cost scenario.

It is generally presumed that operations initially would select the least expensive types of practices to be in compliance. If these practices solve the water quality problem, potentially more expensive, structural practices presumably would not be necessary. Furthermore, some of the structural hardware practices assumed to be implemented for purposes of the economic analysis are likely to be implemented in the future even without the ILRP in response to increasing water supply reliability concerns throughout the Central Valley. Because this iterative decision-making process in which less expensive practices are implemented first could not be captured fully in the cost analysis, the estimated costs presented in Table 17 for the alternatives likely overestimates the actual costs of implementation. As a result, the estimated costs in Table 17 for implementing management practices should be considered an estimate of *potential*, not required, costs of the program for implementing specific practices.

As shown in Table 17, the estimated costs associated with Alternatives 1, 2, and 4 are similar (less than 10 percent difference between them). Costs associated with Alternative 3 would be higher than Alternative 1 by approximately 20 percent. Much of the additional cost in Alternative 3 is attributable to increased administration costs associated with the Central Valley Water Board administration and certification of individual water quality plans, and higher monitoring costs than Alternative 1. Alternative 5 costs are estimated to be much higher (about 176 percent) than those under the current program, primarily because of individual monitoring costs and mandated certified nutrient management.

Table 17. Summary of Average Estimated Annualized Costs ($000,000) by Alternative

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Total administration (planning, etc.)	5.4	6.5	70	20	67
Monitoring	6.8	10.6	35	23	302
Management practices	466	468	468	468	952
Total	**478**	**485**	**574**	**511**	**1,321**
Percent Change from Alternative 1	0	1.4	20	7	176
Source: Irrigated Lands Regulatory Program Economics Report Totals may not exactly equal the sum of individual cost categories as a result of rounding.					

Full implementation of Alternative 1 is considered the continuation of the existing program (i.e., Alternative 1 would continue in the absence of the long-term ILRP). As described above, management practice costs account for much of the estimated costs in Table 17. Because the base condition for the cost analysis, as gathered for the ECR, reflects conditions from the early 2000s before significant implementation of Alternative 1 occurred, a substantial portion of the $466 million in estimated annual costs for management practices under Alternative 1 likely has already been incurred by growers. Also, because the cost of management practices would be similar for all alternatives, except Alternative 5, the costs presented in Table 17 likely overstate the annual cost in the future for all of the alternatives.

2. Consideration of ILRP Goal 3—Economic Impacts

In this section, results of the economic analyses are considered to evaluate whether the long-term program alternatives are consistent with Goal 3, which is to:

> *"Maintain the economic viability of agriculture in California's Central Valley."*

Determining the economic viability of agriculture involves considering the magnitude of relative changes in certain quantitative economic indicators in the context of current and likely future economic conditions for the industry. Quantitative analyses of economic indicators include estimated changes in farm income and production, and secondarily, estimated employment effects on the farm economy in affected regions.

The long-term ILRP also would indirectly affect other sectors of the economy in the Central Valley besides agriculture. Spending associated with constructing and maintaining equipment needed for implementing water quality management practices would contribute to supporting jobs in the regional economy; however, the shift in spending to construct and maintain equipment would negatively affect other sectors of the regional economies. These potential effects on other sectors of the regional economy were quantified in the economics analysis and report but are not identified in this summary.

It should be noted that the long-term ILRP also would have beneficial economic effects that cannot easily be quantified. Important examples of these benefits are (1) reduced water supply and treatment costs associated with improvements in water quality for irrigation and drinking; (2) reduced costs for maintaining irrigation ditches and canals associated with less erosion; and (3) reduced pumping and water supply costs associated with reductions in water usage.

In general, the ILRP would institute requirements that include: (1) the implementation of water quality management practices to control sources of waste discharge from irrigated agricultural operations, (2) monitoring, and (3) reporting. The Central Valley Water Board recognizes that under all of the alternatives, these requirements would increase production costs. The resulting reduced profitability may affect an individual grower's economic viability, and, in some cases, result in the loss of agricultural land from production.

When profitability is reduced, loss of production can occur at a range of scales, from individual fields, to farms, and potentially to substantial portions of an agricultural sector. Loss of production on an individual scale is not likely to undermine agricultural viability throughout the region. Therefore, to determine compatibility with Goal 3, the Board has considered each alternative's impact on the overall viability of Central Valley agriculture. To do so, it has evaluated whether an alternative's costs are likely to have a widespread destabilizing effect on a particular sector of the agricultural economy. The indicators used to assess this effect in each affected basin (Sacramento, San Joaquin, and Tulare Lake) include: changes in total irrigated acreage, changes in the total value of agricultural production, changes in total net revenue in agricultural sectors, and changes in jobs in affected agricultural sectors.

The Central Valley Water Board also considered the estimated effects of the alternatives on the regional economies that are directly and indirectly linked to irrigated agriculture. Although this analysis is not directly pertinent to Goal 3, it is relevant to disclosure of the full range of economic impacts of the ILRP alternatives on regional economies. Results of analyzing the impacts on the regional economies are described in the economics report.

Lastly, a qualitative-based procedure is used to evaluate the consistency of changes attributable to the alternatives with program goals and objectives. Using this indicator-based qualitative approach, alternatives are deemed consistent, partially consistent, or not consistent with the program goal of "maintaining the economic viability of agriculture in the Central Valley."

Alternative 1

Alternative 1 represents a continuation of the current program. The following results compare Alternative 1 to an existing base condition of irrigated crop production and income that reflects the early 2000s prior to substantial implementation of the current program. As described above in the Estimated Costs section, the costs presented in Table 17 likely overestimate the incremental costs associated with implementing Alternative 1 because the base conditions are from the early 2000s. In some cases, the estimated cost of implementing water quality management practices (which is the major share of costs, i.e., more than 90 percent) may not be applicable because the practices have already been implemented. Also, the practices assumed for implementation in the analysis are not required by the long-term ILRP, and less expensive practices are likely to be implemented to solve water quality problems under all of the alternatives.

Economic modeling for the long-term ILRP has been conducted to predict impacts on irrigated agriculture by estimating change in production acreage and value of production based on increased costs. Results are reported by general crop category and basin (Sacramento River, San Joaquin River, Tulare Lake). Table 18 provides a summary of the crop types within the general categories.

Table 18. Crop Category Definition

Abbreviated Crop Category	Aggregated Crop Category	ECR Crop Category
FFGO	Field, Forage, Grain, Other	Field Crops, Grain and Hay, Irrigated Pasture, Rice, Cotton
ORVIN	Orchard, Vineyard	Citrus and Subtropical, Deciduous Orchard, Vineyard
VEGT	Vegetable, Truck	Vegetable and Truck
Source: Irrigated Lands Regulatory Program Economics Report Idle (IDLE) and Semi-agricultural and Incidental (SEMI) were not included in the aggregated crop categories.		

Analysis of farm income and production suggests that production acreage under full implementation of Alternative 1 would be reduced by approximately 395 thousand acres, or 5.0 percent, compared to the early 2000s base condition. The change in production acreage by crop category between full implementation of Alternative 1 and the base condition is greatest in the FFGO crop category, with a total reduction of approximately 384 thousand acres across basins, or 8.0 percent, accounting for 97 percent of the total estimated change. The change in acreage in VEGT and ORVIN was considerably smaller, approximately 6 and 4 thousand acres (0.9, 0.2 percent), respectively.

The value of annual production is estimated to decline by approximately $336 million, or 2.5 percent, compared to the existing condition. Changes in the value of production were greatest in the FFGO crop category, with an estimated total reduction of approximately $304 million, or 8.2 percent across basins, accounting for 90 percent of the total predicted change. The change in the value of annual production in VEGT and ORVIN was considerably less, approximately $19 and $13 million (0.9, 0.2 percent), respectively.

The overall reduction in estimated production acreage and value associated with the full implementation of Alternative 1 would be concentrated on the FFGO crop category. Because cost estimates of the management practices likely overestimate the actual costs of the program, the resulting effect on production and crop value also are likely overestimated. As stated in Section 3.4.1.1 of the economics report:

> *"…management practices assumed to be implemented for the analysis are relatively expensive, especially for lower–revenue crops in the FFGO category. As a result, crops such as irrigated pasture, hay, and some small grains would have difficulty supporting such costs. The analysis indicated large reductions in their acreages in the regions where those costs were incurred. Irrigated pasture, hay, and other field crops (excluding rice and cotton) accounted for over 95 percent of the acreage reduction shown in Table 3–7. To the extent growers of these crops could identify less expensive ways to comply, such as avoiding the use of certain pesticides, the acreage and revenue impacts would be substantially reduced. For example, Appendix A describes how a lower–cost management practice on irrigated pasture would affect direct costs. Further, sensitivity analysis using CVPM indicated that if grower costs per acre for FFGO crops were reduced by 50 percent, the total acreage impact in Alternative 1 would be reduced by 75 percent."*

Full implementation of Alternative 1 is considered the "no-change" condition (i.e., Alternative 1 would continue in the absence of the long-term ILRP). Even so, under this alternative there likely would be a loss of individual operations and production acreage.[39]

From the perspective of the regional agricultural economies, reductions in agricultural production and increases in compliance spending under Alternative 1 would result in agriculture-related job losses in all three basins. Estimated job reductions in agricultural sectors would be 1,180 jobs in the Sacramento River Basin region, 881 jobs in the San Joaquin River Basin region, and 238 jobs in the Tulare Basin region. Most of the job losses would occur in the FFGO sector as a result of reductions in irrigated field crop acreage. These agriculture-related losses would be offset somewhat by increased spending in other industrial sectors driven by program compliance and management practice implementation.

[39] The Central Valley Water Board has considered the potential consequences of these impacts; described further in the economic analysis.

The above estimated losses are a concern for the Water Board, and potentially could be reduced substantially by implementing less expensive management practices and by taking advantage of available funding mechanisms (see Potential Funding section below). Because many of the management practices are believed to have been implemented already, or would be implemented even without a long-term ILRP, these estimated effects are not expected to have a widespread destabilizing effect on a particular sector of the agricultural economy or undermine the overall viability of Central Valley agriculture. *Alternative 1 is consistent with maintaining the economic viability of agriculture.*

Alternative 2

Alternative 2 would impose additional costs for new program requirements, monitoring, and oversight. Tables 19 and 20 show the estimated changes in production acreage and value by basin relative to full implementation of Alternative 1. As shown in the tables, under Alternative 2, production acreage is estimated to decrease by an additional 0.2 percent. From the perspective of the regional agricultural economies, reductions in agricultural production under Alternative 2 would result in relatively minor additional job reductions in the agricultural sectors in all three basins, compared to Alternative 1. Changes in employment would include reductions of 10 jobs in the Sacramento River Basin region, 43 jobs in the San Joaquin River Basin region, and five jobs in the Tulare Basin region. Similar to Alternative 1, these job losses in the agricultural sector would be somewhat offset by increased spending in other industrial sectors driven by program compliance and management practice implementation, Combined across all three basins, employment changes in agricultural sectors would result in a decrease of 58 jobs.

The estimated reduction in production acreage, value, and agriculture-related jobs under Alternative 2 is not appreciably different from under Alternative 1. *Therefore, Alternative 2 is consistent with maintaining the economic viability of agriculture.*

Alternative 3

Tables 19 and 20 show the estimated changes in production acreage and value by basin relative to full implementation of Alternative 1. As shown in the tables, under Alternative 3, production acreage and value are estimated to decrease an additional 0.8 and 0.3 percent, respectively. Changes in agriculture-related employment would include reductions of 108 jobs in the Sacramento River Basin region and 98 jobs in the San Joaquin River Basin region; there would be an estimated net increase of seven jobs in the Tulare Basin region as a result of compliance spending affecting agricultural sectors. Similar to Alternative 1, the job losses in the agricultural sector in the Sacramento River and San Joaquin River Basin regions would be offset somewhat by increased spending driven by program compliance and management practice implementation in non-agricultural sectors. Combined across all three basins, employment changes in agricultural sectors would result in a decrease of 199 jobs.

The estimated reduction in production acreage and value under Alternative 3 is not appreciably different from under Alternative 1. However, the estimated reduction of 199 agriculture-related jobs is a concern. While the estimated losses are not expected to have a widespread destabilizing effect on Central Valley agriculture, the loss of agriculture-related jobs could have local and regional destabilizing economic impacts. *Therefore, Alternative 3 is partially consistent with maintaining the economic viability of agriculture.*

Alternative 4

As shown in Tables 19 and 20, under Alternative 4, overall production acreage and value are estimated to decrease by an additional 0.2 and 0.1 percent, respectively. Changes in agriculture-related employment would include reductions of 26 jobs in the San Joaquin River Basin region, and net increases of nine jobs in the Sacramento River Basin region and 26 jobs in the Tulare Basin region as a net result of compliance spending on jobs. Similar to Alternative 1, the job losses in the agricultural sector in the San Joaquin River Basin would be offset somewhat by increased spending in non-agricultural sectors driven by program compliance and management practice implementation, Combined across all three basins, employment changes in agricultural sectors would result in a net increase of an estimated nine jobs (Table 21).

The estimated reduction in production acreage, value, and agriculture-related jobs under Alternative 4 is not appreciably different from under Alternative 1. *Therefore, Alternative 4 is consistent with maintaining the economic viability of agriculture.*

Alternative 5

Tables 19 and 20 show the estimated changes in production acreage and value by basin relative to full implementation of Alternative 1. As shown in the tables, under Alternative 5, production acreage and value are estimated to decrease by an additional 4.4 and 2.1 percent, respectively. In terms of production acreage and value, this reduction equates to a loss of an additional 297,700 acres of irrigated agricultural operations and 269 million dollars per year in production value.

While the estimated additional reductions in production acreage and value, by themselves, do not appear severe, they would be in addition to estimated reductions in production acreage and production value associated with the "fully implemented" Alternative 1 of 395 thousand acres and 336 million dollars per year, respectively. As described above, the reductions associated with Alternative 1 likely overestimate the actual effects primarily because it is believed that growers will implement more cost-effective measures than those assumed for the analysis. However, the additional losses described for Alternative 5 versus Alternative 1 are most likely not an overestimation. The estimated additional costs are not associated with assumed management practices but reflect the costs of required administration and monitoring.

Much of the estimated reduction in production acreage is in the FFGO category. Because the FFGO category contains crop types with low production value per acre (see economics report), the estimated losses may affect a single crop type even more severely than what is estimated for the category (e.g., irrigated pasture—heavily affected, versus rice—less affected).

Under Alternative 5, changes in agriculture-related employment would include estimated reductions of 880 jobs in the Sacramento River Basin region, 714 jobs in the San Joaquin River Basin region, and 34 jobs in the Tulare Basin region. Similar to Alternative 1, these job losses in the agricultural sector would be somewhat offset by increased spending in non-agricultural sectors driven by program compliance and management practice implementation, Combined across all three basins, employment changes in agricultural sectors would result in a decrease of an estimated 1,628 jobs (Table 21).

Under Alternative 5, the reduction in production acreage, value, and agriculture-related jobs in the three basins is a concern for the Water Board that potentially could be reduced by implementing less expensive management practices and by taking advantage of available funding mechanisms (see Potential Funding section below). However, implementation of the alternative could have a widespread destabilizing effect on Central Valley agriculture (especially for lower-profitability FFGO crop types). *Alternative 5 is not consistent with maintaining the economic viability of agriculture.*

Table 19. Summary of Changes in Total Irrigated Acreage (000) by Basin from Alternative 1

Basin	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Sacramento River	-1.9	-23.8	-0.3	-140.7
Percent Change	-0.1%	-1.3%	-0.02%	-7.4%
San Joaquin River	-8.9	-25.6	-12.3	-125.8
Percent Change	-0.5%	-1.5%	-0.7%	-7.5%
Tulare Lake	-0.4	-2.9	-1.0	-31.1
Percent Change	-0.0%	-0.1%	-0.0%	-1.0%
Total	-11.2	-52.3	-13.6	-297.7
Percent Change	-0.2%	-0.8%	-0.2%	-4.4%
Source: Irrigated Lands Regulatory Program Economics Report Totals may not sum as a result of rounding.				

Table 20. Summary of Changes in Total Value of Production ($000,000) by Basin from Alternative 1

Basin	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Sacramento River	-1.3	-18.3	-4.5	-118.4
Percent Change	-0.0%	-0.6%	-0.1%	-3.6%
San Joaquin River	-5.5	-19.2	-9.2	-108.1
Percent Change	-0.2%	-0.6%	-0.3%	-3.2%
Tulare Lake	-0.6	-3.3	-1.2	-42.2
Percent Change	-0.0%	-0.1%	-0.0%	-0.7%
Total	-7.4	-40.9	-14.9	-268.7
Percent Change	-0.1%	-0.3%	-0.1%	-2.1%
Source: Irrigated Lands Regulatory Program Economics Report Totals may not sum as a result of rounding.				

Table 21. Summary of Changes in Agriculture Sector Jobs by Basin from Alternative 1

Basin	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Sacramento River	-10	-108	9	-880
San Joaquin River	-43	-98	-26	-714
Tulare Lake	-5	7	26	-34
Total	-58	-199	9	-1628
Source: Irrigated Lands Regulatory Program Economics Report Represents net impacts on jobs (full- and part-time) in agricultural sectors resulting from changes in agricultural production and compliance-related spending.				

3. Potential funding

The economics report describes potential funding for irrigated agricultural operations. As indicated in the report, funding that is targeted toward lands, crops, or growers having the greatest potential for losses and economic hardship would be most effective at reducing the impact. Many of the funding mechanisms would help reduce and defray costs associated with implementing water quality management practices, thereby reducing the economic impact of the alternatives. Potential funding mechanisms include those listed below.

- Federal Farm Bill—Title II of the 2008 Farm Bill (the Food, Conservation, and Energy Act of 2008, in effect through 2012) authorizes funding for conservation programs such as the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program.
- The State Water Board, Division of Financial Assistance, currently administers two programs that improve water quality: the Agricultural Drainage Management Loan Program and the Agricultural Drainage Loan Program. Both of these programs were implemented to address the

management of agricultural drainage into surface water. The State Water Board also administers CWA funds that can be used for agricultural water quality improvements.

- The Agricultural Water Quality Grant Program provides funding to reduce or eliminate the discharge of nonpoint-source pollution from agricultural lands into surface and groundwater. It is funded through bonds authorized by Proposition 84.
- The State Water Pollution Control State Revolving Fund Program also has funding authorized through Proposition 84. It provides loan funds to a wide variety of point source and nonpoint-source water quality control activities.
- Other funding programs, including Integrated Regional Water Management grants that were authorized and funded by Proposition 50 and now by Proposition 84.
- Potential funding provided by the Safe, Clean, and Reliable Drinking Water Supply Act of 2010, passed by the Legislature as SBx7-2, and if approved by voters in November 2010, would provide grant and loan funding for a wide range of water-related activities, including agricultural water quality improvement, watershed protection, and groundwater quality protection.

D. Environmental Impacts

The Central Valley Water Board's current ILRP establishes that the Board will develop a PEIR for a long-term ILRP that will protect State waters. The purpose of the PEIR is to provide State and local agencies and the general public with detailed information on the significant environmental impacts that proposed long-term ILRP alternatives are likely to have and to list ways to avoid or mitigate those impacts.

The Central Valley Water Board developed the 2010 *Draft Irrigated Lands Regulatory Program Program Environmental Impact Report* (Draft PEIR) with assistance from environmental consultant ICF International (ICF International 2010). The Draft PEIR programmatically evaluates the environmental impacts of the five alternatives described in the Alternatives Document (Appendix A). In most CEQA documents, the lead agency has identified the proposed project as the "preferred project", which receives a more detailed environmental evaluation than the other alternatives. However, in the ILRP Draft PEIR, no preferred project has been identified by the Central Valley Water Board. The Central Valley Water Board agreed to equally evaluate all five alternatives developed by the Stakeholder Advisory Workgroup as part of the process to identify a preferred alternative. The potential environmental impacts of each of the five alternatives have been equally analyzed to determine and compare anticipated impacts. The overall results of the Draft PEIR are summarized in this section and were considered in the development of the recommended long-term ILRP. The reader is directed to the Draft PEIR for in-depth discussion regarding the environmental impacts of the long-term ILRP alternatives.

1. Potentially Significant Impacts Common to All Alternatives

In general, potential environmental impacts of long-term ILRP alternatives are associated with implementation (e.g., construction and operation) of water quality management practices and construction of monitoring wells. In developing the Draft PEIR, the Central Valley Water Board has assumed that irrigated agricultural operations would implement management practices in areas throughout the region to address water quality concerns. The management practices analyzed, as shown below, are not a mandatory part of any alternative but are identified in the Draft ILRP Economics Report as practices likely to be implemented to meet water quality and other management goals on irrigated lands, including fields, managed wetlands, and nurseries. The analyzed management practices are representative of those most likely to have environmental and economic impacts. These water quality management practices include:

- nutrient management;
- improved water management;
- tailwater recovery system;
- pressurized irrigation;
- sediment trap, hedgerow, or buffer;
- cover cropping or conservation tillage; and
- wellhead protection.

The above practices may be implemented to a similar degree under any of the five alternatives; therefore, associated environmental impacts are not expected to vary widely. The reader is directed to the ECR for more detail on the above practices and other potential practices. Water quality information from the ECR (e.g., pesticide/nutrient levels) has been used to provide spatial focus for implementation of management practices. For example, it is assumed that a mixture of the above types of practices (pressurized irrigation, etc.) likely would be implemented in an area with high levels of chlorpyrifos, while additional practices would not necessarily be implemented in areas without water quality concerns. Details of the process used to estimate the spatial implementation of management practices are discussed in the Draft ILRP Economics Report.

Potentially significant impacts can also occur in the process of drilling groundwater monitoring wells. Alternatives 2, 4, and 5 would require groundwater monitoring. Under Alternatives 2 and 4, it has been assumed that groundwater monitoring would be conducted mainly using existing wells. It is assumed that Alternative 5 would involve installation of a substantial number of new monitoring wells.

Water quality management practices that involve construction or disturbance of land have the potential to cause environmental impacts, as do those that limit or redirect existing surface water flow patterns. For example, construction of a tailwater recovery system would involve excavation, use of pumping equipment, and ongoing maintenance.

Because the Draft PEIR is a program-level analysis, there are limitations involved with determining the potential significance of these types of impacts. These limitations are discussed below.

- The long-term ILRP would not specify required practices; therefore, it is uncertain which of the above practices, if any, would be implemented in a particular location. Growers will choose from the many available management practices to meet water quality goals; some practices may be inappropriate for some crop types, soil conditions, or other considerations.
- Most impacts associated with management practices and construction of monitoring wells would be potentially significant only in areas with sensitive resources (e.g., endangered species habitat, sensitive plant communities).

Considering the above limitations, the programmatic analysis estimates the types of practices that may be implemented and potential impacts of those practices. The environmental impacts estimated as potentially significant at a programmatic level in the Draft PEIR would only be potentially significant at a project level in certain areas or under certain conditions (e.g., increasing particulate matter in air in a nonattainment area as a result of diesel emissions). The combination of a grower's choice of management practice and where that practice is implemented may result in significant environmental impacts under certain conditions for the following resource areas:

- Cultural resources (potential loss of resources from construction and operation of practices and monitoring wells)
- Noise and vibration (exposure of sensitive land uses to noise from construction and operation of practices and monitoring wells)
- Air quality (generation of construction and operational emissions from management practices and monitoring wells)
- Climate change (cumulative: potential increase in greenhouse gas emissions)
- Vegetation and wildlife (loss of habitat, wildlife, and wetland communities from reduced surface water discharge and construction and operation of practices and monitoring wells)

- Fisheries (loss of habitat from construction of management practices and monitoring wells, and toxicity attributable to coagulant additives)

* The above is a generalized summary of affected resource areas. The reader is directed to the Draft PEIR for specific impacts and discussion.

In practice, the impacts described above can be reduced to a less than significant level through the employment of alternate practices (e.g., altered use of a pesticide rather than construction of a tailwater return system) or by choosing a location that avoids sensitive areas (e.g., installing a sedimentation basin in a portion of the property that is already developed rather than in an area that provides riparian habitat). Where no alternate practice or less sensitive location for the practice exists, irrigated agricultural operations that choose to employ these practices would be directed to avoid impacts to sensitive resources by following project-level mitigation measures that will be required for a grower to qualify for coverage under the implementation mechanism (e.g., WDRs/ waivers) of the chosen ILRP alternative. Specific mitigation measures will be identified[40] in conjunction with the Board's development of the ILRP implementation mechanisms. Performance standards for development of such mitigation, and program-level mitigation measures, are discussed in each resource section of the PEIR.

It is also very important to note that although there may be instances of site-specific impacts from these practices, there also are positive environmental benefits at a regional scale that should be considered. A few examples of these environmental benefits are reduction of toxic air contaminants (TACs) through reduced fertilizer and pesticide applications; reduction of diesel pumping emissions through improved water management; reduction of fugitive (PM10/PM2.5) dust by reducing the amount of exposed soil (cover cropping); and potential for increased surface water flows resulting from improved water management.

Another factor in considering the potential impacts of this program is that many of the practices could be adopted for other or multiple reasons. For example, wellhead protection is required by the DPR; the San Joaquin Valley Air Pollution Control District requires growers to select conservation management practices that protect air quality, but would also protect water quality (e.g., cover crops); and growers may make a business decision to improve their water, pesticide, and nutrient management practices to reduce costs.

Protection of water quality is the primary mission of the Water Boards. As described in the ECR, and in Section III.C of this report, there are numerous water bodies in the Central Valley that currently do not meet water quality

[40] Such mitigation measures will include those identified in the PEIR and may include other mitigation measures necessary to meet the mitigation performance standards described in the PEIR. Should any additional identified mitigation measures potentially cause environmental impacts, additional environmental impact analysis will be conducted.

objectives. Implementation of water quality management practices and associated monitoring to determine whether practices are effective is the only way to meet project goals of restoring and/or maintaining the highest reasonable water quality and maintaining the viability of Central Valley agriculture. The following programmatic mitigation will be required as part of any Central Valley Water Board ILRP policy, or implementation mechanism, in order to meet ILRP water quality goals and prevent significant environmental impacts on sensitive resources.

> *Where an irrigated agricultural operation/third-party group determines that a proposed management practice/monitoring well may affect a sensitive resource, the ILRP will require that the irrigated agricultural operation/third party either (1) select a different management practice (or location of practice/monitoring well) that meets water quality goals, but does not involve impacts on a sensitive resource; (2) implement the mitigation measures described in the implementation mechanism* (e.g., WDRs/ waiver) *for the potentially affected resource; or (3) work with the Central Valley Water Board to obtain an individual waste discharge permit and site-specific CEQA analysis.*

Inclusion and implementation of this requirement in ILRP implementation mechanisms would reduce the significant impacts described above, except for climate change, to less than significant. Due to the unavailability of enforceable mitigation, the identified impacts to the area of climate change,[41] which may result from anticipated regulatory compliance actions, are considered significant and unavoidable at the programmatic level.

2. Alternative-Specific Potentially Significant Impacts

In addition to the above impacts, there are a number of potentially significant impacts that are specific to alternatives. Resource areas that have alternative-specific potentially significant impacts are:

- hydrology and water quality (contribute to degradation of groundwater—Alternative 1), and
- agriculture resources (loss of farmland from increased regulatory costs).

Hydrology and Water Quality

Alternative 1 would involve full implementation of the current ILRP. The Draft PEIR indicates that the surface water focus of Alternative 1 may lead to continued degradation of groundwater from agricultural practices. This potentially significant impact can be mitigated to less than significant through the development of a groundwater management plan that would be implemented by irrigated agricultural operations. The groundwater management plan would need

[41] There are also significant and unavoidable impacts in the area of agriculture resources. These impacts are described below, under “Agriculture resources.”

to identify practices that would minimize waste discharge to groundwater from irrigated agricultural operations.

Alternatives 2–5 would require development of groundwater management plans—regional for Alternative 2, and individual for Alternatives 3–5. Alternative 2 is essentially Alternative 1 with groundwater management plan requirements. The groundwater management plans identified for Alternatives 2–5 would establish management practices that would work to minimize waste discharge to groundwater. *The measure described as mitigation for Alternative 1 would be a required part of the program under Alternatives 2–5.*

Agriculture Resources

The Economic Impacts section of this report summarizes economic modeling that has been conducted for the long-term ILRP. The modeling estimates economic impacts on irrigated agriculture by estimating change in production acreage and value of production based on increased regulatory costs.

Predicted reductions in production acreage are a concern, not only from the standpoint of economic health, but also from the perspective of agricultural land as a resource. As described in the Economic Impacts section, there is a predicted reduction in production acreage because of increased costs for each of the five alternatives, with the least estimated reduction under full implementation of Alternative 1[42] and the highest estimated reduction under Alternative 5.

A high percentage of the cost of the alternatives would be attributable to implementation of water quality management practices. The predicted reductions in production acreage are considered an overestimation because of (1) lack of information regarding already implemented management practices, (2) the ILRP could not require specific management practices (CWC 13360) (it is likely that operators would implement less expensive practices in order to prevent high costs), and (3) there are funding mechanisms that could help mitigate the cost of management practice implementation (see Section IX.C.3). Nevertheless, there likely will be some reduction in production acreage as a result of increased regulatory costs imposed by the alternatives. Much of the production acreage losses are estimated to be within the FFGO (field crops, grain and hay, irrigated pasture, rice, cotton; see Table 18) crop category. There is a substantial percentage of prime farmland[43] (more than 40 percent) within the FFGO category. The loss of prime farmland production acreage is considered a significant impact. Therefore, each of the alternatives may result in significant environmental impacts on agriculture resources.

[42] Note that baseline conditions for this analysis are early 2000s, coinciding with the information collected in the ECR. Full implementation of Alternative 1 would be realized upon implementation of management practices that would work to solve water quality problems identified in the ECR. The current program, Alternative 1, is considered partially implemented at this time.
[43] Prime farmland is defined in section 5.10.2 of the Draft PEIR.

Mitigation measures to reduce the scope of the impact on agriculture resources include reducing costs of alternatives to irrigated agricultural operations, allowing additional time for implementation, and providing financial assistance. It is not anticipated that these mitigation measures would reduce the predicted environmental impacts to less than significant. Therefore, the impacts identified for agricultural resources are considered significant and unavoidable.

> *Selection of requirements with lower administration and monitoring costs, along with additional time for implementation, and financial assistance programs would work to reduce the scope of this significant impact. Reducing administration and monitoring costs would allow irrigated agricultural operations and the Central Valley Water Board to focus limited resources on implementation of water quality management practices.*

X. RECOMMENDED PROGRAM ALTERNATIVE

In the above evaluation of proposed long-term program alternatives, each alternative was found to achieve some of the program evaluation measures but not others. As is shown in Table 11, of the five alternatives proposed, no single alternative achieved complete consistency with all evaluation measures. However, after review of each of the alternatives and their common elements (lead entity, monitoring type), it is clear that a program that more completely satisfies the evaluation measures can be developed by selecting from the best-performing elements of the proposed alternatives.

A. Best-Performing Program Elements

In this section, the elements of alternatives that best achieve evaluation measures are considered in the development of a recommended program alternative.

1. Waste Discharge to Groundwater

Options: *Include groundwater requirements—Alternatives 2–5*
Do not include groundwater requirements—Alternative 1

All the alternatives except Alternative 1 contain requirements for protecting groundwater from irrigated agricultural waste discharge. Alternative 1 did not fully meet the goals of the long-term ILRP, CWC requirements for protecting beneficial uses, and antidegradation requirements. This is mainly because Alternative 1 would not address waste discharge to groundwater from irrigated agricultural operations.

The Draft PEIR identifies significant environmental impacts on groundwater under full implementation of Alternative 1 mainly because of continued waste discharge to groundwater associated with agricultural operations.

Recommendation: Include groundwater requirements.

2. Implementation Mechanism

Options: *Conditional waiver of WDRs*
WDRs
Conditional Basin Plan prohibition

There are no requirements that establish the type of implementation mechanism for the long-term ILRP. Accordingly, the implementation mechanism could be any of the above.

Program goals and objectives establish that long-term program requirements should be coordinated with other regulatory and non-regulatory programs. Developing implementation mechanisms that are geographically based would facilitate this coordination. Regional water quality planning and monitoring could be coordinated with other programs. Also, this approach would allow for addressing water quality concerns that may have multiple inputs in a watershed or basin. Developing geographically based implementation mechanisms also would allow the Central Valley Water Board to prioritize requirements more effectively, working to provide more targeted water quality protection while reducing costs.

There are some key differences between waivers and WDRs that should be considered in light of developing geographically based implementation mechanisms with prioritized requirements. These differences are:

- ***Waivers:*** must be reviewed every 5 years and lower fees could be established to reflect lower level of staff oversight.
- ***General WDRs:*** do not expire (no required review period).

Because waivers allow for lower fees, they could be most effectively used to implement ILRP requirements in lower-priority areas. Program requirements and fees could be reduced in these areas to help facilitate focusing limited resources in higher-priority areas. The required 5-year review period would provide assurance that waste discharge conditions have not changed in a way that could degrade State waters. General WDRs could be used most effectively in higher-priority areas, allowing the Central Valley Water Board, third-party groups, and irrigated agricultural operations to focus on solving problems instead of renewing regulatory requirements.

Where geographically based general WDRs and waivers are ineffective, individual WDRs could be required. This would provide additional oversight and more clear enforcement mechanisms. Fees also would be higher for individual WDRs, mainly because of the additional oversight.

Recommendation: A series of area-, geographically based, or commodity-based implementation mechanisms with prioritized requirements. Implementation mechanisms could include waivers in low-priority areas and general *WDRs in high-priority areas. Individual WDRs could be developed and implemented as an enforcement tool.*

3. Lead Entity

Options: *Third party established in Alternatives 1 and 2*
Third party established in Alternative 4
Central Valley Water Board established in Alternatives 3 and 5

The range of alternatives contains three different lead entity structures. Alternatives 1 and 2 would be fully implemented by a third party (e.g., water quality coalition group). In Alternative 4, the third party would be responsible for regional monitoring and reporting. In Alternatives 3 and 5, the Central Valley Water Board would be the lead entity. Program goals and objectives and policy requirements do not require that the lead entity be the Central Valley Water Board or a third party.

The environmental and economic impact analyses, summarized in Sections IX.C–D, provide that administration costs should be minimized in order to mitigate the scope of significant environmental impacts on agriculture resources and minimize economic impacts on irrigated agriculture. The administrative costs of the third-party lead entity structure established in Alternatives 1 and 2 are less than the administration costs under Alternatives 3–5.

As described in Section IX.B, enforcement of program requirements can be difficult in the third-party framework. This is because the Board cannot enforce program requirements directly upon the third party; rather, enforcement must be conducted directly upon the irrigated agricultural operation. There may be cases where individual operations may be unaware of third-party non-compliance, and also unaware of program requirements. This potential problem can be mitigated by (1) requiring individual operations to enroll directly with the Central Valley Water Board so that they are aware of the program and requirements, (2) requiring that third-party groups provide the Board with information regarding non-compliant operations, and (3) requiring that third-party groups provide transparency and communication of requirements to growers.

Recommendation: Third-party structure established in Alternatives 1 and 2 with additional structural and third-party transparency requirements described above.

4. Program Organization

Options: *Requirements similar for all operations—Alternatives 1,3,5*
Requirements tiered—Alternatives 2 and 4

Alternatives 1, 3, and 5 would apply requirements in a nature similar to all irrigated agricultural operations. Alternatives 2 and 4 contain systems for prioritizing waste discharges based on monitoring and other threat factors (e.g., pesticide/fertilizer use). Program goals and objectives contain requirements to provide incentives for irrigated agricultural operations to implement water quality management practices. A tiered system would provide these incentives by allowing reduced requirements for lower threat or priority operations.

The environmental and economic impact analyses, summarized in Sections IX.C–D, provide that program costs should be minimized in order to mitigate the scope of significant environmental impacts on agriculture resources and minimize economic impacts on irrigated agriculture. Tiering program requirements would help to reduce costs for some operations; however, administration of a tiering system may be more costly. Tiering systems that would apply to individual growers would be more costly. In order to keep administration costs to a minimum, any tiering system should be geographically based, or generalized to a class of waste discharges.

Recommendation: Establish geographically based tiering system to reduce costs for lower threat areas.

5. Water Quality Management Plans

Options: *Regional water quality management plans—Alternatives 1 and 2*
Individual water quality management plans—Alternatives 3–5

Alternatives 1 and 2 would establish regional water quality management plans in areas where water quality objectives are not being met. Alternatives 3–5 would require that each individual operation develop water quality management plans regardless of whether there is an identified water quality concern (e.g., water quality objectives not being met).

Program goals and objectives establish that long-term program requirements should be coordinated with other regulatory and non-regulatory programs. Regional water quality plans would facilitate this type of coordination. For example, where a water quality problem is attributable to multiple sources, an overarching regional plan could be developed to address the concern.

Antidegradation requirements establish that BPTC must be implemented where degradation of water quality is occurring. Regional and individual water quality plans would work to implement BPTC. However, the approach outlined in Alternatives 1 and 2 would require plans only in areas that already have exceedances of water quality objectives. In order to meet antidegradation requirements, regional plans also should be developed in areas where irrigated agricultural waste discharges are causing degradation.

As described in Section IX.B, it is difficult for the Central Valley Water Board to directly enforce program requirements, such as implementation of management measures, in the third-party regional approach. This is because Board enforcement authority applies to the entity discharging waste to State waters. In the regional water quality management plan approach described under Alternatives 1 and 2, the Board would not have a direct relationship with each irrigated agricultural operation (the entity discharging waste) and would not have information regarding the method(s) and practices the operation has or plans to implement to work toward solving identified water quality concerns. Conversely, the individual water quality management plan approach would provide the information necessary for the Board to directly enforce program requirements. Essentially, operations would be required to implement the management practices identified in the individual water quality management plan.

The environmental and economic impact analyses, summarized in Sections IX.C–D, provide that costs should be minimized. Requiring that every irrigated agricultural operation develop a water quality plan, regardless of whether there are water quality problems, would drive program costs higher and may not necessarily benefit water quality (see Section IX.B, describing difficulties the Central Coast Water Board has had in ensuring individual plans address water quality problems).

> *Recommendation: Regional water quality plans similar to those described in Alternatives 1 and 2 with additional requirements to (1) ensure the plans are designed to implement BPTC to minimize degradation and address exceedances of water quality objectives, and (2) develop individual water quality management plans where regional plans have been ineffective.*

6. Monitoring

Options: *Third-party regional monitoring—Alternatives 1 and 2*
Individual monitoring—Alternative 3
Third-party regional + individual monitoring—Alternative 4
Individual monitoring—Alternative 5

Alternatives 1 and 2 would establish regional monitoring programs. The regional monitoring under these alternatives would not implement a groundwater monitoring program, except in areas that have local groundwater management plans. The individual monitoring under Alternative 3 would not include water quality monitoring. Alternative 4 would include a regional surface and groundwater quality monitoring program in addition to individual monitoring. Alternative 5 would include individual surface and groundwater quality monitoring.

The policy analysis, Sections IX.A.2–4, explains that feedback monitoring is necessary to determine whether management practices are effective (NPS Policy, antidegradation). This is especially important given the iterative nature of each of the alternatives. Regional or individual monitoring therefore should be a component of the long-term ILRP.

The benefits and drawbacks of regional and individual monitoring are described in Section VIII. In general, regional monitoring (1) costs less overall than individual monitoring (see Section IX.C.1, Estimated costs), (2) could be used to determine whether there is a water quality concern and whether implemented practices are effectively addressing these concerns, (3) would not be effective at determining waste contributions of individual operations, and (4) does not easily facilitate determination of whether other sources (e.g., municipal, natural, industrial) of waste are casing a water quality problem, mainly because individual source contributions would be unknown.

There is a need to minimize costs of the long-term ILRP (economic analysis and PEIR, Sections IX.C–D). The individual monitoring proposed in Alternative 5 is very costly. Regional monitoring programs proposed in Alternatives 2 and 4 are less costly than individual monitoring and could be used to provide the required feedback.

Program goals and objectives establish that long-term program requirements should be coordinated with other regulatory and non-regulatory programs. Regional water quality monitoring would facilitate this type of coordination. For example, monitoring conducted by DPR and local groundwater programs could be coordinated with regional monitoring under the long-term ILRP. This would reduce costs and help involved agencies fulfill their missions.

As described above, limitations of regional monitoring programs include the inability to determine individual contributions of waste. This is of particular concern where a water quality problem has been identified and there are multiple sources of the problem, with irrigated agricultural operations being one of the sources. In these situations, irrigated agricultural operations would need to minimize their waste contributions to such water quality problems.

> *Recommendation: Regional surface and groundwater monitoring described in Alternatives 2 and 4 with the understanding that inability of regional monitoring to determine irrigated agricultural waste contributions will not excuse action to work toward minimizing contributions to identified water quality problems. Individual monitoring would be required if the third-party entity fails to provide the necessary information.*

7. Time Schedule for Compliance

The NPS Policy requires the establishment of a time schedule for compliance with water quality objectives. The five alternatives do not establish time schedules for compliance. However, time schedules could be developed in water quality management plans.

Recommendation: Develop a general time schedule that would defer, where appropriate, to more specific time schedules developed as part of water quality management plans.

B. Recommended Long-Term Irrigated Lands Regulatory Program

This section describes the recommend long-term ILRP. The recommended long-term ILRP has been developed from the elements of the five programmatic alternatives evaluated in this report joined with State policy requirements, the findings of the Draft PEIR and economics report, and information developed from the Draft Groundwater Nitrate Summary Report (Appendix B). The rationale for the main components of the recommended program is given in the above section (Section X.A). In addition to the evaluation conducted in this report, the Central Valley Water Board conducted several stakeholder meetings during April and May 2010 to discuss many of the aspects of the recommended long-term program—as a "Straw Proposal." Stakeholder concerns and the above evaluation have been used to identify the most workable long-term ILRP given the numerous constraints.

This section includes the following topics:

- Scope
- Goals and objectives
- Timeframe for implementation
- Implementation mechanism
- Lead entity
- Regulatory requirements
- Monitoring provisions
- Time schedule for compliance

1. Scope

The scope of the long-term ILRP includes all discharges from irrigated lands that could affect the quality of waters of the State in the Central Valley region. Irrigated lands include land irrigated to produce crops for commercial purposes; nurseries; private and public managed wetlands; irrigated pasture. Waste discharges from irrigated lands include discharges to surface water, such as irrigation return flows, tailwater, drainage water, subsurface drainage generated by irrigating crop land or by installing and operating systems to lower the water table below irrigated lands (tile drains), stormwater runoff flowing from irrigated lands, and non-runoff discharges (e.g., aerial drift or overspray of pesticides).[44] Waste discharges from irrigated lands also include discharge to groundwater, such as leaching of waste to groundwater, waste discharge to groundwater as a result of backflow of waste into wells (e.g., backflow during chemigation), and irrigated agricultural waste discharged into unprotected wells.[45]

Operations associated with irrigated agriculture involving the application of materials and constituents directly or indirectly to land may leach waste into groundwater, potentially causing degradation, or causing or contributing to exceedances of water quality objectives. Because all irrigated agricultural operations could affect groundwater quality, they have been considered in the scope of the long-term ILRP. There may be cases where leaching of waste could not affect groundwater quality; however, this would be difficult to determine without intensive site-specific information. In implementing the long-term ILRP, the Central Valley Water Board would consider such site-specific information, as provided by irrigated agricultural operations, to reevaluate whether a particular waste discharge could affect groundwater quality.

2. Goals and Objectives

The goals and objectives would be those adopted by the Advisory Workgroup, given in Section VII of this report.

3. Timeframe for Implementation

The changes proposed for the long-term ILRP would require the development of new institutional structures and will likely add 2 million additional acres to the program.[46] To minimize the disruption to the current surface water program and provide a smooth transition to the new program, a phased 3-year implementation timeframe is proposed prior to the new requirements taking full effect. Compliance during this transition will be based on completing required actions for each phase. The primary actions, completion dates, and responsible parties are described in Table 22. Upon adoption of the long-term program, Central Valley Water Board staff will develop a more detailed time line with interim milestones to ensure the primary actions are completed on time.

[44] The Central Valley Water Board recognizes that DPR is the lead State agency for regulating pesticide use. In implementing the long-term ILRP, the Board intends to work closely with DPR where waste discharge associated with overspray or other pesticide wastes cause water quality problems.

[45] Irrigated lands that are regulated under another Water Board order (e.g., WDRs, including NPDES permits) would not be regulated under the ILRP. However, if the other Water Board order governs only some of the waste discharge activities (e.g., application of wastewater to crop land), the owner/operator of the irrigated lands must obtain regulatory coverage for all discharges of waste through the ILRP or by obtaining appropriate changes in their existing WDRs.

[46] The estimated additional 2 million acres would be attributable to the increased scope of the long-term ILRP to include waste discharge to groundwater. This number is estimated by subtracting the irrigated acreage in the current ILRP from DWR estimates of total irrigated acreage in the Central Valley.

Table 22. Long-Term ILRP Timeframe for Implementation

Phase/Action	Completion Date (from Adoption of Long-Term Program)[a]	Responsible Party
Identification of geographic areas/commodities receiving orders[b] and responsible third-party groups	3 months	Central Valley Water Board/third parties
Board issuance of geographic/commodity specific orders	12 months	Central Valley Water Board
Enrollment of new participants/operations[c]	30 months	Operations/Central Valley Water Board
New program fully in effect	3 years	Central Valley Water Board/third parties/operations

[a] Date of Central Valley Water Board certification of Final PEIR and direction to implement recommended ILRP.
[b] WDRs and waivers.
[c] Irrigated agricultural lands, or operations, as defined in Section X.B.1.

Although staff anticipate that it will take 12 months to adopt all the new orders for the program, staff will bring 2–3 orders to the Board for consideration every quarter to ensure all necessary orders are adopted within the 12-month time frame. The current ILRP conditional waivers for surface water will need to be renewed for this time period to ensure that current ILRP participants are in compliance while the new orders are developed.

Current ILRP participants would be enrolled automatically (i.e., grandfathered into new program; reapplication would not be required) as the relevant provisions are established. The Central Valley Water Board will coordinate with current ILRP management plans to address surface water quality problems. These efforts would continue as part of the long-term ILRP.

4. Implementation Mechanism

Irrigated agricultural operations vary considerably throughout the Central Valley. Environmental conditions also vary considerably. These variations lead to non-uniformities in discharge waste parameters and also associated management practices that would be best suited to reduce waste discharge. For example, in areas with fine clay soils, implementing management practices to reduce potential leaching of waste to groundwater may not address the main discharge pathways (e.g., tailwater discharge, runoff to unprotected wellheads). In some cases, management practices have been identified that could intensify waste discharge; examples would include holding tailwater in an area with coarse soils and shallow groundwater.

On numerous occasions stakeholders have urged that the program be flexible and allow irrigated agricultural operations to implement practices that make the most sense at their particular sites. Staff agree with these stakeholder concerns and have noted that the variability of conditions and agricultural operations must be given primary consideration when developing regulatory requirements. In order to address these concerns, a series of general WDRs and conditional waivers, based on local conditions, would be developed.

General orders or waivers would be developed for similar areas/watersheds/commodities, with the regulatory and monitoring requirements tailored to the conditions and waste discharge pathways. These orders and associated requirements generally would be geographically based. However, there may be occasions where commodity-based requirements are appropriate. One such example would be rice, because of commodity-specific water quality management practices and general geographic continuity. To provide a degree of flexibility while limiting the number of orders that must be developed, a total of 8–12 tailored orders would be developed. This proposal would establish prioritization factors for determining the type of requirements (e.g., planning, management) and monitoring that would generally be applied. The ideas for this prioritization system have already been developed in long-term ILRP Alternatives 2 and 4 by the Advisory Workgroup (low threat, and tiered program, see Alternatives Document, Appendix A). The prioritization factors are described below in the Regulatory Requirements section.

Developing general orders and waivers for specific areas/commodities would provide the Board and third-party groups the opportunity to tailor requirements most effectively to applicable waste discharge conditions. For example, areas with multiple surface water concerns because of pesticides would not be subject to the same requirements as areas with minimal pesticide concerns. This approach also would facilitate effective coordination with other water quality programs.

Throughout the development of the long-term ILRP, the Central Valley Water Board has been urged to coordinate with DPR's Groundwater Protection Program, other regulatory programs, and local groundwater management programs. Developing orders specific to geographic areas would allow the Central Valley Water Board to coordinate and consider existing practices and monitoring associated with DPR, local groundwater management programs, and other programs and consider existing local regulatory efforts, thus minimizing duplication of efforts and multiple overlapping regulatory requirements.

The implementation mechanisms that will be developed include:

Conditional waiver of waste discharge requirements—applicable to lower priority (see description below) areas/watersheds/commodities. Benefits of establishing waivers for these areas would include potential program fee reduction and the requirement for reassessment every 5 years. Periodic reassessment would provide assurance that waste discharge conditions have not changed in a way that could degrade State waters.

General waste discharge requirements—applicable to higher priority (see description below) areas/watersheds/commodities. Benefits of establishing general WDRs for higher-priority areas include increased stability. Higher priority areas would be those where agricultural operations are causing or contributing to a water quality problem. Once adopted, general WDRs would require that irrigated agricultural operations implement practices and programs to solve water quality problems. This may take longer than 5 years. General WDRs do not expire and would allow the Central Valley Water Board, third-party groups, and irrigated agricultural operations to focus on solving problems instead of renewing regulatory requirements.

In general, there would be a single, main regulatory mechanism for waste discharges to surface and groundwater applicable to a geographic area or in some cases, a commodity. Where a large geographic area has multiple low and high-priority sub-areas, the mechanism would be WDRs [high/low prioritization is defined below in the Regulatory Requirements section]. The requirements of the WDRs then may be tailored to address the sub-areas. An example of this approach can be seen where an area encompasses vulnerable groundwater areas. The requirements inside the vulnerable groundwater areas may be different from the requirements outside the vulnerable areas.

Conditional prohibition of discharge—applicable to irrigated agricultural operations whose waste discharge could affect the quality of the State's waters that have not obtained necessary regulatory coverage within 1 year of adoption of applicable long-term ILRP order (WDRs/waivers); or 1 year of obtaining the irrigated lands or converting the land use to one that meets the irrigated lands definition. The prohibition would be applicable only to irrigated agricultural operations with waste discharges that could affect the quality of State waters that have not obtained coverage under the ILRP. The prohibition will be established through amendments to the two Central Valley Basin Plans.

No regulatory program—where evidence has been provided to the Central Valley Water Board and the Board has concurred that the irrigated lands operation could not affect the quality of the State's waters. This determination would include a thorough review of site-specific information that would be used to characterize and determine whether irrigated lands waste discharge can affect the quality of the State's ground and/or surface waters.[47]

[47] This option is identified because the Central Valley Water Board can have a regulatory program only if the discharge of waste could affect the quality of waters of the State. The Central Valley Water Board currently does not have information identifying any irrigated agricultural areas in which such an option could apply. Given the potential discharge pathways to ground and surface waters from irrigated agriculture, staff expects that this option may not be applicable or may apply in only limited, site-specific circumstances.

5. Lead Entity

As part of the ILRP, specific lead entities will need to be identified. This section describes the likely lead entity categories and their roles and responsibilities.

Third Party

A coalition or other third-party group would be responsible for general administration of the ILRP. In order to be approved by the Central Valley Water Board for administration of this alternative, third-party groups would need to agree to assume the following responsibilities.[48]

1. Provide members and the Central Valley Water Board an organizational or management structure identifying persons responsible for ensuring that program requirements are fulfilled.
2. Agree to provide or make available to group members the annual summaries of expenditures of fees used to comply with the ILRP. [49]
3. Notify potentially affected third-party group members each time the group has received a notice of violation or other enforcement action from the Central Valley Water Board and provide information regarding the reason for the enforcement.
4. Develop and implement monitoring/management practice tracking plans.
5. Conduct required water quality monitoring.
6. Work with the Central Valley Water Board to inform growers of program requirements, provide coordination to ensure that water quality concerns are addressed, and provide informational materials on potential environmental impacts of water quality management practices.[50]
7. Work cooperatively with the Central Valley Water Board to ensure all third-party group members are providing any required information and taking necessary steps to address any identified water quality issues.
8. If a monitoring well is proposed that may affect a sensitive resource (e.g., endangered species habitat, sensitive plant communities), the third party

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[48] To represent irrigated agricultural operations, a third party must receive Central Valley Water Board approval to act as a representative (similar to the current ILRP). In its application for approval as a third party, the applying entity must demonstrate that its governance structure is accountable to its members and it has the capacity to carry out the responsibilities identified in this program. Third-party entities would not be required to submit a Report of Waste Discharge.

[49] It is not the intent of this provision for the Central Valley Water Board to review and approve these reports. The intent is to promote accountability and transparency on the part of the third-party entities.

[50] Informing irrigated agricultural operations of potential environmental impacts of water quality management practices is required to ensure that operations have the information to select practices that do not have an impact on sensitive resources (see section IX.D.1).

must (1) select a different monitoring well location that meets water quality goals, but does not involve impacts on the resource, or (2) implement the mitigation measures described in the implementation mechanism (e.g., WDRs/ waiver) for the potentially affected resource, or (3) work with the Central Valley Water Board to obtain a site-specific CEQA analysis.[51]

Additional third-party requirements are included below in the regulatory requirements section.

General Central Valley Water Board Role and Responsibilities

1. Require 100 percent ILRP participation.[52] In implementing this requirement, the Central Valley Water Board would work with third-party groups to identify non-participants. The Board would be responsible for enforcement of the 100 percent participation goal. Third-party groups would be required to assist the Board by providing non-participant information.

2. Enroll irrigated agricultural operations in the ILRP and provide them with approval to join a third-party group. Automatically enroll current ILRP participants in the long-term ILRP.

3. Review and approve monitoring plans.

4. Review and approve SQMPs.

5. Review and approve GQMPs (and, where applicable, local groundwater management plans requested to substitute for GQMPs).

6. Review monitoring reports.

7. Review overall program performance with regard to achieving ILRP objectives.

8. Respond to individual problems and complaints dealing with irrigation discharge and informing/coordinating with the responsible third-party group.

9. In an iterative process, require additional monitoring, information, and/or management measures where applicable water quality objectives are not being met or degradation is occurring.

10. Enforce ILRP requirements.

The Central Valley Water Board will be the lead entity working directly with operators (1) who have chosen not to enroll with a third-party entity, (2) where a

[51] This requirement is considered to ensure that any installed monitoring wells do not cause unintended environmental impacts on sensitive resources (see section IX.D.1 and Draft PEIR).
[52] Where irrigated agricultural operations have a waste discharge that would be regulated under the ILRP.

third-party entity is unavailable or has demonstrated noncompliance with ILRP requirements, or (3) who, through their action or inaction, demonstrate that direct Central Valley Water Board oversight is required to ensure compliance with the ILRP.

6. Regulatory Requirements

The regulatory requirements for the long-term ILRP include planning and implementation of water quality management practices that would reduce waste discharge to State waters associated with irrigated agricultural operations. Under the current ILRP and other programs, there have been vast amounts of water quality data collected characterizing impacts on Central Valley waters associated with irrigated lands (Central Valley Water Board and Jones and Stokes [2008], *Existing Conditions Report* or "ECR"). The ECR also suggests that there are watersheds and groundwater basins with irrigated agricultural operations with little to no measured water quality impacts.[53]

In general, irrigated agricultural operations have the potential to discharge waste; however, the overall impact of the waste discharge is dictated by various conditions such as:

- management practices,
- commodity type,
- cultural practices,
- other sources, and
- environmental conditions (annual rainfall, geology, intensity of operations).

This concept, coupled with availability and adequacy of water quality data must be the building block of any successful long-term ILRP. This ILRP incorporates the importance of the above conditions as "priority factors" (described later in this section) that will be used to establish general threat conditions and associated regulatory requirements to be applied using the area/watershed/commodity–specific implementation mechanisms. The implementation mechanisms would be tailored to the discharge pathways (mode by which waste is reaching State waters, e.g., leaching to groundwater through coarse soils).

Regulatory requirements for irrigated agricultural operations would include those following.

1. Submit an application to the Central Valley Water Board to enroll in the program (if not already enrolled in the current program); where required, join a third-party group; and pay applicable program fees. Irrigated agricultural operations would not be required to submit a formal report of waste discharge unless applying for individual WDRs, or in cases of enforcement.

[53] In some cases, monitoring data is not available. Inadequate monitoring data would not provide justification that an area does not have impacts.

2. Implement water quality management practices in accordance with any water quality management plans, including GQMPs. Water quality management practices could be instituted on an individual basis, or be installed to serve a group of growers discharging to a single location (e.g., combined tailwater return or wetlands serving a group of growers).

3. Prevent nuisance conditions and/or exceedance of water quality objectives in State waters associated with waste discharge from their irrigated agricultural lands.

4. Provide the third-party group with information requested for compliance with the ILRP.

5. Where a management practice is proposed, for compliance with the ILRP, and the irrigated agricultural operation determines that it may affect a sensitive resource (e.g., endangered species habitat, sensitive plant communities), the irrigated agricultural operation must (1) select a different management practice that meets water quality goals, but does not involve impacts on a sensitive resource, or (2) locate the management practice outside of sensitive resource areas, or (3) implement the mitigation measures described in the implementation mechanism (e.g., WDRs/ waiver) for the potentially affected resource, or (4) work with the Central Valley Water Board to obtain an individual waste discharge permit and site-specific CEQA analysis.[54]

Irrigated agricultural operations that do not meet the above requirements would be required to work directly with the Central Valley Water Board and obtain WDRs or an individual waiver of WDRs.

Priority Factors

The long-term ILRP would use the following factors to determine the priority (e.g., high or low) and the associated requirements for a given area:

1. irrigated agricultural operations—identified as causing or contributing to a water quality problem for surface and/or groundwater (e.g., exceedance of water quality objectives, degradation of water quality[55]);

2. located in a high-threat area based on environmental conditions (e.g., DPR/State Water Board groundwater vulnerability area,* intensity of

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[54] This requirement is considered to ensure that implemented water quality management practices do not cause unintended environmental impacts on sensitive resources (see section IX.D.1 and Draft PEIR).

[55] Degradation is considered here to comply with State Water Board Resolution 68-16, *State Antidegradation Policy.*

operations,[56] geology, proximity to surface water bodies, or in an area of shallow groundwater);

3. management practices in place to protect water quality; and

4. demonstrated non-compliance with ILRP.

**** DPR/State Water Board groundwater vulnerability areas are considered here as priority factors. The Central Valley Water Board reviewed these vulnerability areas along with Central Valley groundwater quality data for nitrate (Nitrate Summary Report [Appendix B]). One general conclusion from the Nitrate Summary Report is that: "State Water Board and USGS Maps depicting areas…where groundwater quality has been impacted by nitrates are in general agreement with the vulnerability maps." As groundwater in these areas is generally vulnerable to pesticides and nitrates, it is likely that there is vulnerability to other groundwater waste discharge associated with irrigated agriculture (e.g., salts). Therefore, these are considered priority areas for implementing management practices to protect groundwater quality. There are approximately 2 million acres of State Water Board/DPR vulnerability areas throughout the Central Valley.***

The general requirements that would be applied under high and low-priority scenarios are given below as a two-tier system. Tier 1 requirements would be applicable in low-priority areas, and Tier 2 requirements would be applicable in higher-priority areas. The requirements established in any given area would be applied separately to surface and groundwater depending on the above factors. However, the decision on the type of implementation mechanism would be based on whether the area contains high-priority areas for surface or groundwater. The implementation mechanism then would be tailored to the appropriate high-priority waste discharge(s). Figure 22 contains a flowchart summarizing the proposed prioritization process.

Third-party groups and the Central Valley Water Board would identify low and high-priority areas in the development of watershed/area/commodity–specific implementation mechanisms during the 3-year transition period.[57] The Central Valley Water Board intends to use existing information in this prioritization. However, there will be the flexibility for third-party groups and other interested parties to provide additional information during the process. The Central Valley Water Board will make the final determination regarding area/discharge priority. Examples of high-priority areas for surface water would be those under SQMPs in the current ILRP (where irrigated agricultural operations are a source of the

[56] Consideration of intensity of operations would include information such as estimations of amount of waste discharge, relative amount of irrigated agricultural use compared to other land uses in the geographic area, and pesticide use.
[57] During this process, there would be opportunity for public input.

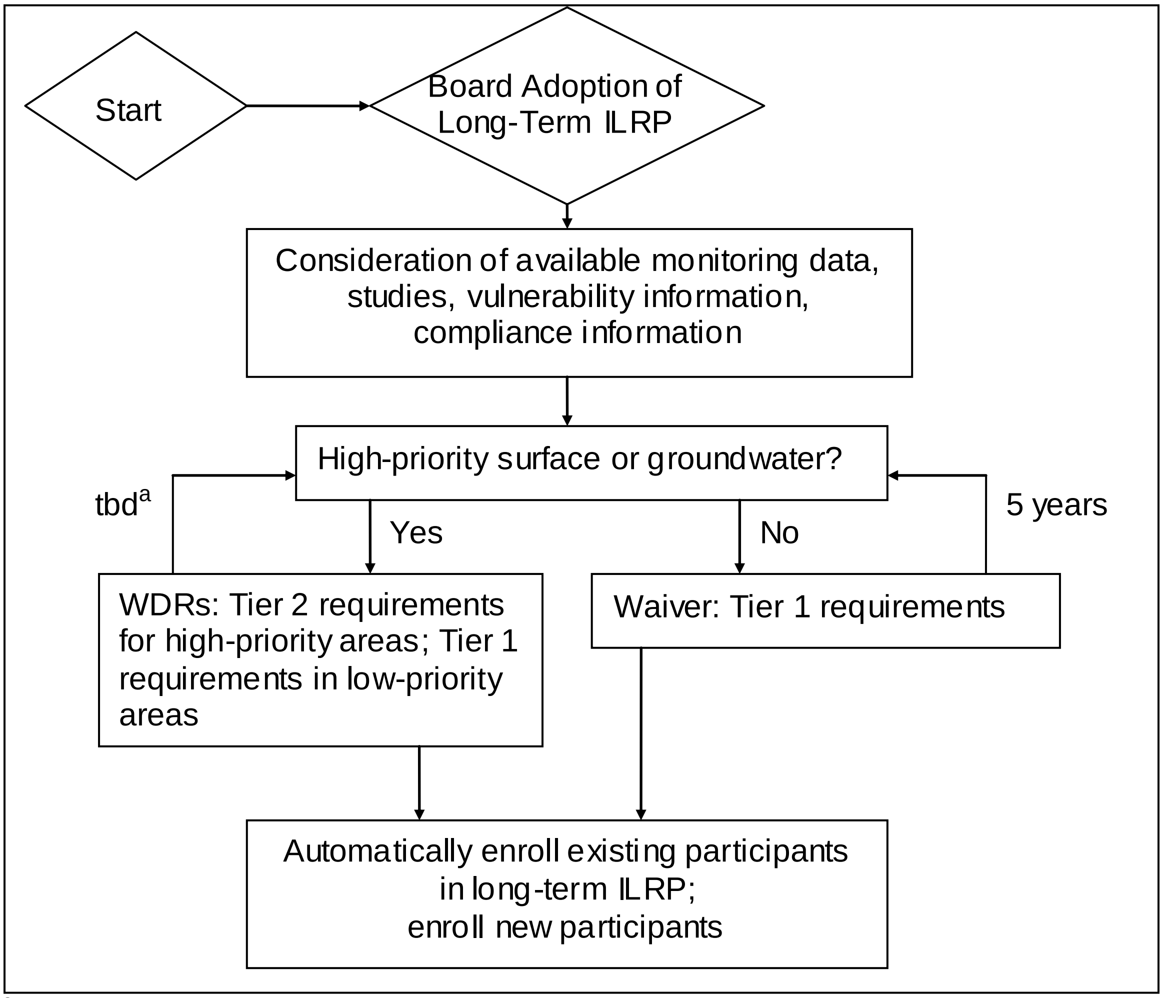
water quality concern). Area priority may be re-classified by the Central Valley Water Board based on review of new information collected during program implementation (see feedback loop in Figure 22).

Tier 1

Tier 1 requirements would be applicable in low-priority areas described using the factors above. These requirements would be aimed to ensure that irrigated agricultural operations maintain or improve the existing level of water quality protection (e.g., maintain or improve existing management objectives unless they are found as not benefiting water quality). Management objectives would establish goals for water quality protection that irrigated agricultural operations would achieve through implementation of specific management practices. Operations would be required to continue achievement of current water quality protection (e.g., management objectives); however, the management practices that are used may change or evolve over time. This flexibility is especially important where a less expensive, perhaps more protective practice or technology becomes available that meets the same objective. The Central Valley Water Board does not wish to limit irrigated agricultural operations to singular practices, only to ensure that they continue meeting their existing level of water quality protection.

Under this tier, the Central Valley Water Board considers the existing level of management objectives as BPTC, and protective of surface and groundwater quality. Third-party groups are required to describe the area’s existing water quality management objectives in a report to the Central Valley Water Board. Management practices tracking, every 5 years, would be the method by which the Central Valley Water Board would evaluate, in general, whether operations are continuing to meet existing management objectives.

Figure 22. Flowchart Summarizing Proposed Prioritization Process



[a] Reassessment time frame dependent on time schedule for compliance with water quality objectives.

Tier 2

Tier 2 requirements would be applicable in high-priority areas.

High-Priority Surface Water

Third-party group develop and implement an SQMP.

An SQMP must be developed for the watershed represented by the monitoring site for any parameter that exceeds water quality objectives two or more times in a 3-year period. Surface water quality management plans developed under the existing ILRP would be accepted under the long-term ILRP. Under SQMPs, irrigated agricultural operations are required to implement management practices to achieve BPTC[58] of the constituent of concern. Monitoring and other collected information would be used to assess the effectiveness of management practices and whether BPTC has been achieved. Additional practices/monitoring may be necessary, in an iterative process, to address water quality concerns. Required elements of SQMPs are given in Appendix D.

Based on information provided by the third party and other interested stakeholders, the Central Valley Water Board's Executive Officer will: (1) approve the SQMP; (2) conditionally approve the SQMP and require revisions to address other surface waters or constituents of concern; (3) conditionally approve the SQMP and require other revisions necessary to meet program requirements and goals; or (4) disapprove the SQMP or portions of the SQMP. Review of the SQMP by the Central Valley Water Board and the associated action by the Executive Officer will be based on findings as to whether the SQMP meets program requirements and goals and contains the information required for a SQMP (see appendix D).

Periodic Review of Approved SQMPs: At least every 2 years, the Central Valley Water Board will meet with third-party groups and other interested parties to evaluate the sufficiency of SQMPs and to determine whether and, generally, how they should be updated to reflect priorities based on new information. The Executive Officer also may require revision of the SQMP based on available information indicating that exceedances of water quality objectives or degradation of surface water require the inclusion of additional surface water bodies or constituents of concern(s) in the SQMP. The general requirements for a SQMP are identified in Appendix D.

High-Priority Groundwater

Third-party group develop and submit for Central Valley Water Board approval a GQMP within 18 months of issuance of the geographic/commodity specific WDRs by the Central Valley Water Board [except in areas where a local groundwater management plan has been developed and approved (by the Central Valley Water Board) for substitution].[59] Under GQMPs or local groundwater management plans, irrigated agricultural operations would be required to implement management practices to achieve BPTC of the constituent of concern.[60] Monitoring and other collected information would be used to assess

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[58] BPTC is considered here to comply with State Water Board Resolution 68-16, *State Antidegradation Policy.*

[59] Where local agencies have developed local groundwater management plans (e.g., AB 3030, SB 1938, Integrated Regional Water Management plans) that meet the requirements of GQMPs, the Central Valley Water Board may approve the local groundwater management plan to be substituted for the GQMP. However, irrigated agricultural operations still would be required to enroll with an approved third-party group. The third-party group would be the responsible lead entity for ILRP administration, monitoring and reporting.

[60] For example, where the constituent of concern is nitrate, and the discharge pathway of concern is leaching to groundwater, the GQMP would need to include nutrient budgeting and efficient irrigation. In such cases, plan implementation would be tracked, and groundwater monitoring data

the effectiveness of management practices and whether BPTC has been achieved. Additional practices/monitoring may be necessary, in an iterative process, to address water quality concerns.

As part of GQMP development, the third party would collect and evaluate available groundwater data, identify groundwater quality management areas (GMAs) of concern, identify constituents of concern in the GMAs, prioritize the GMAs and constituents of concern, identify agricultural practices that may be causing or contributing to the problem, and identify agricultural management practices that should be employed by local growers to address the constituents of concern. Based on information provided by the third party and other interested stakeholders, the Central Valley Water Board's Executive Officer will: (1) approve the GQMP; (2) conditionally approve the GQMP and require revisions to address other GMAs or constituents of concern; (3) conditionally approve the GQMP and require other revisions necessary to meet program requirements and goals; or (4) disapprove the GQMP or portions of the GQMP. Review of the GQMP by the Central Valley Water Board and the associated action by the Executive Officer will be based on findings as to whether the GQMP meets program requirements and goals and contains the information required for a GQMP (see appendix D).

Periodic review of approved GQMPs: At least every 5 years, the Central Valley Water Board will meet with third-party groups and other interested parties to evaluate the sufficiency of GQMPs, and to determine whether and, generally, how they should be updated to reflect priorities based on new information. The Executive Officer also may require revision of the GQMP based on available information indicating that exceedances of water quality objectives or degradation of groundwater require the inclusion of additional GMA(s) or constituents of concern(s) in the GQMP. The general requirements for a GQMP are identified in Appendix D.

Individual FWQMPs would be required if objectives are not met, improvements in water quality do not occur within the approved time schedule for implementation, or where irrigated agricultural operations are not implementing requirements in SQMPs/GQMPs. FWQMPs would be aimed to minimize waste (e.g., nutrients, pesticides, sediment, pathogens) discharge to surface water and groundwater (to include wellhead protection practices[61])—this plan also would be kept on the site

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and/or other information would be reviewed to determine whether program objectives are being met. Plan requirements may need to be iteratively adjusted based on program tracking/monitoring feedback.

[61] DPR has developed wellhead protection requirements for pesticides that are codified in California Code of Regulations, Title 3, Section 6609. Wellhead protection measures for the ILRP would include similar types of practices instituted to prevent other agricultural wastes (e.g., nutrients) from entering wellheads.

and submitted to the Central Valley Water Board/third-party group upon request. FWQMP requirements are summarized in Appendix D. [62]

Optional Certified Farm Water Quality Management Plan

This is an ***optional*** program component that would not apply geographically, but at the individual farm level. In this option, the operation would implement a certified[63] FWQMP. It is envisioned that these plans would be developed by commodity groups or other third parties for operations with similar waste discharges; however, individual operations would be required to implement practices in the certified plan. Individual operations also could develop and implement their own certified FWQMP. The certified FWQMP must address discharges to both ground and surface water. Irrigated agricultural operations implementing certified plans would be considered lower priority because there has been on-farm verification (by an approved certifier) of practices implemented to control waste discharge to surface and groundwater. The approved certifier(s) would be the lead entity for this option.

7. Monitoring provisions

The general goals of the ground and surface water quality monitoring efforts are to determine:

- whether the discharge of waste from irrigated lands are in compliance with applicable water quality objectives, total maximum daily loads (TMDLs), and implementation plans in the Basin Plans;
- the extent of management practice implementation;
- the effectiveness of implemented management practices and whether those practices achieve BPTC;
- the effectiveness of any applicable regional ground or SQMP; and
- compliance with the requirements or conditions of applicable WDRs or waivers of WDRs.

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[62] There may be cases where regional management plans fail to be effective at meeting the goals of the long-term ILRP. This could be attributable to a variety of reasons, such as individual grower refusal to participate in the regional management plan or third-party failure to implement plan objectives. In such cases, the Central Valley Water Board would need to ensure that program goals are achieved through establishing requirements at the individual operation level. This is mainly because the permitting and enforcement authorities of the Central Valley Water Board are applicable to the entity responsible for the waste discharge. Coalitions are third-party groups, not responsible for the waste discharge. This option would be exercised only as part of iterative enforcement where regional management plans have failed or enforcement directed toward individuals not in compliance is necessary. Certification of the individual plans would not be required.

[63] Certification includes Central Valley Water Board approved Certification Entity review and certification of the plan. As part of certification program, the Certification Entity would conduct an initial certification inspection and a minimum annual inspection frequency of 5% of operations with approved plans. Certification entities would report results to the Central Valley Water Board.

Monitoring requirements will be tailored to address the concerns specific to the areas or commodities for which they would apply. The monitoring requirements will be developed during the development of implementation mechanisms (WDRs, waivers). The Central Valley Water Board intends that regional monitoring programs would be coordinated with DPR surface and groundwater monitoring, local groundwater management plans, the Central Valley Water Board Dairy Program, and other existing programs. The primary goal of this coordination is to prevent duplicative monitoring programs. For example, existing water quality data (e.g., Surface Water Ambient Monitoring Program, SWAMP data; DPR groundwater data; etc.) could be used, and the monitoring parameters would be tailored to the farm inputs and water quality issues in the watershed or groundwater basin.

Areas with surface and/or groundwater quality problems (e.g., exceedance of water quality objectives, degradation of water quality), where irrigated agricultural operations have not been identified as a source but may be a potential contributor, would be required to work with the Central Valley Water Board and other potential sources (e.g., municipalities, dairies) to conduct monitoring and applicable source studies.

Areas with insufficient information available to determine prioritization would be required to complete assessment monitoring or studies within 5 years of long-term program adoption.[64] The goal of the assessment would be to determine whether irrigated agricultural operations are causing degradation of surface or groundwater quality. However, the Central Valley Water Board does not intend to monitor every water body in the Central Valley as part of the long-term ILRP. Therefore, "representative" monitoring and other information (see priority factors two and three above) will be considered first in tier classification.

Tier 1 and Optional Certified FWQMP

Surface Water

Monitoring would consist of tracking of management practices and watershed-based assessment monitoring 1 year every 5 years (similar to the assessment monitoring required under the current ILRP). Monitoring and tracking results would be submitted in a report every 5 years to the Central Valley Water Board. Additional monitoring may be required where assessment monitoring identifies a water quality concern.

Groundwater

One year every 5 years, participate in regional groundwater monitoring program (see regional groundwater monitoring for Tier 2 below). Additional monitoring may be required where monitoring identifies a water quality concern.

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[64] Date of Central Valley Water Board certification of Final PEIR and direction to implement recommended ILRP.

Tier 2

Surface Water

Watershed-based assessment and special project monitoring similar to the monitoring required under the current ILRP (Central Valley Water Board Order No. R5-2008-0005).

Under this monitoring scheme, third-party groups will work with the Central Valley Water Board to develop monitoring plans during the development of implementation mechanisms. These plans would specify monitoring parameters and site locations. Monitoring also would include gathering management practices tracking information from member growers and summarizing the information. Monitoring and tracking results would be submitted in an annual report to the Central Valley Water Board.

Groundwater

Participate in regional groundwater monitoring. The Central Valley Water Board and third parties will engage and coordinate with local groundwater management agencies and other programs conducting groundwater monitoring in meeting this requirement so as to prevent duplication of monitoring. Regional groundwater monitoring would consist of the following components.

1. Regional monitoring for constituents of concern to provide baseline groundwater information and track trends in groundwater quality over time. Nutrient/pesticide application tracking and associated modeling may be used to evaluate discharges to groundwater in place of monitoring, where technically feasible and appropriate.

2. Targeted site-specific studies to evaluate the effects of changes in management practices on groundwater quality (this would occur only at a selected number of sites—the Fertilizer Research and Education Program [FREP] would be approached as a potential funding source for this monitoring).

3. Gathering management practices tracking information from member growers.

4. Submitting an annual report to the Central Valley Water Board summarizing management practice tracking and the regional and targeted site-specific monitoring results.

5. Using a database system to compile existing groundwater quality data and data collected during regional and site-specific monitoring (e.g., the GAMA/GeoTracker database may be a potential system).

Figure 23 illustrates how the Central Valley Water Board envisions the application of the prioritization scheme and associated requirements.

8. Time schedule for compliance[65]

Priority surface and groundwater quality issues are identified below and would be subject to the compliance time schedules described. It is likely that the practices to address the priority issues also will lead to improvement or achievement of objectives for the non-priority issues. Through periodic review of the ILRP, the Central Valley Water Board will determine whether additional compliance time schedules need to be established for the non-priority water quality issues.

The following general time schedules apply when irrigated lands are causing or contributing to a discharge that results in exceedances of water quality objectives. The Executive Officer or Water Board may modify these schedules based on evidence that meeting the compliance date is technically or economically infeasible (e.g., where irrigated agriculture demonstrates reduction in contributions, but cannot influence complete compliance because of other sources; where irrigated agriculture has implemented best practical treatment or control and water quality objectives are not achieved).

Management plan time schedules developed under the current ILRP would continue to apply in the long-term ILRP. Any other applicable time schedule for compliance or priorities established in the Central Valley Water Board's Basin Plans would take precedence over the schedules below.

Priority Surface Water Quality Issues

1. Which water bodies are considered priority?—specific water bodies with beneficial uses identified in the Basin Plans; streams tributary to water bodies in the Basin Plan with aquatic life uses based on the "tributary rule";[66] tributary streams with identified municipal or domestic drinking water intakes; water bodies with specific compliance time schedules established in the Basin Plans.

2. Which beneficial uses are considered priority?—aquatic life, drinking water, and human consumption uses[67] in the above water bodies.

3. Which pollutants are considered priority?—those pollutants that cause or contribute to a violation of water quality objectives associated with the priority beneficial uses and water bodies.

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[65] The State Water Board's NPS Policy requires the establishment of a time schedule for compliance with water quality objectives.

[66] Resolution R5-2005-0137 describes the application of the tributary rule. Agricultural drains and other constructed conveyances (not identified in the Basin Plans) would not be considered priority.

[67] In the Basin Plans, the specific beneficial uses within these general categories include Warm Freshwater Habitat, Cold Freshwater Habitat, Estuarine Habitat, Preservation of Biological of Special Significance; Rare, Threatened, or Endangered Species; Migration of Aquatic Organisms; Spawning, Reproduction, and/or Early Development; Municipal and Domestic Supply; Commercial and Sport Fishing; Shellfish Harvesting; and Water Contact Recreation.

Compliance time schedule—5 to 10 years. For watershed areas with multiple water body/pollutant issues to address, compliance schedules may be staggered between 5 and 10 years, but cannot exceed 10 years.

Priority Groundwater Quality Issues

1. Which groundwater aquifers are considered priority?—aquifers with identified municipal or domestic drinking water wells; aquifers in which drinking wells were closed because of exceedances of water quality objectives.

2. Which beneficial uses are considered priority?—drinking water uses (i.e., municipal and domestic supply).

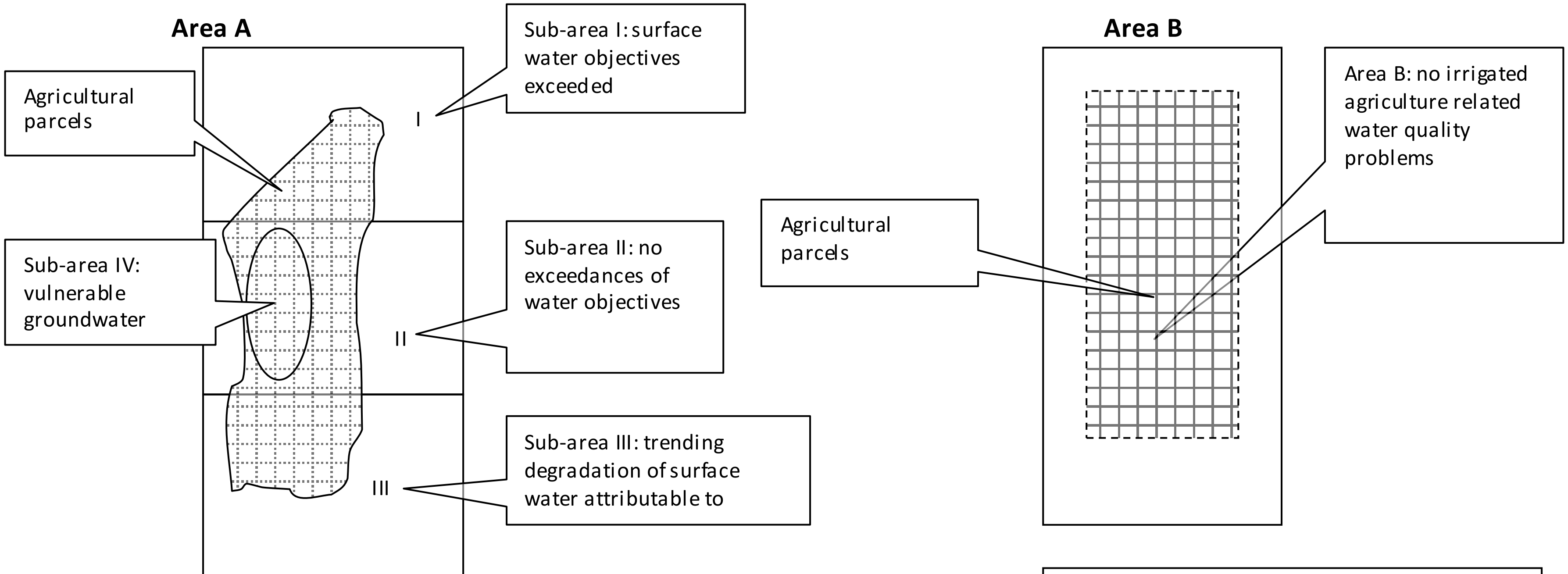
3. Which pollutants are considered priority?—those pollutants that cause or contribute to a violation of water quality objectives or degradation of groundwater quality associated with drinking water uses.

Compliance time schedule—5 to 10 years. For areas with multiple aquifer/pollutant issues to address, compliance schedules may be staggered between 5 and 10 years, but cannot exceed 10 years. Compliance is considered to be demonstrated improvement in water quality or reduction in discharge based on evaluation of available data of first encountered groundwater in the high-priority aquifer. However, with Central Valley Water Board approval, compliance can be demonstrated through documented implementation of management practices, assessment of water quality data, and/or groundwater quality modeling.

9. Fees

Fees charged will be dependent on the amount of State funding allocated through legislative appropriation and the State Water Board’s analysis of the level of staff effort required to implement the program. The Central Valley Water Board will recommend that the fee structure reflect the differing levels of effort for the different tiers and oversight of irrigated agricultural operations as individuals versus as part of a third-party group.

Figure 23. Long-Term ILRP Prioritization Scheme Example



Area A: WDRs	Sub-area I	Sub-area II	Sub-area III	Sub-area IV
SW requirements	Tier 2	Tier 1	Tier 2	Tier 1
GW requirements	Tier 1	Tier 1	Tier 1	Tier 2

Area B: Waiver of WDRs:

Tier 1 surface water requirements/monitoring

Tier 1 groundwater requirements/monitoring

XI. EVALUATION OF RECOMMENDED LONG-TERM IRRIGATED LANDS REGULATORY PROGRAM

In this section the recommended ILRP is evaluated for consistency with the evaluation measures considered in Section IX. The measures include: program goals and objectives, CWC, NPS Policy, and State Antidegradation Policy. The recommended ILRP has been developed using the components of Alternatives 1–5. The evaluation in this section is based on the results of the evaluation of the five alternatives conducted in Section IX. In order to fully understand the evaluation conducted in this section, the reader should be familiar with, and is referred to Section IX.

The qualitative system described in Section IX is used to establish a measure of how well the recommended alternative fulfills the evaluation measures. The qualitative system is based on whether alternatives are expected to meet existing requirements (i.e., would the alternative be consistent with goals/policy/laws).

In addition to the evaluation, Sections XI.B–D provide a discussion of (1) how effectively the Central Valley Water Board could administer the recommended ILRP, (2) estimated economic impacts of the recommended ILRP, and (3) anticipated environmental impacts of the recommended ILRP.

A. Consistency with Program Goals and Objectives and Policies

The qualitative scoring system for the goals and objectives and policy evaluation measures uses the following factors:

- recommended alternative is consistent with the requirement,
- recommended alternative is partially consistent with the requirement, and
- recommended alternative is not consistent with the requirement.

1. Program Goals and Objectives

In this section, the recommended alternative is evaluated against the goals and objectives of the long-term program—considering the results of the full evaluation of Alternatives 1–5 (Section IX.A). Goals 1, 2 and Objectives 1, 2 are similar in nature and have been evaluated together; Goals 3, 4 have been evaluated separately, and Objectives 4, 5 have been evaluated together.

Consideration of Goals 1, 2 and Objectives 1, 2

See Section VII.B for a description of these goals and objectives. The evaluation of Alternatives 1–5, conducted in Section IX.A.1, stated that successful implementation of management measures will work to achieve Goals 1, 2 and Objectives 1, 2. Alternatives requiring implementation of management measures for surface and groundwater were found to be consistent with these goals and objectives. The recommended long-term ILRP will require that third-party groups develop regional surface and groundwater management plans. These plans would specify management measures that would work to restore and/or maintain the highest reasonable surface and groundwater quality. Irrigated agricultural operations would be required to implement management measures identified in the plans. *The recommended long-term ILRP is consistent with Goals 1, 2 and Objectives 1, 2.*

Consideration of Goal 3

Goal 3 requires that the Central Valley Water Board consider the economic impacts of each alternative on the overall viability of agriculture throughout the Central Valley. The Board contracted an economic analysis to evaluate whether alternatives are consistent with this goal. Section XI.C (Recommended ILRP Economic Impacts) of this report provides a discussion of costs and consideration of how well the recommended ILRP meets this goal.

Consideration of Goal 4

Goal 4 requires that the ILRP ensure that irrigated agricultural discharges do not impair Central Valley communities' and residents' access to safe and reliable drinking water. The evaluation of Alternatives 1–5, conducted in Section IX.A.1, described that key factors in evaluating the alternatives for consistency with Goal 4 include whether groundwater quality management measures would be required. Alternatives 2–5 were found to be consistent with Goal 4. Under the recommended ILRP, third-party groups would develop regional surface and groundwater management plans (similar to the plans required under Alternative 2, with additional requirements to develop individual plans where regional management is ineffective). These plans would specify management measures that would work to restore and/or maintain the highest reasonable surface and groundwater quality. The recommended long-term ILRP would include requirements to implement management measures to protect surface and groundwater quality and ultimately work to promote reliable drinking water sources for Central Valley communities. *The recommended ILRP is consistent with Goal 4.*

Consideration of Objective 3

The evaluation of Alternatives 1–5, conducted in Section IX.A.1, describes that factors for consistency with Objective 3 include whether the ILRP would provide incentives for operations to minimize waste discharge. Alternatives that provide reduced oversight and monitoring for lower-priority/threat operations were found to be consistent with this objective (Alternatives 2–4). The recommended ILRP provides a prioritization system that would allow reduced monitoring, fees, and management requirements in lower-priority areas (similar to the prioritization systems given in Alternatives 2 and 4). *The recommended ILRP is consistent with Objective 3.*

Consideration of Objectives 4, 5

Objectives 4, 5 essentially require that the ILRP promote coordination with Central Valley Water Board programs and other regulatory and non-regulatory agencies. As described in Section IX.A.1, ILRP management at the regional level would likely better facilitate coordination with other programs and agencies. Management at the farm level would not work to promote coordination with other Water Board programs and regulatory and non-regulatory agencies (e.g., tens of thousands of individual FWQMPs would be much more difficult to coordinate than regional management plans). Because of the proposed regional approach, Alternatives 1 and 2 are consistent with Objectives 4, 5, While the individual approach described in Alternatives 3–5 (e.g., individual FWQMPs) is partially consistent with the objectives (coordination can occur with some difficulty). The recommended ILRP will be managed at the regional level, similar to Alternatives 1 and 2. *The recommended ILRP is consistent with Objectives 4, 5.*

2. California Water Code

Table 9 summarizes CWC requirements for developing a long-term program for irrigated agricultural waste discharges. As shown in the table, requirements vary depending on the regulatory mechanism the Central Valley Water Board adopts to establish program requirements (implementation mechanism). Under the recommended ILRP, the Central Valley Water Board will adopt waivers of WDRs in low-priority areas, WDRs in higher-priority areas, and a Basin Plan conditional prohibition of discharge. As the Board will be adopting all of the three mechanisms, the recommended ILRP is evaluated against each of the CWC requirements regardless of the mechanisms for which it would apply.

Consideration of California Water Code Sections 13263 and 13269

In general, these sections of the CWC require that implementation mechanisms be consistent with any applicable State or regional water quality control plan; in the public interest; include the performance of individual, group, or watershed-based monitoring unless the Central Valley Water Board waives the monitoring because the discharge(s) do not pose a significant threat to water quality; take into consideration the beneficial uses to be protected and the water quality objectives reasonably required for that purpose; other waste discharges; the need to prevent nuisance; and the provisions of Section 13241.

ILRP components that would work to achieve the above requirements, as described in Section IX.A.2, include requirements to develop surface and groundwater management plans and monitoring. Alternatives 2–5 were found to be consistent with these sections of the CWC. Alternative 1 is not consistent, mainly because of lack of requirements to protect groundwater beneficial uses. The recommended ILRP would include requirements to develop surface and groundwater management plans (similar to Alternative 2) and monitoring requirements (similar to Alternative 4). *The recommended ILRP is consistent with these sections of the CWC.*

Consideration of California Water Code Section 13241

CWC Section 13263 requires that six factors listed under Section 13241 be considered in the development of those components of the long-term ILRP relying on WDRs (see Section IX.A.2 for a description of the components). These factors will not need to be considered for the full recommended program, only for WDRs developed. The recommended ILRP will include development of WDRs for high-priority areas. *Because WDRs for the recommended ILRP will incorporate a consideration of Section 13241 factors, the ILRP is considered to be consistent with Section 13241 of the CWC.*

Consideration of California Water Code Section 13141

CWC Section 13141 requires that:

> *"…prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of financing, shall be indicated in any regional water quality control plan."*

The recommended ILRP includes a Basin Plan amendment (as part of the conditional prohibition of discharge). The estimated total cost of the recommended ILRP is described below in Section XI.C.1 (Recommended ILRP Economic Impacts). Potential sources of financing are described above in Section IX.C.3 of this report. The estimated total cost and potential sources of financing will be incorporated into the Basin Plans. *The recommended ILRP is consistent with Section 13141 of the CWC.*

3. Nonpoint-Source Policy

The recommended ILRP would regulate waste discharges from irrigated agricultural lands to State waters as an NPS program. Accordingly, the long-term ILRP must meet the provisions of the State Water Board's NPS Policy. The NPS Policy is described in Section IV.C of this document. In this section, the recommended ILRP is evaluated against the five key elements of the NPS Policy in light of the full evaluation of Alternatives 1–5 (see Section IX.A.3).

Consideration of Key Element 1

The evaluation in Section IX.A.3 found that Alternatives 1–5 all meet the requirements of Key Element 1. This is mainly because the key element requires, in part, that the NPS control implementation program's ultimate purpose be explicitly stated (other portions of this key element are evaluated as part of other sections, see Section IX.A.3 for more information). The purpose of the long-term program is explicitly stated in the Goals and Objectives. As given in the Goals and Objectives, the ultimate purpose of all program alternatives is the same. *All program alternatives, including the recommended ILRP, are consistent with this requirement.*

Consideration of Key Element 2

In general, Key Element 2 requires that an NPS implementation program include a description of the management practices expected to be implemented to ensure attainment of the program's purpose (goals and objectives), and the process used to select and ensure proper implementation of management practices. Successful implementation of water quality management measures will work toward achieving the goals and objectives of the long-term program. The Draft PEIR and Draft ILRP Economics Report discuss the types of management practices that may be implemented for all of the alternatives, including the recommended ILRP. ILRP components that would work to achieve consistency with Key Element 2 include water quality management plans to protect surface and groundwater and tracking of implemented practices. Alternatives 2–5 are consistent with Key Element 2 because they include requirements to develop surface and groundwater quality management plans and mechanisms to ensure implementation of practices (tracking, inspections). The recommended ILRP includes requirements to develop surface and groundwater quality management plans and tracking requirements to verify implementation. *The recommended ILRP is consistent with Key Element 2.*

Consideration of Key Element 3

If the Central Valley Water Board determines that it is necessary to allow time to achieve water quality requirements in an NPS program, Key Element 3 requires that the program include a time schedule with quantifiable milestones. In Section IX.A.3, Alternatives 2–5 were found to be consistent with this element because time schedules would be included in surface and groundwater quality management plans. Alternative 1 is not consistent with this element because there are recognized exceedances of groundwater quality objectives (e.g., nitrates), and the alternative would not require groundwater protection requirements or a time schedule for working toward achieving water quality objectives. *The recommended ILRP includes a time schedule for working to achieve water quality objectives and therefore is consistent with Key Element 3.*

Consideration of Key Element 4

Key Element 4 requires that an NPS program include feedback mechanisms so that the Central Valley Water Board, regulated operations, and the public can determine whether the program is effective. In Section IX.A.3, only Alternatives 4 and 5 were found to be fully consistent with this key element. This is because Alternatives 4 and 5 include surface and groundwater quality monitoring to provide feedback on whether the ILRP is meeting goals and objectives (e.g., maintaining beneficial uses). The recommended long-term ILRP includes regional surface and groundwater quality monitoring similar to Alternative 4. *The recommended ILRP is consistent with Key Element 4.*

Consideration of Key Element 5

Key Element 5 requires that the Central Valley Water Board make clear, in advance, the potential consequences for failure to achieve an NPS control implementation program's stated purposes.

Compliance with this element is the responsibility of the Central Valley Water Board. The potential consequences for failure to achieve the long-term ILRP's stated purpose would be the same regardless of the chosen program alternative and would include the following steps:

1. require, in an iterative process, additional monitoring information, and/or management practices where water quality objectives are not being met;

2. specify enforcement action where iterative process is unsuccessful, program requirements are not met, or time schedules are not met; and

3. require submittal of an ROWD to work individually with the Central Valley Water Board.

The Central Valley Water Board will ensure consistency with Key Element 5 by including the above potential consequences in waivers and WDRs adopted to implement the ILRP.

4. Antidegradation

Applicable antidegradation provisions and the ILRP's strategy for meeting the provisions are described in Sections IV.E and IX.A.4 of this report. Generally, to be consistent with antidegradation provisions, the ILRP must include the following programmatic approach:

> ***Implementation of the program must work to achieve site-specific antidegradation requirements through iterative implementation of BPTC and representative monitoring (e.g., where monitoring indicates degradation, BPTC would evolve to prevent such degradation).***

In Section IX.A.4, only Alternatives 4 and 5 were found to be fully consistent with antidegradation provisions. Alternative 2 was found to be partially consistent with antidegradation requirements. This is because the regional surface and groundwater management plan approach would require implementation of management practices where there are exceedances of water quality objectives, whereas the antidegradation provisions require implementation of management practices (BPTC) where degradation is occurring. Also, inconsistent with the programmatic approach described above, Alternative 2 would not require groundwater quality monitoring. The recommended ILRP includes Alternative 2's regional ground and surface water management approach, but includes (1) provisions to ensure that management practices (BPTC) would be required where degradation is occurring, and (2) regional surface and groundwater monitoring similar to Alternative 4. *The recommended ILRP is consistent with the antidegradation approach.*

B. Recommended Irrigated Lands Regulatory Program Predicted Effectiveness of Administration Based on Existing Programs

This section provides a discussion of how effectively the Central Valley Water Board could administer the recommended ILRP. This discussion is based on the evaluation and discussion conducted on Alternatives 1–5 in Section IX.B.

The lead entity structure and regional management approach of the recommended ILRP are similar to Alternative 2. Accordingly, it is anticipated that the effectiveness of administration challenges for third-party frameworks (Alternatives 1 and 2) would be similar for the recommended ILRP. However, the recommended ILRP includes additional transparency and individual management plan enforcement requirements aimed to ensure the effectiveness of the third-party framework. These additional measures are described below.

Enrollment and Transparency Requirements

As described in Section IX.B, enforcement of program requirements can be difficult in the third-party framework. This is because the Board cannot enforce program requirements directly upon the third party; rather, enforcement must be conducted directly upon the irrigated agricultural operations. There may be cases where the individual operations may be unaware of third-party non-compliance, and also unaware of program requirements. This potential problem is mitigated in the recommended ILRP by (1) requiring individual operations to enroll directly with the Central Valley Water Board so that they are aware of the program and requirements, (2) requiring that third-party groups provide the Board with information regarding non-compliant operations, and (3) requiring that third-party groups provide transparency and communication of requirements with growers.

Individual Water Quality Plans Where Regional Approach is Ineffective

In the proposed regional water quality management plan approach, the Board would not have a direct relationship with each irrigated agricultural operation (the entity discharging waste) and would not have information regarding the specific method(s) and practices the operation has or plans to implement to work toward solving identified water quality concerns. This potential problem is mitigated in the long-term ILRP by requiring, where a regional water quality plan is ineffective, that individual water quality management plans be developed as an enforcement step.

With the above requirements, the recommended ILRP is estimated to have the effectiveness of administration benefits described in Section IX.B for Alternatives 1 and 2 (e.g., regional management efficiencies), with added enforcement effectiveness similar to the direct implementation approach described for Alternative 5.

Because the recommended ILRP includes the third-party, regional administration framework, almost identical to Alternative 2, Central Valley Water Board staffing levels are anticipated to be similar to Alternative 2. One difference that must be considered is that the long-term ILRP would require that the Central Valley Water Board develop a series of 8–12 WDRs and waivers. Developing these implementation mechanisms will involve considerable staff time.

Alternative 2 does not contain a measure of how many waivers or WDRs would be developed, but the underlying assumption is that there would be a couple of mechanisms that would have multiple requirements to address the different conditions found throughout the Central Valley. Having multiple implementation mechanisms likely would require more staff time up front, as requirements are developed and adopted by the Central Valley Water Board. However, as some of the requirements need to be reevaluated, the evaluation need not include the entire Central Valley program, as would be the case under Alternative 2, only specific geographic areas that need reevaluation. This will work to reduce staffing costs in the long run. Also, the amount of staff work involved with developing an implementation mechanism that could fit the many conditions found throughout the Central Valley under Alternative 2 actually may be comparable to developing a series of smaller, more manageable implementation mechanisms. For these reasons, the staffing levels for the recommended ILRP are estimated to be similar to that described for Alternative 2 (see economics report for Alternative 2 staffing costs).

C. Recommended Irrigated Lands Regulatory Program Economic Impacts

1. Estimated costs

The recommended ILRP contains the third-party lead entity structure, regional surface and groundwater management planning, and regional surface water quality monitoring approach similar to Alternative 2; management practices tracking and regional groundwater monitoring similar to Alternative 4; and a tiering system based on systems described by Alternatives 2 (watershed or area management objectives plan) and 4 (pesticide and nutrient use). Therefore, overall potential costs of the recommended ILRP are estimated using the costs for these components of Alternatives 2 and 4 given in Tables 2-19 and 2-21 of the economics report.[68] Estimated costs of management practices implementation are equal for Alternatives 2–4.

[68] The recommended ILRP provides the option for individual operations to develop certified water quality management plans in order to obtain reduced monitoring and reporting requirements.

Total administrative costs are estimated to be similar to the costs shown for Alternative 2 in Table 2-19 of the economics report (average $0.15 per acre annually—greater than Alternative 1).[69] Total surface water monitoring and reporting costs are estimated to be similar to the costs shown for Alternative 2 (no change from Alternative 1). Total regional groundwater monitoring and reporting costs are estimated to be similar to the costs shown for Alternative 4 in Table 2-21 of the economics report minus the Tier 3 individual monitoring (average $0.96 per acre annually—greater than Alternative 1). Tracking costs are estimated to be similar to the costs shown for Alternative 4 in Table 2-21 of the economics report (average $0.42 per acre annually—greater than Alternative 1). Estimated management practices costs are equal under Alternatives 2 and 4 (average $0.27 per acre annually—greater than Alternative 1). Estimated average per acre annualized costs relative to full implementation of Alternative 1 (for the recommended ILRP) are summarized below.

Administration	$0.15 per acre annually
Monitoring and reporting	$0.96 per acre annually
Tracking	$0.42 per acre annually
Management practices	$0.27 per acre annually
Total estimated additional cost per acre	$1.79 per acre annually[70]

The total estimated cost of the recommended ILRP, 492 million dollars per year, is greater than Alternative 2 (485 million dollars per year) but less than Alternative 4 (511 million dollars per year) and is 2.9 percent greater than Alternative 1 (see Table 17 for estimated costs of each alternative).

As described in the economics report and Section IX.C of this report, stated potential costs for management practices are likely an overestimate.

2. Consideration of ILRP Goal 3—Economic Impacts

Goal 3 requires that the economic viability of agriculture in California's Central Valley be maintained. In Section IX.C.2, Alternatives 1, 2, and 4 were found to be consistent with Goal 3. Alternative 3 is partially consistent with Goal 3, and Alternative 5 is not consistent with Goal 3 because of predicted economic impacts on agriculture resulting from the substantial predicted cost increase. Total estimated costs to agricultural operations/State of the recommended ILRP are greater than Alternative 2, but less than Alternative 4. Both Alternatives 2 and 4 are consistent with Goal 3. *Therefore, the recommended ILRP is consistent with Goal 3.*

Because this is not a mandatory requirement of the recommended ILRP, potential costs of that option are not reflected in this analysis.

[69] Per acre average changes from full implementation of Alternative 1 (continuation of the current program) have been computed by subtracting Alternative 1 costs from recommended ILRP costs and dividing by the estimated irrigated agricultural acreage shown in Table 16 of this report.

[70] Totals may not sum as a result of rounding.

Section IX.C.2 of this report also summarizes estimated regional changes in total irrigated acreage, value of production, and jobs in the Central Valley attributable to implementation of Alternatives 2 and 4. It is estimated that predicted changes from implementation of the recommended ILRP would be bracketed by the changes predicted for Alternatives 2 and 4. Recommended ILRP estimated changes in total irrigated acreage, value of production, and jobs relative to Alternative 1 are summarized below (see Tables 19–21 of this report).

Irrigated acreage	-0.2%
Value of production	-0.1%
Jobs (lost/gained)	-58 (Alternative 2) to 9 (Alternative 4)

D. Recommended Irrigated Lands Regulatory Program Environmental Impacts

Potential significant environmental impacts of all five alternatives are associated with implementation of water quality management practices, construction of monitoring wells, and potential loss of agriculture resources. Loss of agricultural resource lands has been estimated using economic modeling procedures, considering the potential costs of each alternative. Alternatives with lower costs are estimated to result in less loss of agriculture resources (see Section IX.C.2). Additionally, Alternative 1 may have significant environmental impacts on groundwater quality because of failure to institute requirements to protect groundwater quality.

As described above, the recommended ILRP has been developed from the components of Alternatives 2 and 4. Management practices implemented under the recommended ILRP are estimated to be the same as those implemented under Alternatives 2 and 4. Therefore, potentially significant environmental impacts associated with implementation of management practices for the recommended ILRP are in the range of those described for Alternatives 2 and 4 in the Draft PEIR. Similarly, potentially significant impacts on agriculture resources under the recommended ILRP would be in the range of those estimated under Alternatives 2 and 4.

The recommended ILRP may result in significant impacts under certain conditions, for the following resource areas* (described in the Draft PEIR and summarized in Section IX.D of this report):

- cultural resources (potential loss of resources from construction and operation of practices and monitoring wells);
- noise and vibration (exposure of sensitive land uses to noise from construction and operation of practices and monitoring wells);
- air quality (generation of construction and operational emissions from management practices and monitoring wells);

- climate change (cumulative: potential increase in greenhouse gas emissions);
- vegetation and wildlife (loss of habitat, wildlife, wetland communities from reduced surface water discharge, construction, and operation of practices and monitoring wells);
- fisheries (loss of habitat from construction of management practices and monitoring wells, toxicity attributable to coagulant additives); and
- agriculture resources (potential loss of Prime Farmland).

* a generalized summary of affected resource areas. The reader is directed to the Draft PEIR for specific impacts and discussion.

The identified potential impacts of implementing management practices and construction of monitoring wells are indirect, and can be avoided through the employment of alternate practices (e.g., altered use of a pesticide rather than construction of a tailwater return system). Where no alternate practice or less sensitive location for the practice exists, irrigated agricultural operations that choose to employ these practices would be directed to avoid impacts to sensitive resources by following project-level mitigation measures that will be required for a grower to qualify for coverage under the implementation mechanism (e.g., WDRs/ waivers) of the chosen ILRP alternative. Specific mitigation measures will be identified[71] in conjunction with the Board's development of the ILRP implementation mechanisms. Performance standards for development of such mitigation, and program-level mitigation measures, are discussed in each resource section of the PEIR. The recommended ILRP contains the following programmatic strategy as an environmental commitment intended to reduce the potential for significant impacts to sensitive resources:

> *Where an irrigated agricultural operation/third-party group determines that a proposed management practice/monitoring well may impact a sensitive resource, the ILRP will require that the irrigated agricultural operation/third party (1) select a different management practice (or location of practice/monitoring well) that meets water quality goals, but does not involve impacts on a sensitive resource, or (2) implement the mitigation measures described in the implementation mechanism (e.g., WDRs/ waiver) for the potentially affected resource, or (3) work with the Central Valley Water Board to obtain an individual waste discharge permit and site-specific CEQA analysis.*

Inclusion and implementation of this requirement in ILRP implementation mechanisms would reduce the significant impacts described above, except for climate change and agriculture resources, to less than significant. Due to the

[71] Such mitigation measures will include those identified in the PEIR and may include other mitigation measures necessary to meet the mitigation performance measures described in the PEIR. Should any additional identified mitigation measures potentially cause environmental impacts, additional environmental impact analysis will be conducted.

unavailability of enforceable mitigation, the identified impacts to the areas of climate change and agriculture resources, which may result from anticipated regulatory compliance actions, are considered significant and unavoidable at the programmatic level.

XII. NEXT STEPS

Five programmatic long-term ILRP alternatives have been considered in the Draft PEIR, economics report, and policy analysis. The recommended long-term ILRP has been developed from the components of the five alternatives using the findings of these analyses.

Adoption of the long-term program will include Central Valley Water Board certification of the final PEIR and adoption of the policies and framework governing the long-term ILRP, as described above. Specific requirements will be established subsequently through Basin Plan amendments (e.g., for the conditional prohibition of discharge), requirements established in WDRs, or conditions established in waivers of WDRs. Those subsequent actions must be consistent with the general policies and framework established through the Board's adoption of the long-term program. However, the issuance of those specific orders or amendments may require additional environmental, cost, or policy analysis. To the extent such analysis is required, the appropriate supplemental documentation will be developed by staff and provided for public review.

The final PEIR and recommended long-term ILRP will be scheduled for a Central Valley Water Board hearing. At this hearing, the Board will consider:

1. the five programmatic alternatives,
2. the recommended program alternative,
3. the final PEIR and economics report,
4. this report, and
5. public comments

The Central Valley Water Board would have the option of certifying the PEIR and directing staff to implement the recommended long-term program at the hearing. Alternatively, the Board could direct staff to make changes to the recommended program, require changes be made to the PEIR, certify the PEIR and one or a combination of the five alternatives, or take no action.

REFERENCES

Agricultural Water Management Council. 2009. Efficient water management irrigation district achievements. Available: http://www.agwatercouncil.org/Publications/AWMC-Final/menu-id-86.html

Anning, D.W., S.A. Thiros, L.M. Bexfield, T.S. McKinney, and J.M. Green. 2009. National Water Quality Assessment program, Southwest Principal Aquifers Regional Ground-Water Quality Assessment: US Geological Survey Fact Sheet 2009–3015, March 2009.

Balazs C. 2008. Just Water? Social Disparities in Nitrate Contaminated Drinking Water in California's Central Valley, Doctoral Dissertation, University of California, Berkeley, CA.

Bartholomay R.C., J.M. Carter, S.L. Qi, P.J. Squillace, and G.L. Rowe. 2007. Summary of Selected U.S. Geological Survey Data on Domestic Well Water Quality for the Centers for Disease Control's National Environmental Public Health Tracking Program: U.S. Geological Survey, Scientific Investigations Report 2007–5213, 57 p. Available: http://pubs.usgs.gov/sir/2007/5213/downloads/sir2007–5213web.pdf

Barton L., L.A. Schipper, G.F. Barkle, M. McLeod, T.W. Speir, M.D. Taylor, A.C. McGill, A.P. van Schaik, N.B. Fitzgerald, and S.P. Pandey. 2005. Land Application of Domestic Effluent onto Four Soil Types: *Journal of Environmental Quality*, Vol. 34:p. 635–643.

Bennett, G.L., K. Belitz, and B.J. Milby Dawson. 2006. California GAMA Program—Ground-water quality data in the northern San Joaquin basin study unit, 2005: U.S. Geological Survey Data Series 196, 122 p. Available: http://pubs.usgs.gov/ds/2006/196/ds_196.pdf

Bowman, D.C., C.T. Cherney, and T.W. Rufty, Jr. 2002. Fate and Transport of Nitrogen Applied to Six Warm-Season Turfgrasses: *Crop Science Society of America*, Vol. 42, p. 833–841.

Brand, M.R., R.J. McAvoy, and E.G. Corbett. 1993. Nitrate loading to the soil profile underlying two containerized nursery crops supplied controlled release fertilizer: *Journal of Environmental Horticulture* Vol. 11, p. 82–85.

British Geological Survey. 2009. Groundwater Information Sheet, The Impact of Agriculture: National Environmental Resource Council, 6 p.

Burow, K.R., J.L. Shelton, and N.M. Dubrovsky. 1998. Occurrence of nitrate and pesticides in groundwater beneath three agricultural land-use settings in the eastern San Joaquin Valley, California: USGS Water-Resources Investigations Rep. 97-4284. USGS, Sacramento, CA

Burow, K.R., S.V. Stork, and N.M. Dubrovsky. 1998. Nitrate and Pesticides in Ground Water in the Eastern San Joaquin Valley, California: Occurrence and Trends: USGS Water-Resources Investigations Rep. 98-4040A.

Burow, K.R., N.M. Dubrovsky, and J.L. Shelton. 2007. Temporal trends in concentrations of DBCP and nitrate in groundwater in the eastern San Joaquin Valley, California, USA: *Hydrogeology Journal* (2007) 15: 991–1007.

Burow, K.R., and C.T. Green. 2008. Spatial and Temporal Trends in Nitrate Concentrations in the Eastern San Joaquin Valley Regional Aquifer and Implications for Nitrogen Fertilizer Management, California Plant and Soil Conference: Conservation of Agricultural Resources, February 5 & 6, 2008, Visalia, California, 47–52 p.

Burow, K.R., J.L. Shelton, N.M. Dubrovsky. 2008. Regional Nitrate and Pesticide Trends in Ground Water in the Eastern San Joaquin Valley, California: *Journal of Environmental Quality*, Vol. 37: 249–263 p.

Burton, C.A., and K. Belitz. 2008. Ground-water quality data in the southeast San Joaquin Valley, 2005– 2006—Results from the California GAMA Program: U.S. Geological Survey Data Series 351, 103 p. Available: http://pubs.usgs.gov/ds/351/

Buszka, P.M., L.R. Watson, and T.K. Greeman. 2006. Hydrogeology, Ground-Water-Age Dating, Water Quality, and Vulnerability of Ground Water to Contamination in a Part of the Whitewater Valley Aquifer System near Richmond, Indiana, 2002–2003: U.S. Geological Survey Scientific Investigations Report 2006–5281, 120 p. Available: http://pubs.usgs.gov/sir/2006/5281/pdf/sir2006–5281.pdf

California Code of Regulations, Sections 21000–21194 (California Environmental Quality Act), 1970. Available: http://www.leginfo.ca.gov/cgi-bin/waisgate?WAISdocID=6474966502+0+0+0&WAISaction=retrieve

California Code of Regulations, Sections 13000–16104 (Porter-Cologne Water Quality Control Act). 2010. Available: http://www.waterboards.ca.gov/laws_regulations/docs/portercologne.pdf

California Department of Food and Agriculture. 1961–2008. Fertilizing Materials Tonnage Reports.

California Department of Food and Agriculture. 1989.Nitrate and Agriculture in California: Nitrate Working Group, February 1989.

California Department of Food and Agriculture, About Fertilizers, Criteria for Nitrate-Sensitive Areas, Map 2.

California Department of Food and Agriculture, *California Agricultural Resource Directory 2008–2009.*

California Department of Pesticide Regulation. Groundwater Protection Program. Available: http://www.cdpr.ca.gov/docs/emon/grndwtr/index.htm

California Department of Public Health. 2009. Proposition 84 Section 75022—Second Round Project Priority List Small Community Infrastructure Improvements for Chemical and Nitrate Contaminants.

California Environmental Protection Agency. 1997. Office of Environmental Health Hazard Assessment, public health goals for nitrate and nitrite in drinking water.

California Environmental Protection Agency. 2004. Intra-agency Environmental Justice Strategy. Available: http://www.calepa.ca.gov/EnvJustice/Documents/2004/Strategy/Final.pdf

California Natural Resources Agency. 2009. California Environmental Quality Act Guidelines. Available: http://ceres.ca.gov/ceqa/guidelines/

California Regional Water Quality Control Board, Central Coast Region. 2004. Order No. R3-2004-0117 Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. Available: http://www.waterboards.ca.gov/centralcoast/board_decisions/adopted_orders/2004/2004_0117_wdr_conditional_ag_waiver.pdf

California Regional Water Quality Control Board, Central Coast Region. 2004. Monitoring and Reporting Program No. R3-2004-0117 for Dischargers Enrolled under Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. Available: http://www.waterboards.ca.gov/centralcoast/board_decisions/adopted_orders/2004/2004_0117_mrp_conditional_ag_waiver.pdf

California Regional Water Quality Control Board, Central Valley Region. 1995 (rev. 2004). Water Quality Control Plan for the Tulare Lake Basin. Available: http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/index.shtml

California Regional Water Quality Control Board, Central Valley Region. 1996. Grassland Bypass Project. Available: http://www.waterboards.ca.gov/centralvalley/water_issues/grassland_bypass/

California Regional Water Quality Control Board, Central Valley Region. 1998 (rev. 2009). Water Quality Control Plan for the Sacramento and San Joaquin River Basins. Available: http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/index.shtml

California Regional Water Quality Control Board, Central Valley Region. 2006. Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. Available: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/index.shtml

California Regional Water Quality Control Board, Central Valley Region. 2007. Waste Discharge Requirements General Order No. R5-2007-0035 for Existing Milk Cow Dairies. Available: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2007-0035.pdf

California Regional Water Quality Control Board, Central Valley Region. 2008. Coalition Group MRP Plans, Irrigated Lands Regulatory Program. Available: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/monitoring/monitoring_and_reporting_program_plans/index.shtml

California Regional Water Quality Control Board, Central Valley Region. 2008. Staff Report, Regulation of Food Processing Waste Discharges to Land.

California Regional Water Quality Control Board, Central Valley Region. 2009. Relative-Risk Evaluation for Pesticides Used in the Central Valley Pesticide Basin Plan Amendment Project Area, Final Staff Report. Available: http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/central_valley_pesticides/risk_evaluation/index.shtml

California Regional Water Quality Control Board, Central Valley Region, and Jones and Stokes. 2008. Irrigated Lands Regulatory Program Existing Conditions Report. Available: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/long_term_program_development/rev_existing_conditions_report/

California Regional Water Quality Control Board, Central Valley Region, and ICF Jones & Stokes. 2009. Long-term Irrigated Lands Regulatory Program Alternatives. Available: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/long_term_program_development/ilrp_longterm_alts_final.pdf

California Regional Water Quality Control Board, Los Angeles Region. 2005. Order No. R4-2005-0080 Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands in the Los Angeles Region. Available: http://www.waterboards.ca.gov/losangeles/water_issues/programs/tmdl/waivers/05_1220/order%20no.%20%20r4-2005-0080.pdf

California Regional Water Quality Control Board, Los Angeles Region. 2005. Monitoring and Reporting Program No. CI-8835 for Individual Dischargers under Order No. R4-2005-0080. Available: http://www.waterboards.ca.gov/losangeles/water_issues/programs/tmdl/waivers/05_1220/mrp%20individual.pdf

California Regional Water Quality Control Board, Los Angeles Region. 2005. Monitoring and Reporting Program No. CI-8836 for Discharger Groups under Order No. R4-2005-0080. Available: http://www.waterboards.ca.gov/losangeles/water_issues/programs/tmdl/waivers/05_1220/mrp%20group.pdf

California Regional Water Quality Control Board, Lahontan Region. 2007. Resolution No. R6T-2007-0019 Waiver of Waste Discharge Requirements for Grazing Operations in the East Walker River Watershed (Bridgeport Valley and Tributaries) of the Lahontan Region. Available: http://www.waterboards.ca.gov/lahontan/board_decisions/adopted_orders/2007/docs/r6t_2007_0019_grazingwaiverwdr.pdf

California Regional Water Quality Control Board, San Diego Region. 2007. Conditional Waiver No. 4—Discharges from Agricultural and Nursery Operations. Available: http://www.waterboards.ca.gov/sandiego/board_decisions/waivers/docs/Conditional_Waiver_4_Final.pdf

California State Water Resources Control Board. 1968. Resolution No. 68-16, Statement of Policy with Respect to Maintaining High Quality of Waters in California. Available: http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

California State Water Resources Control Board. 1981. Order No. WQ 81-5. Available: http://www.swrcb.ca.gov/board_decisions/adopted_orders/water_quality/1981/wq1981_05.pdf

California State Water Resources Control Board. 1982. Order No. WQ 82-5. Available: http://www.swrcb.ca.gov/board_decisions/adopted_orders/water_quality/1982/wq1982_05.pdf

California State Water Resources Control Board. 1987. Office of Chief Counsel Memorandum on the Federal Antidegradation Policy.

California State Water Resources Control Board. 1990. Municipal Stormwater Program. Available: http://www.waterboards.ca.gov/water_issues/programs/stormwater/municipal.shtml

California State Water Resources Control Board. 1990. Order No. WQ 90-6. Available: http://www.swrcb.ca.gov/board_decisions/adopted_orders/water_quality/1990/wq1990_06.pdf

California State Water Resources Control Board. 1992. Memorandum from the Office of Chief Counsel, State Water Resources Control Board, regarding implementation of State and Regional Water Board requirements at Federal facilities. July 7.

California State Water Resources Control Board. 1994. Nutrient TAC Report: Nonpoint Source (NPS) Pollution Control Program, Plant Nutrient Management TAC, November 1994. Available: http://www.swrcb.ca.gov/water_issues/programs/nps/docs/tacrpts/tac_nutrient.doc

California State Water Resources Control Board. 1997. Industrial Storm Water General Permit Order 97-03-DWQ. Available: http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/induspmt.pdf

California State Water Resources Control Board. 1998. NPS/CZARA Fact Sheet No. 1: Agricultural Management Measures. Available: http://www.waterboards.ca.gov/water_issues/programs/nps/docs/guidance/agricmms.pdf

California State Water Resources Control Board. 1999. General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 99-08-DWQ). Available: http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/finalconstpermit.pdf

California State Water Resources Control Board. 2000. Order No. WQ 2000-07. Available: http://www.swrcb.ca.gov/board_decisions/adopted_orders/water_quality/2000/wq2000_07.pdf

California State Water Resources Control Board, Division of Clean Water Programs, Groundwater Special Studies Unit, Groundwater Information Sheet—Nitrate/Nitrite Revised: October 23, 2002.

California State Water Resources Control Board. 2004. Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program. Available: http://www.waterboards.ca.gov/water_issues/programs/nps/docs/oalfinalcopy052604.doc

California State Water Resources Control Board, Division of Water Quality, GAMA Program, Groundwater Information Sheet—Nitrate / Nitrite Revised: February 2008.

California State Water Resources Control Board. 2009. Construction General Permit Order 2009-0009-DWQ. Available: http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo_2009_0009_complete.pdf

California State Water Resources Control Board. 2009. Water Quality Enforcement Policy. Available: http://www.waterboards.ca.gov/water_issues/programs/enforcement/docs/enf_policy_final111709.pdf

California State Water Resources Control Board, Septic Tanks Program. Available: http://www.waterboards.ca.gov/water_issues/programs/septic_tanks/

Centers for Disease Control and Prevention. 1995. A survey of the quality of water drawn from domestic wells in nine Midwest states. Atlanta: US Department of Health and Human Services.

Colangelo, D.J., and M.H. Brand. 2001. Nitrate Leaching beneath a Containerized Nursery Crop Receiving Trickle or Overhead Irrigation: *Journal of Environmental Quality*, Vol. 30, p. 1564–1574.

Daughton, C.G. 2007. Pharmaceuticals in the Environment: Sources and Their Management, Chapter 1, 1–58, *In* Analysis, Fate and Removal of Pharmaceuticals in the Water Cycle (M. Petrovic and D. Barcelo, Eds.), *Wilson & Wilson's Comprehensive Analytical Chemistry* series (D. Barcelo, Ed.), Volume 50, Elsevier Science, 564p.

Dawson, B.J. 2001. Ground-Water Quality in the Southeastern Sacramento Valley Aquifer, California, 1996: U.S. Geological Survey, Water-Resources Investigations Report 01-4125, p.30.

Dawson, B.J. 2001a, 2001. Shallow ground-water quality beneath rice areas in the Sacramento Valley, California, 1997: U.S. Geological Survey Water-Resources Investigations Report 2001-4000, 33p.

Dawson, B.J., G.L.Bennett, and K. Belitz. 2008. Ground-Water Quality Data in the Southern Sacramento Valley, California, 2005—Results from the California GAMA Program: U.S. Geological Survey Data Series 285, 93 p. http://pubs.usgs.gov/ds/285/ds285.pdf

Dinnes, D.L., D.L. Karlen, D.B. Jaynes, T.C. Kaspar, J.L. Hatfield, T.S. Colvin, and C.A. Cambardella. 2002. Nitrogen Management Strategies to Reduce Nitrate Leaching in Tile-Drained Midwestern Soils: *Agronomy Journal*, Vol. 94, p. 153–171.

Domagalski, J.L., S.P. Phillips, E.R.Bayless, C. Zamora, C. Kendall, R.A. Wildman, and J.G. Hering. 2008. Influences of the unsaturated, saturated, and riparian zones on the transport of nitrate near the Merced River, California, USA: *Hydrogeology Journal*, 2008, vol.16, pp. 675–690.

Dubrovsky, N.M., C.R. Kratzer, L.R. Brown, J.M. Gronberg, and K.R. Burow. 1998. Water quality in the San Joaquin–Tulare Basins, California, 1992–95: USGS Circ. 1159.

Dubrovsky, N.M., S. Ator, R. Coupe, K. McCarthy, D. Lampe, M. Sandstrom, and N. Baker. 2008. Comparative Study of Transport Processes of Nitrogen, Phosphorus, and Herbicides to Streams in Five Agricultural Basins, USA: *Journal of Environmental Quality*, Vol. 37, p. 1158–1169.

Eimers, J.L., and T.B. Spruill. 1997. Relating Minimum Soil Infiltration Rate to Nitrate-Nitrogen Concentrations in Shallow Ground Water in the Coastal Plain of Albemarle-Pamlico Drainage Basin, North Carolina and Virginia: Albemarle-Pamlico Estuarine Study Comprehensive Conservation and Management Plan Implementation Forum, June 5–6.

Engelsjord, M.E., B.E. Branham, and B.P. Horgan. 2004. The Fate of Nitrogen-15 Ammonium Sulfate Applied to Kentucky Bluegrass and Perennial Ryegrass Turfs: Crop Science Society of America, Vol. 44, p. 1341–1347.

Esser, B., B. Hudson, J. Moran, H. Beller, T. Carlsen, B. Dooher, P. Krauter, W. McNab, V. Madrid, D. Rice, and M. Verce. 2002. Nitrate Contamination in California Groundwater: An Integrated Approach to Basin Assessment and Resource Protection: Lawrence Livermore National Laboratory under Contract W-7405-ENG-48.

Esser, B.K., H.R. Beller, S.F. Carle, G.B. Hudson, S.R. Kane, R.N. Leif, T.E. LeTain, W.M. McNab, and J.E. Moran. 2009. California GAMA Program: Impact of Dairy Operations on Groundwater Quality: Lawrence Livermore National Laboratory under Contract W-7405-ENG-48, August 17, 2009.

Faunt, C.C., ed. 2009. Groundwater availability of the Central Valley Aquifer, California. U.S. Geological Survey Professional Paper 1766, 225 p.

Fisher, L.H., and R.W. Healy. 2008. Water movement within the unsaturated zone in four agricultural areas across the United States: *Journal of Environmental Quality*, Vol. 37, p. 1051–1063.

Frank, K.W., K.M. O'Reilly, J.R. Crum, and R.N. Calhoun. 2005. The Fate of Nitrogen Applied to a Mature Kentucky Bluegrass Turf: Crop Science Society of America, Vol. 46, p. 209–215.

Fuhrer, G.J., Gilliom, R.J., Hamilton, P.A., Morace, J.L., Nowell, L.H., Rinella, J.F., Stoner, J.D., Wentz, D.A., . 1999. The Quality of our Nation's Waters: Nutrients and Pesticides: U.S. Geological Survey Circular; 1225.

Gold, A.J., W.R. DeRagon, W.M. Sullivan, and J.L. Lemunyon. 1990. Nitrate-nitrogen Losses to Groundwater from Rural and Suburban Land Uses: *Journal of Soil and Water Conservation*, March–April1990, Vol. 45, Number 2.

Great Valley Center. 2009. The state of the Great Central Valley of California: supporting the economic, social, and environmental well-being of California's Great Central Valley. Great Valley Center, Modesto, CA. http://www.greatvalley.org/artman2/uploads/1/econindicators09_final.pdf

Green, C.T., L.H. Fisher, and B.A. Bekins. 2008. Nitrogen Fluxes through Unsaturated Zones in Five Agricultural Settings across the United States: *Journal of Environmental Quality*, May–June 2008, Vol. 37, pp. 1073–1085.

Haller, L, P. McCathy, T. O'Brien, J. Riehle, and T. Stuhldreher. 1996. Nitrate Pollution of Groundwater. http://www.reopure.com/nitratinfo.html

Harter, T., H. Davis, M.C. Mathews, and R.D. Meyer. 2001. Monitoring Shallow Groundwater Nitrogen Loading from Dairy Facilities with Irrigated Forage Crops: American Society of Agricultural Engineers Meeting Presentation, ASAE Paper Number 01-2103*, 2001 ASAE Annual International Meeting, Sacramento, CA, July 30–August 1, 2001*.

Harter, T. 2003. Water Well Design and Construction, PUBLICATION 8086 University of California, Division of Agriculture and Natural Resources. http://groundwater.ucdavis.edu/Publications/Harter_FWQFS_8086.pdf

Harter, T., Y.S. Onsoy, K. Heeren, M. Denton, G. Weissmann, J.W. Hopmans, and W.R. Horwath. 2005. Deep vadose zone hydrology demonstrates fate of nitrate in eastern San Joaquin Valley: California Agriculture, Vol. 59, No.2, p.124–132.

Harter, T. 2009. Agricultural Impacts on Groundwater Nitrate: Southwest Hydrology, July/August 2009, p. 22–23 and 35.

Helperin, A.N., D.S. Beckman, and D. Inwood. 2001. California's Contaminated Groundwater—Is the State Minding the Store? : National Resources Defense Council, April 2001.

Hull, L.C. 1984, Geochemistry of ground water in the Sacramento Valley, California. U.S. Geological Survey, Sacramento, CA. Professional paper 1401-B.

ICF International. 2010. *Irrigated Lands Regulatory Program Program Environmental Impact Report EIR*. Draft. July. (ICF 05508.05.) Prepared for: Central Valley Regional Water Quality Control Board, Rancho Cordova, CA.

ICF International. 2010. *Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program*. Draft. July. (ICF 05508.05.) Prepared for: Central Valley Regional Water Quality Control Board, Rancho Cordova, CA.

Jagucki, M.L., B.C. Jurgens, K.R. Burow, and S.M. Ebets. 2009. Assessing the Vulnerability of Public-Supply Wells to Contamination: Central Valley Aquifer System near Modesto, California: U.S. Geological Survey Fact Sheet 2009-3036, April 2009.

Johnson, B. 1991. Setting Revised Specific Numerical Values: Environmental Hazards Assessment Program, California Department of Food and Agriculture. http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/eh9106.pdf

Johnston, W.E. and A.F. McCalla. 2004. Whither California: up, down, or out? Some thoughts about the future. Giannini Foundation Special Report 04-1.

Kaown, D., Y. Hyun, G. Bae, and K. Lee. 2007. Factors Affecting the Spatial Pattern of Nitrate Contamination in Shallow Groundwater: *Journal of Environmental Quality*, Vol. 36 p. 1479–1487.

Kendall, C. and J.J. McDonnell. 1998. Tracing nitrogen sources and cycling in catchments: *In Isotope Tracers in Catchment Hydrology*, Amsterdam, Elsevier, pp. 519–576.

Kubin, E. 1998. Leaching of nitrate nitrogen into the groundwater after clear felling and site preparation: Boreal Environmental Research, Vol. 3, p. 3–8, July 1998.

Law, N.L., L.E. Band, and J.M. Grove. 2004. Nutrient Input from Residential Lawn Care Practices: *Journal Environmental Planning and Management*, Vol. 47: p.737–755.

Landon, M.K., and K. Belitz. 2008. Ground-water quality data in the Central Eastside San Joaquin Basin 2006: Results from the California GAMA Program: U.S. Geological Survey Data Series 325, 88 p.

Landon, M.K., and M.S. Fram. 2009. Occurrence and Distribution of Nitrate in Groundwater in the Central Valley: presentation Irrigated Lands Regulatory Program Workshop, April 15, 2009.

Lee, G.F. and A. Jones-Lee. 2007. Water Quality Issues of Irrigated Agricultural Runoff/Discharges San Joaquin River, Central Valley, California: *Agriculture and the Environment—2007 Conference*, Central Coast Agricultural Water Quality Coalition, Monterey, CA November 2007.

Longe, E.O., and L.O. Enekwechi. 2007. Investigation on potential groundwater impacts and influence of local hydrogeology on natural attenuation of leachate at a municipal landfill: *International Journal of Science and Technology*, Vol. 4 (1), p. 133–140.

Loper, C.A., K.J. Breen, T.M .Zimmerman, and J.W. Clune. 2009. Pesticides in ground water in selected agricultural land-use areas and hydrogeologic settings in Pennsylvania, 2003–07: U.S. Geological Survey Scientific Investigations Report 2009–5139, 121 p. http://pubs.usgs.gov/sir/2009/5139/sir2009-5139.pdf

McNab, W.W., M.J. Singleton, J.E. Moran, and B.E. Esser. 2007. Assessing the Impact of Animal Waste Lagoon Seepage on the Geochemistry of an Underlying Shallow Aquifer: Environmental Science & Technology, Vol. 41, p. 753–758.

Meixner, T., M.E. Fenn, and P.M. Wohlgemuth. 2003. Fire Disturbance and Nitrogen Deposition Impacts at the Watershed Scale in Southern California: U. S. Department of Agriculture, Agriculture Research Service, First Interagency Conference on Research in the Watersheds, Oct. 27–30, 2003.

Mills, G.A., B. Vrana, I. Allan, D.A. lvarez, J.N. Huckins, and R. Greenwood. 2007. Trends in monitoring pharmaceuticals and personal-care products in the aquatic environment by use of passive sampling devices: Anal Bioanal Chem, Vol. 387 p.1153–1157.

Minnesota Department of Agriculture. 2006. A Co-occurrence of Nitrate and Pesticides.

Moran, J.E., B.K. Esser, G.B. Hudson, and M.J. Singleton. 2005. The Effects of Agricultural Nitrate Sources on Groundwater Supplies in California: Geological Society of America *Abstracts with Programs*, Vol. 37, No. 7, p. 247, October 2005.

Moran J.E., M.J. Singleton, S.F. Carle, and B.K. Esser. 2007. Intrinsic and Extrinsic Chemical and Isotopic Tracers for Characterization of Groundwater Systems: Illinois State Geological Survey: 3D workshop. http://www.isgs.illinois.edu/research/3DWorkshop/2007/pdf-files/moran.pdf

Mueller, D.K., P.A. Hamilton, D.R. Helsel, K.J. Hitt, and B.C. Ruddy. 1995. Nutrients in Ground Water and Surface Water of the United States—An Analysis of Data through 1992. U.S. Geological Survey, Reston, VA. Water Resources Investigations Report 95-4031.

Munoz-Arboleda, F., R. Mylavarapu, C. Hutchinson, and K. Portier. 2008. Nitrate-Nitrogen Concentrations in the Perched Ground Water under Seepage-Irrigated Potato Cropping Systems: *Journal of Environmental Quality*, Vol. 37 p. 387–394.

Natural Resources Conservation Service. 2009. Watershed Boundary Dataset (WBD) User Guide.

Newkirk, D., and J. Darby. 2008. Evaluation and Design of Small Water Systems Cost Estimating and SWS Grants/Funding, University of California Davis Press.

Nolan, B.T., and B.C. Ruddy. 1996. Nitrate in Ground Water of the United States—Assessing the Risk: U.S. Geological Survey Fact Sheet FS-092-96.

Nolan, B.T., B.C. Ruddy, K.J. Hitt, and D.R. Helsel. 1997. Risk of nitrate in groundwaters of the United States—a national perspective: Environmental Science and Technology, v. 31, n. 8, p. 2229–2236.

Nolan B.T., B.C. Ruddy, K.J. Hitt, and D.R. Helsel. 1998. A national look at nitrate contamination of ground water: Water Conditioning and Purification Magazine, vol. 39, number 12, p. 76–79.

Nolan, BT. 2001. Relating Nitrogen Sources and Aquifer Susceptibility to Nitrate in Shallow Ground Waters of the United States. *Ground Water*, 39(2):290–299.

Nolan, B.T., K.J. Hitt, and B.C. Ruddy. 2002. Probability of Nitrate Contamination of Recently Recharged Groundwaters in the Coterminous United States: Environmental Science & Technology, Vol. 36, No. 10, p. 2138–2145.

Nolan, B.T., and K.J. Hitt. 2006. Vulnerability of Shallow Groundwater and Drinking-Water Wells to Nitrate in the United States: Environmental Science & Technology, Vol. 40, No. 24, p. 7834–7840.

Onsoy, Y.S., T. Harter, T.R. Ginn, and W.R. Horwath. 2005. Spatial Variability and Transport of Nitrate in a Deep Alluvial Vadose Zone: *Vadose Zone Journal* Vol. 4, p. 41–54.

Orang, M., R. Snyder, and S. Matyac. 2005. Survey of Irrigation Methods in California. California Department of Water Resources and University of California, Davis. *California Water Plan Update 2005*. Volume 4, pg 299–318.

Pang, L., C. Nokes, J. Sumunek, H. Kikkert, and R. Hector. 2006. Modeling the Impact of Clustered Septic Tank Systems on Groundwater Quality: *Vadose Zone Journal*, Vol. 5, P. 599–609.

Panno, S.V., K.C. Hackley, W.R. Kelly, and H. Hwang. 2006. Isotopic Evidence of Nitrate Sources and Denitrification in the Mississippi River, Illinois: *Journal of Environmental Quality*, Vol. 35 p. 495–504.

Paul, A.P., R.L. Seiler, T.G. Rowe, and M.R. Rosen. 2007. Effects of agriculture and urbanization on quality of shallow ground water in the arid to semiarid western United States, 1993–2004: U.S. Geological Survey Scientific Investigations Report 2007–5179, 56 p.

Peralta, J.M., and C.O. Stockle. 2002. Dynamics of nitrate leaching under irrigated potato rotation in Washington State: a long-term simulation study: Agriculture, *Ecosystems & Environment*, Vol. 88, Issue 1, p. 23–34.

Power, J.F., R. Wiese, and D. Flowerday. 2001. Managing Farming Systems for Nitrate Control: A research Review from Management Systems Evaluation Areas: *Journal of Environmental Quality*, Vol. 30 p. 1866–1880.

Simmons, H. Provost & Pritchard Consulting. Telephone communication with Central Valley Water Board staff. March 10, 2010.

Puckett, L.J., and W.B. Hughes. 2005. Transport and Fate of Nitrate and Pesticides: Hydrogeology and Riparian Zone Processes: *Journal of Environmental Quality*, Vol. 34 p. 2278–2292.

Puckett, L.J., C. Zamora, H. Essaid, J.T. Wilson, H.M. Johnson, M.J. Brayton, and J.R. Vogel. 2008. Transport and Fate of Nitrate at the Ground-Water / Surface-Water Interface: *Journal of Environmental Quality*, Vol. 37 p. 1034–1050.

Raciti, S.M., P.M. Groffman, and T.J. Fahey. 2008. Nitrogen Retention in Urban Lawns and Forests. *Ecological Applications*: Vol. 18, No. 7, pp. 1615–1626.

Ristvey, A.G., J.D. Lea-Cox, and D.S. Ross. 2004. Nutrient Uptake, Partitioning and Leaching Losses from Container-Nursery Production Systems: *Acta Horticulturae*, Vol. 630, p. 321–328.

Rosen, M.R., and W.W. Lapham. 2008. Introduction to the U.S. Geological Survey National Water-Quality Assessment (NAWQA) of Ground-Water Quality Trends and Comparison to Other National Programs: *Journal of Environmental Quality*, Vol. 37 p. S190-S198.

Ruddy, B.C., D.L. Lorenz, D.K. Mueller. 2006. County-Level Estimates of Nutrient Inputs to the Land Surface of the Conterminous United States, 1982–2001.U.S. Geological Survey, Reston, VA. Scientific Investigations Report 2006-5012.

Rupert, M.G. 2008. Decadal-Scale Changes of Nitrate in Ground Water of the United States, 1988–2004: *Journal of Environmental Quality*, Vol. 37 p. 240–248.

Scanlon, B.R., R.C. Reedy, D.A. Stonestrom, D.E. Prudic, and K.F. Dennehy. 2005. Impact of land use and land cover change on groundwater recharge and quality in the southwestern US: *Global Change Biology* (2005) Vol. 11, p.1577–1593.

Schoups, G., J.W. Hopmans, C.A. Young, J.A. Vrugt, W.W. Wallender, K.K. Tanji, S. Panday. 2005. *Sustainability of Irrigated Agriculture in the San Joaquin Valley, California*. Proceedings of the National Academy of Sciences of the United States of Amercia, Volume 102 No. 43.

Seiler, R.L., S.D. Zaugg, J.M. Thomas, and D.L. Howcroft. 1999. Caffeine and Pharmaceuticles as Indicators of Waste Water Contamination in Wells: *Ground Water*, May–June 1999, Vol. 37, No.3, p. 405–510.

Shelton, J.L., I. Pimentel, M.S. Fram, and K. Belitz. 2008. Ground-water quality data in the Kern County subbasin study unit, 2006—Results from the California GAMA Program: U.S. Geological Survey Data Series 337, 75 p. http://pubs.usgs.gov/ds/337/pdf/ds337.pdf

Singleton, M.J., B.K. Esser, J.E. Moran, G.B. Hudson, W.W. McNab, and T. Harter. 2007. Saturated Zone Denitrification: Potential for Natural Attenuation of Nitrate Contamination in Shallow Groundwater Under Dairy Operations: *Environmental Science & Technology*, Vol. 41, p. 759–765.

Spalding, R.F., D.G. Watts, J.S. Schepers, M.E. Burbach, M.E. Exner, R.J. Poreda, and G.E. Martin. 2001. Controlling Nitrate Leaching in Irrigated Agriculture: *Journal of Environmental Quality*, Vol. 30 p. 1184–1194.

Standley, L.J., R.A. Rudel, C.H. Swartz, K.R. Attfield, J. Christian, M. Erickson, and J.G. Brody. 2008. Wastewater-Contaminated Groundwater as a Source of Endogenous Hormones and Pharmaceuticals to Surface Water Ecosystems: *Environmental Toxicology and Chemistry*, Vol. 27, Issue 12, p. 2457–2468.

Stewart, I.T., and K. Loague. 2004. Assessing Ground Water Vulnerability with the Type Transfer Function Model in the San Joaquin Valley, California: *Journal of Environmental Quality*, Vol. 33 p. 1487–1498.

Suen, C.J. 2008. Using Isotopic Ratios and Major Minerals Data to Identify the Sources of Ground Water and Ground Water Nitrate in Relation to Pesticide Residues: California Department of Pesticide Regulation, Environmental Monitoring Branch, June 24, 2008.

Suen, C.J. 2008. Metadata Guide for Salinity Data Sources for the Central Valley of California. California Water Institute, California State University, Fresno, for the California Regional Water Quality Control Board, Central Valley Region, Rancho Cordova, CA.

Tesoriero, A.J., D.A. Saad, K.R. Burow, E.A. Frick, L.J. Puckett, and J.E. Barbash. 2007. Linking ground-water age and chemistry data along flow paths: Implications for trends and transformations of nitrate and pesticides: *Journal of Contaminant Hydrology*, 94 (2007), p. 139–155.

Thiros, S.A., 1999, Quality of shallow ground water in areas of recent residential and commercial development in Salt Lake Valley, Utah, 1999: U.S. Geological Survey Fact Sheet 106-00.

Tomer, M.D., and M.R. Burkart. 2003. Long-Term Effects of Nitrogen Fertilizer Use on Ground Water in Two Small Watersheds: *Journal of Environmental Quality*, Vol. 32 p. 2158–2171.

Townsend, M.A., and D.P. Young. 1995. Factors Affecting Nitrate Concentrations in Ground Water in Stafford County, Kansas: Kansas Geological Survey, Current Research in Earth Sciences, Bulletin 238, part 1.

Troiano, J., F. Spurlock, and J. Marade. 1999. Update of the California Vulnerability Soil Analysis for Movement of Pesticides to Ground Water: October 14, 1999. California Department of Pesticide Regulation, Sacramento, CA. EH 00-05.

University of California, Davis. 2009. Global Markets and Trade; University of California Agricultural Issues Center.

University of Minnesota. 2006. Drinking Water Protection Series, Nitrate Contamination—What is the Cost? Minnesota Department of Agriculture.

U.S. Census Bureau. 2004. The American housing survey for the United States, 2003. US Department of Commerce, Washington, DC.

U.S. Code of Federal Regulations Title 40 Section 131.12, Antidegradation Policy.

USDA Economic Research Service, State Fact Sheets: California, 2008 estimates.

USDA National Agricultural Statistics Service, 2007 Census of Agriculture. http://www.agcensus.usda.gov/

USDA National Agricultural Statistics Service. 2009. California Agricultural Overview. http://www.nass.usda.gov/Statistics_by_State/California/Publications/California_Ag_Statistics/2008cas-ovw.pdf

USEPA, Federal Insecticide, Fungicide, and Rodenticide Act, Title 7, United States Code section 136. http://www.law.cornell.edu/uscode/html/uscode07/usc_sup_01_7_10_6_20_II.html

USEPA, 1990, National pesticide survey: project summary. Washington, DC.

USEPA. 1998. Office of Water Standards and Applied Sciences Division Environmental *Impacts of Animal Feeding Operations, December 31, 1998.*

USEPA. 2002. Onsite Wastewater Treatment Systems Manual, Chapter 3, page 3–11, EPA/625/R-00/008. February. Available: http://www.epa.gov/nrmrl/pubs/625r00008/html/600R00008chap1.htm

USEPA. 2002. Chapter1: Background and Use of Onsite Wastewater Treatment Systems, EPA600/R-00/008.

USEPA. 2003. National Management Measures to Control Nonpoint Source Pollution from Agriculture (EPA 841-B-03-004). http://www.epa.gov/nps/agmm/

USEPA. 2008. Handbook for Developing Watershed Plans to Restore and Protect Our Waters: Chapter 4. http://www.epa.gov/nps/watershed_handbook/#contents

USEPA. 2009. National Primary Drinking Water Regulations, U.S. Environmental Protection Agency. http://www.epa.gov/safewater/contaminants/

USGS. 1999. The quality of our nation's waters: nutrients and pesticides. Circular 1225, US Department of the Interior, Reston, VA.

USGS. 2006. County-Level Estimates of Nutrient Inputs to the Land Surface of the Conterminous United States, 1982–2001. Scientific Investigations Report 2006-5012.

USGS. 2007. U.S. Geological Survey Scientific Investigations Report 2007–5179, 56 p.

USGS and USDA, Natural Resources Conservation Service. 2009. Federal guidelines, requirements, and procedures for the national Watershed Boundary Dataset: U.S. Geological Survey Techniques and Methods 11–A3, 55 p.

USGS. The Reston Chlorofluorocarbon Laboratory, $^3H/^3He$ Dating Background: Online at http://water.usgs.gov/lab/.

Van der Schans, M.L., T. Harter, A. Leijnse, M.C. Mathews, and R.D. Meyer. 2009. Characterizing sources of nitrate leaching from an irrigated dairy farm in Merced County, California: *Journal of Contaminant Hydrology*, Vol. 110, Issue 1–2, 3 November 2009, p. 9–21.

Wakida, F.T., and D.N. Lerner. 2005. Non-agricultural Sources of Groundwater Nitrate: A Review and Case Study: *Water Research*, Vol. 39, Issue 1, January 2005, pages 3–16.

Wakida, F.T. 2008. Sources of Nitrate in Urban Groundwater: *Science Topics*, 22 August 2008.

Wallace, J., and M. Lowe. 1998. The Potential Impact of Septic Tank Soil-Absorption Systems on Water Quality in the Principal Valley-Fill Aquifer, Ogden Valley, Weber County, Utah—Assessment and Guidelines: Utah Geological Survey, Report Investigation 237, May 1998.

Ward, M.H., B.A. Kilfoy, P.J. Weyer, K.E. Anderson, A.R. Folsom, J.R. Cerhan. 2010. Nitrate Intake and the Risk of Thyroid Cancer and Thyroid Disease. *Epidemiology*. Mar 23.

Watanabe, N., T.H. Harter, and B.A. Bergamaschi. 2008. Environmental Occurrence and Shallow Ground Water Detection of the Antibiotic Monensin from Dairy Farms: *Journal of Environmental Quality*, Vol. 37 p. S-78-S-85.

Widory, D., E. Petelet-Giraud, P. Negrel, and B. Ladouche. 2005. Tracking the Sources of Nitrate in Groundwater Using Coupled Nitrogen and Boron Isotopes: A Synthesis: *Environmental Science and Technology*, Vol. 39, p. 539–548.

Wiederholt, R., and B. Johnson. 2005. Nitrogen Behavior in the Environment: North Dakota State University, NM-1299, November.

Wildman, R.A. Jr., J.L. Domagalski, and J.G.Hering. 2009. Hydrologic and Biogeochemical Controls of River Subsurface Solutes under Agriculturally Enhanced Ground Water Flow: *Journal of Environmental Quality*, 2009, Vol. 38, pp. 1830–1840.

Wilkison, D.H. 1998. USGS research at Management Systems Evaluation Areas, 1991–95: USGS Fact Sheet 042-98, 4 p.

Williams, A.G., J.F. Dowd, D. Scholefield, N.M. Holden, and L.K. Deeks. 2003. Preferential Flow Variability in a Well-Structured Soil: *Soil Science Society of America Journal*, Vol. 67, p.1272–1281.

Wu, L., J. Letey, C. French, Y. Wood, and D. Birkle. 2005. Nitrate leaching hazard index developed for irrigated agriculture. *Journal of Soil and Water Conservation.*60, 4, 90A-95A.

Xu, Y., L.A. Baker, and P.L. Johnson. 2007. Trends in Ground Water Nitrate Contamination in the Phoenix, Arizona Region: *National Ground Water Association, Ground Water Monitoring & Remediation*, Vol 27, No.2, Spring 2007, p. 49–56.

Zhao, C., C. Hu, W. Huang, X. Sun, Q. Tan, and H. Di. 2009. A Lysimeter study of Nitrate Leaching and Optimum Nitrogen Application rates for Intensively Irrigated Vegetable Production System in Central China: *Journal of Soils and Sediments*, Online First, Article 43, 28 March 2009.

Internet Links

Dairy Program, Central Valley Regional Water Board: http://www.waterboards.ca.gov/centralvalley/water_issues/dairies)

Waste Discharges to Land, Central Valley Regional Water Board: http://www.waterboards.ca.gov/centralvalley/water_issues/waste_to_land/

Watershed Boundary Dataset (WBD): http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/

APPENDIX A

DECEMBER 2009 PROPOSED LONG-TERM IRRIGATED LANDS REGULATORY PROGRAM ALTERNATIVES

PROPOSED

LONG-TERM IRRIGATED LANDS REGULATORY PROGRAM ALTERNATIVES

PREPARED FOR:

Long-Term Irrigated Lands Regulatory Program
Stakeholder Advisory Workgroup

PREPARED BY:

Central Valley Regional Water Quality Control Board
ICF Jones & Stokes

December 2009

Central Valley Regional Water Quality Control Board and ICF Jones & Stokes. 2009. *Proposed Long-Term Irrigated Lands Regulatory Program Alternatives*. December. (ICF J&S 05508.05.) Sacramento, CA. Prepared for: Long-Term Irrigated Lands Regulatory Program Stakeholder Advisory Workgroup, Sacramento, CA.

Contents

Tables

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Acronyms and Abbreviations

Basin Plan	Water Quality Control Plan
Central Valley Water Board	California Regional Water Quality Control Board, Central Valley Region
CEQA	California Environmental Quality Act
Conditional Waiver	Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands
DPH	California Department of Public Health
DPR	California Department of Pesticide Regulation
DWR	California Department of Water Resources
EIR	Environmental Impact Report
FREP	Fertilizer Research and Education Program
FWQMP	Farm Water Quality Management Plan
GAMA	Groundwater Ambient Monitoring and Assessment
GMAs	groundwater management areas (GMAs
GQMPs	groundwater quality management plans
GW	groundwater categories
ILRP	Irrigated Lands Regulatory Program
IWMP	Irrigation Water Management Plan
JPA	joint powers authority
MOU	Memorandum of Understanding
NMP	Nutrient Management Plan
NRCS	National Resources Conservation Service
PRC	Public Resources Code
RCD	Resource Conservation Districts
SW	surface water categories
UC	University of California
WDRs	waste discharge requirements
Workgroup	Long-Term Irrigated Lands Regulatory Program Stakeholder Advisory Workgroup
WQMP	Water Quality Management Plan

Proposed Long-Term Irrigated Lands Regulatory Program Alternatives December 2009

Introduction

The California Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board) Irrigated Lands Regulatory Program (ILRP) was initiated in 2003 with the adoption of a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Conditional Waiver). Under the 2003 Conditional Waiver, the Central Valley Water Board directed staff to prepare an Environmental Impact Report (EIR) for a long-term ILRP. The 2003 Conditional Waiver expired in 2006, at which time a Revised Conditional Waiver was adopted that continues the Conditional Waiver until June 2011.

The Central Valley Water Board must develop recommendations for a long-term ILRP by summer 2009 in order to have enough time to complete the necessary California Environmental Quality Act (CEQA) and economic review prior to the expiration of the interim program in June 2011. Proposed modifications to the ILRP must be approved by the Central Valley Water Board and may include:

- Establishing subcategories and related requirements for different types of agricultural operations and/or geographic areas.
- Adding requirements to protect groundwater from potential impacts related to irrigated agriculture.
- Considering various regulatory approaches, such as use of management practice requirements, technology performance standards, narrative or numeric water quality-based limits, or a combination of approaches.

This draft provides a summary of 1) the overall goals of the Central Valley Water Board's ILRP, 2) the process that was used to develop the proposed alternatives in collaboration with stakeholders, and 3) the range of proposed ILRP alternatives that were developed by the Long-Term ILRP Stakeholder Advisory Workgroup (Workgroup) and Central Valley Water Board staff. All alternatives must be consistent with program goals and meet minimum statutory requirements. To this end, each alternative advanced for evaluation in the EIR will be reviewed by Central Valley Water Board staff and may be subject to modifications. However, any such modifications will be done only after discussion with Workgroup members.

During the course of reviewing the alternatives, Central Valley Water Board staff may identify other feasible alternatives that are more cost effective, are less likely to have a negative impact on the environment, or have other desirable characteristics. If such alternatives are developed by staff, those alternatives will be discussed with the Workgroup prior to their inclusion for evaluation in the EIR.

Goals and Objectives of the Long-Term Irrigated Lands Regulatory Program

Irrigated agricultural lands include lands where water is applied to produce crops, fiber, or livestock for commercial sale or use. For the purposes of this ILRP, irrigated agricultural lands also include managed wetlands, nurseries, and water districts[1]. Understanding that irrigated agriculture in the Central Valley provides valuable food and fiber products to communities worldwide, the overall goals of the ILRP are to 1) restore and/or maintain the highest reasonable quality of state waters[2] considering all the demands being placed on the water, 2) minimize waste discharge from irrigated agricultural lands[3] that could degrade the quality of state waters, 3) maintain the economic viability of agriculture in California's Central Valley, and 4) ensure that irrigated agricultural discharges do not impair Central Valley communities and residents access to safe and reliable drinking water. In accordance with these goals, the objectives of the ILRP are to:

- Restore and/or maintain appropriate beneficial uses established in Central Valley Water Board Water Quality Control Plans by ensuring that all state waters meet applicable water quality objectives.[4]
- Encourage implementation of management practices that improve water quality in keeping with the first objective without jeopardizing the economic viability for all sizes of irrigated agricultural operations in the Central Valley or placing an undue burden on rural communities to provide safe drinking water.
- Provide incentives[5] for agricultural operations to minimize waste discharge to state waters from their operations.
- Coordinate with other Central Valley Water Board programs, such as the Grasslands Bypass Project waste discharge requirements for agricultural lands, the Westlands Water District's effort to develop waste discharge requirements for agricultural lands, total maximum daily load development, CV-Salts, and waste discharge requirements for dairies.
- Promote coordination with other regulatory and non-regulatory programs associated with agricultural operations (e.g., the California Department of Pesticide Regulation [DPR], the California Department of Public Health [DPH] Drinking Water Program, the California Air Resources Board, the California Department of Food and Agriculture, Resource Conservation Districts, the University of California Extension, Natural Resource Conservation Service, National Organic Program, California Agricultural Commissioners, State Water Resources Control Board Groundwater Ambient Monitoring and Assessment program, United States Geological Survey, and local groundwater programs [SB 1938, AB 3030, Integrated Regional Water Management Plans]) to minimize duplicative regulatory oversight while ensuring program effectiveness.

[1] Water districts would be included only if it accepts or receives discharges from irrigated lands, and discharges or threatens to discharge waste to waters of the state.

[2] California Water Code section 13050 defines state waters as any surface water or groundwater, including saline waters, within the boundaries of the state.

[3] Irrigated agricultural lands include managed wetlands, nurseries, and water districts.

[4] This objective did not receive Workgroup consensus and consequently was not recommended by the Workgroup. In general, concerns regarding this proposed objective have to do with whether there should be some qualifier that accounts for the feasibility and reasonableness of restoring all state waters to applicable water quality objectives.

[5] Incentives could include financial, monitoring reductions, certification, or technical help.

Alternatives Development and Screening

CEQA Requirements

In accordance with State CEQA Guidelines Section 15126.6(a), EIRs must evaluate a “range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project.” State CEQA Guidelines Section 21061.1 defines *feasible* as “capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.” Selecting a range of project alternatives for evaluation is the responsibility of the lead agency, which must “publicly disclose its reasoning for selecting those alternatives.” [State CEQA Guidelines Section 15126.6(a)].

State CEQA Guidelines Section 15126.6(c) also directs that EIRs should “identify any alternatives that were considered…but were rejected as infeasible,” and “briefly explain the reasons” for the determination. It explains that alternatives may be rejected due to “(i) failure to meet most of the basic project objectives, (ii) infeasibility, and (iii) inability to avoid significant environmental impacts.” The factors that will be weighed to determine the feasibility of ILRP alternatives include economic viability[6], consistency with existing plans or planning documents, regulatory limitations, and jurisdictional authority.

Considered alternatives must include the specific alternative of "no project," or conditions at the time the notice of preparation is published. When the project is the revision of an existing land use or regulatory plan, policy, or ongoing operation, the "no project" alternative is the continuation of the existing plan, policy or operation into the future. [State CEQA Guidelines Section 15126.6(d)–(e)]. In this instance, the "no project" scenario will be presented as the "proposed project", the project against which the range of identified alternatives is compared.

In most CEQA documents, the lead agency has identified the proposed project as the "preferred project", and thus the alternatives may typically receive a reduced level of analysis in comparison. However, in this document, no preferred project will be identified by the Central Valley Water Board. Instead, each chosen project alternative will receive a full measure of analysis, to the extent necessary to determine and compare all anticipated impacts.

An EIR “shall include sufficient information about each alternative to allow meaningful evaluation, analysis, and comparison with the proposed project.” [State CEQA Guidelines Section 15126.6(d)]. The State CEQA Guidelines Section 15126.6(b) provides that the discussion of alternatives should focus on alternatives “which are capable of avoiding or substantially lessening any significant effects of the project, even if these alternatives could impede to some degree the attainment of the project objectives or would be more costly.”

The final decision regarding the feasibility of alternatives lies with the decision maker for a given project, who must make the necessary findings addressing the potential feasibility of reducing the severity of significant environmental effects. (Public Resources Code [*PRC*] 21081, State CEQA Guidelines Section 15091).

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[6] Unlike other CEQA lead agencies, Regional Water Boards are directed by California Water Code section 13241 to consider economics when establishing water quality objectives.

Stakeholder Process

In fall 2008, the Central Valley Water Board convened the Workgroup to provide staff with input on the development of the ILRP. The Workgroup includes a range of stakeholder interests representing local government, industry, agricultural, and environmental coalitions throughout the Central Valley.

The Workgroup operates under a Charter document that contains a plan for communicating Workgroup recommendations to the Central Valley Water Board, establishes the Workgroup structure, and clarifies roles and responsibilities. Workgroup meetings conducted to date are summarized here.

- October 9, 2008: Organizational Workgroup Meeting.
- December 17, 2008: Workgroup Meeting to Discuss Strategy.
- February 2, 2009: Groundwater Information Session.
- February 17, 2009: Workgroup Meeting to Present Participant Proposed Alternatives.
- April 15, 2009: Groundwater Nitrate Information Session.
- May 19, 2009: Workgroup Meeting to Discuss Proposed Long-term ILRP alternatives.
- August 20, 2009: Final Workgroup Meeting to Discuss Proposed Long-term ILRP alternatives.

The Workgroup meetings provide a forum for stakeholder input and deliberation. Because the ILRP is complex, information sessions were arranged to share technical information.

Alternatives Development Process

Alternatives that will be evaluated in the EIR need to meet the goals and objectives for the ILRP and be substantially different so that the alternatives can be compared to each other. Initially, Central Valley Water Board staff proposed a two-phase process for developing alternatives.

- **Phase I:** Develop a comprehensive list of alternatives and prioritize the alternatives using an evaluation measures–based (e.g., effectiveness, cost) quantitative scoring system. The goal of the Phase I step is to develop a comprehensive list of alternatives that could meet the goals and objectives for the ILRP for further Workgroup consideration.
- **Phase II:** Collaboratively screen the comprehensive list of alternatives to determine which alternatives would be evaluated in the EIR for the ILRP.

At the December 17 Workgroup meeting, the Workgroup decided to refine the approach for evaluating alternatives by combining the two phases into a shortened process. It was decided that the Workgroup and Central Valley Water Board staff would develop a range of alternatives that could meet the objectives of the ILRP, and sort through those alternatives as they were being developed. Ultimately, the Workgroup will provide input to assist the Central Valley Water Board in determining the alternatives to be evaluated in the EIR.

Central Valley Water Board staff developed a template and program matrix to assist Workgroup participants in the development of alternatives. The template and matrix were included in a Workgroup Strategy Document dated January 9, 2009. The Workgroup Strategy Document included a discussion of minimum requirements for alternatives, a Workgroup meeting schedule, and a process for selecting ILRP alternatives for EIR analysis.

On February 17, 2009, Workgroup participants presented proposed ILRP alternatives. After the February 17 Workgroup meeting Central Valley Water Board staff began working with Workgroup participants that proposed alternatives to develop the details of their alternatives. Central Valley Water Board staff have also developed additional alternatives as necessary to represent a range of possible programs to evaluate in the EIR (per the State CEQA Guidelines requirements). Many of the proposed alternatives that were presented were combined, or additional features were added, to develop complete alternatives that could meet the goals and objectives of the program.

At the final Workgroup meeting on August 20, 2009 the Workgroup voted on the proposed range of alternatives and each program goal and objective. The workgroup came to consensus that the proposed range of alternatives should be evaluated in the Environmental Impact Report. Also, the Workgroup has come to consensus on each of the proposed program goals and all but one of the proposed objectives (see Goals and Objectives section). Following the August 20 meeting, Workgroup participants provided additional written comments on the proposed alternatives. The additional written comments will be considered during the EIR process.

Alternatives Screening

In order to be considered alternatives under CEQA, ILRP alternatives must meet the goals and objectives of the project (as defined above). At a minimum, alternatives must also meet statutory requirements established in applicable state policy and regulations (e.g., the California Water Code; the Central Valley Water Board Water Quality Control Plan, or the *Basin Plan*; the State Water Resources Control Board Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program; and the State Antidegradation Policy). Alternatives that do not meet minimum statutory requirements will not be considered for inclusion in the ILRP.

An effort has been made throughout the development process to ensure that the alternatives meet statutory requirements as well as the goals and objectives for the program. This effort included circulating an alternative development template (included in the Workgroup Strategy Document) and Central Valley Water Board staff conducted meetings with Workgroup participants.

The Central Valley Water Board staff–recommended ILRP will be selected from among the alternatives considered in the EIR. Rather than the typical EIR approach of starting with a project and then looking at alternatives to that project, the EIR will be used as a tool to inform decision makers during the selection process. In explanation, each alternative will be evaluated equally in the EIR. In addition to environmental analysis, economics and policy considerations will also be evaluated in order to inform the selection of a staff-recommended ILRP alternative that would be considered by the Central Valley Water Board. As part of the policy analysis, each alternative will need to be evaluated to determine how well the alternative implements minimum statutory requirements and other required policy. Chapter 2 of the ILRP Existing Conditions Report summarizes the main policies and statutory requirements that will be considered.

In addition to the aforementioned requirements for alternatives, the Workgroup Strategy Document includes the following guidance for determining which alternatives will be evaluated in the EIR.

- **Consensus alternatives.** All ILRP alternatives that receive Workgroup consensus (as defined in Section 3.7 of the Workgroup Charter) for further consideration will be evaluated in the EIR.

- **Non-consensus alternatives.** Central Valley Water Board staff will make an effort to include non-consensus ILRP alternatives that are feasible and reasonable in the EIR analysis.

As required under the State CEQA Guidelines Section 15126.6(c), the EIR will also briefly describe those alternatives that were considered but rejected as infeasible. The reasons for their infeasibility will be summarized in the EIR.

Alternatives

Proposed ILRP alternatives are summarized in Table 1 and Attachment A. In order to evaluate the environmental, economic, and policy impacts of the alternatives, additional detail may be necessary. During the evaluation process, Central Valley Water Board staff will work to provide any necessary detail in a consistent manner over the entire range of alternatives. For example, assumptions would need to be made in order to estimate how a particular requirement may affect growers (e.g., costs of management plan development). In this scenario, any assumptions made for this evaluation would be applied, as appropriate, to all alternatives containing the particular requirement.

In conjunction with each alternative (described below), irrigated agricultural lands operations would have the option to work individually with the Central Valley Water Board to obtain an individual waiver of waste discharge requirements or waste discharge requirements.

Information submitted to the Central Valley Water Board under the ILRP would be required in an electronic format where feasible, unless there is a need for the information to remain confidential.

Table 1. Summary of Proposed ILRP Alternatives

No.	Alternative	Lead Entity[a]	WQ Plans[b]	Monitoring
1	No Change	Third-Party	To address water quality problems[c]	Regional
2	Third-Party Lead Entity	Third-Party	Yes, regional	Regional
3	Individual Farm Water Quality Management Plan (FWQMP)	CVWB[d]	Yes, farm	Farm
4	Direct Oversight with Regional Monitoring	Responsible Legal Entity[e] CVWB	Yes, farm	Regional and Farm
5	Direct Oversight with Farm Monitoring	CVWB	Yes, farm	Farm

[a] Describes Central Valley Water Board interaction with growers. For more information on lead entity see Attachment II, page 3, of the Workgroup Strategy Document at: <http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/long_term_program_development/advisory_wrgrp_strategy.pdf>.

[b] Water quality management plans (WQ Plans)—could be on the farm or regional level.

[c] Water quality management plans are required only where water quality problems have been identified.

[d] CVWB = Central Valley Regional Water Quality Control Board.

[e] Legal entity assuming responsibility for waste discharge (e.g., Joint Powers Authority).

Alternative 1—No Change Alternative (Maintain Current Program)

Surface Water

Under this alternative, the Central Valley Water Board would renew the current program. This would be considered the “no project” alternative per CEQA guidance at Title 14, California Code of Regulations, Section 15126.6(e)(3)(A): “When the project is the revision of an existing land use or regulatory plan, policy or ongoing operation, the “no project” alternative will be the continuation of the existing plan, policy, or operation into the future.”

Coalition groups would continue to function as lead entities representing growers (irrigated landowners, wetland managers, nursery owners, and water districts). This alternative would be based on continuing watershed monitoring to determine whether operations are causing water quality problems. Where monitoring indicates a problem, third-party groups and growers would be required to implement management practices to address the problem and work toward compliance with applicable water quality standards.

Groundwater

This alternative would not establish any new Central Valley Water Board requirements for discharges to groundwater from irrigated agricultural lands. However, local programs in place provide varying degrees of groundwater management and oversight in some areas of the Central Valley (i.e., these programs were not developed to specifically meet the goals of this ILRP). The following is a brief description of the local groundwater management programs.

Assembly Bill 3030, which is codified in the California Water Code section 10750, authorizes local agencies within groundwater basins to prepare and adopt groundwater management plans with the following recommended components:

1. Control of saline water intrusion.
2. Identification and management of wellhead protection areas and recharge areas.
3. Regulation of the migration of contaminated groundwater.
4. The administration of a well abandonment program.
5. Mitigation of conditions of overdraft.
6. Replenishment of groundwater extracted by water producers.
7. Monitoring of groundwater levels and storage.
8. Facilitating conjunctive use operations.
9. Identification of well construction policies.
10. The construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.
11. The development of relationships with state and federal regulatory agencies.
12. The review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination.

Local agencies throughout the Central Valley have developed groundwater management programs pursuant to California Water Code section 10750. However, areas throughout the Central Valley are not covered by local agency groundwater management plans.

Senate Bill 1938 imposed additional groundwater management program requirements on local agencies seeking state funds, administered by the California Department of Water Resources (DWR), for construction of groundwater projects. These requirements include a groundwater management plan that includes components relating to the monitoring and management of groundwater levels within the basin, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality.

In addition to local groundwater management plans, the DPR regulates the use of pesticides that pose a threat to groundwater (Groundwater Protection Program). The DPR's Groundwater Protection Program requires that growers implement management practices to prevent pesticides from moving to groundwater. The DPR also conducts monitoring for pesticides to evaluate management practices and overall program effectiveness.

This alternative would not establish new Central Valley Water Board requirements for regulating irrigated agricultural discharges to groundwater. The alternative would recognize that local groundwater management programs currently exist in some localities and that the DPR currently implements a groundwater protection program to protect groundwater quality from pesticide impacts.

Implementation Mechanisms and Lead Entity

Under this alternative, the Central Valley Water Board would renew the current program through a waiver of waste discharge requirements or through waste discharge requirements. Third-party water quality coalition groups[7] would continue to function as lead entities. These coalition groups would continue to work on behalf of the members to ensure all Central Valley Water Board requirements are met.

As in the current program, coalition groups would be approved by the Central Valley Water Board prior to functioning as a lead entity. Specifically, coalition groups would:

1. Enroll member growers.
2. Develop monitoring plans.
3. Conduct required water quality monitoring.
4. Develop and implement surface water quality management plans where surface water monitoring results indicate two or more exceedances of any applicable water quality objective in a three-year period.
5. Inform growers of program requirements and provide coordination to ensure water quality concerns are addressed.

[7] Water quality coalition groups have formed throughout the Central Valley to function as representative or "lead" entities in the administration of the current ILRP. Coalitions represent growers, provide education, organize monitoring, and work with the Central Valley Water Board to help ensure that the current program is effectively implemented.

General Central Valley Water Board Role and Responsibilities

1. Require 100% ILRP participation.[8]
2. Review and approve monitoring plans.
3. Review monitoring reports.
4. Review and approve surface water quality management plans.
5. Review overall program performance with regard to achieving ILRP objectives.
6. Respond to individual problems and complaints dealing with irrigation discharge.
7. Enforce ILRP requirements.

Regulatory Requirements

In order to be eligible for this alternative, growers would be required to:

1. Submit an application to the Coalition group to enroll in the program and pay applicable program fees. The Coalition group would apply for coverage on behalf of members. Required application information would include name and contact information of owner/operator and parcel numbers. Coalition groups would collect the application information for each member grower and report the information to the Central Valley Water Board.
2. Implement water quality management practices in accordance with any water quality management plans. Water quality management practices could be instituted on an individual basis, or be installed to serve a group of growers discharging to a single location (e.g., combined tailwater return or wetlands serving a group of growers).
3. Prevent nuisance conditions and/or exceedance of water quality objectives in state waters associated with waste discharge from their irrigated agricultural lands.
4. Provide the Coalition group with information requested for compliance with the ILRP.

Growers who do not meet these requirements would be required to work directly with the Central Valley Water Board and obtain waste discharge requirements or an individual waiver of waste discharge requirements.

Monitoring Provisions

Monitoring under this alternative would be the same as the watershed-based assessment and core monitoring required under the current ILRP. Under this monitoring scheme, coalition groups would work with the Central Valley Water Board to develop monitoring plans for Central Valley Water Board approval. These plans would specify monitoring parameters and site locations. Required monitoring would include the parameters and frequencies shown in Table 2.[9]

[8] Where growers have a waste discharge that would be regulated under the ILRP.

[9] The current ILRP monitoring program provides flexibility to reduce the monitoring shown in Table 2.

Table 2. Monitoring Requirements

Assessment Monitoring for 1 Year Out of Every 3 Years	
Parameter	**Frequency**
303(d) listed constituents with agricultural source	Monthly
Water column toxicity, pesticides, metals, nutrients, pathogens, physical parameters	Monthly
Toxicity identification evaluation—as needed	Monthly
Sediment toxicity	Twice per year
Photo monitoring	During every monitoring event
Continuing Core Monitoring	
Parameter	**Frequency**
General physical parameters, nutrients, pathogens	Monthly
Parameters/constituents of concern as determined by the Central Valley Water Board	Monthly
Photo monitoring	During every monitoring event

Alternative 2—Third-Party Lead Entity

Under this alternative, the Central Valley Water Board would develop a single or series of regulatory mechanisms (e.g., waivers, waste discharge requirements, conditional prohibition of discharge) for waste discharge from irrigated agricultural lands to ground and surface water. The series of regulatory mechanisms would be designed to provide flexibility in establishing requirements for growers considering the variety of environmental conditions and agricultural operations throughout the Central Valley.

Under this alternative, third-party groups (e.g., water quality coalitions) would function as lead entities representing growers. Regulation of discharges to surface water under this alternative would be similar to Alternative 1 (current ILRP). However, this alternative allows for a reduction in monitoring under lower threat circumstances and where watershed or area management objectives plans are developed. This alternative also includes requirements for development of groundwater quality management plans to minimize discharge of waste to groundwater from irrigated agricultural lands. This alternative relies on coordination with the DPR for regulating discharges of pesticides to groundwater.

Implementation Mechanisms and Lead Entity Responsibilities

Implementation mechanisms for this alternative could include conditional waivers of waste discharge requirements, waste discharge requirements, or conditional prohibitions of discharge.

Under this alternative, a coalition or other third-party group would be responsible for general administration of the ILRP. In order to be approved by the Central Valley Water Board for administration of this alternative, third-party groups would need to agree to assume the following responsibilities.

1. Enroll member growers. Provide summary member information to the Central Valley Water Board (see Regulatory Requirement No. 1).

2. Provide members and the Central Valley Water Board an organizational or management structure identifying persons responsible for ensuring that program requirements are fulfilled.

3. Agree to provide or make available to group members the annual summaries of expenditures of fees used to comply with the ILRP.

4. Notify potentially affected third-party group members each time the group has received a notice of violation or other enforcement action from the Central Valley Water Board and provide information regarding the reason for the enforcement.

5. Develop and implement monitoring/management practice tracking plans.

6. Conduct required water quality monitoring.

7. Develop and implement surface water quality management plans (similar to the current ILRP) where surface water monitoring results indicate two or more exceedances of any applicable water quality objective in a 3-year period.

8. Develop groundwater quality management plans for third-party identified groundwater management areas within 4 years of adoption of the ILRP by the Central Valley Water Board *(except in areas where a local groundwater management plan has been developed and approved (by the Central Valley Water Board) for substitution—see the section titled "Groundwater Quality Management Plan" below).*

9. Inform growers of program requirements and provide coordination to ensure that water quality concerns are addressed.

Optional Watershed or Area Management Objectives Plan (surface water)

Third-party groups would have the option of developing a watershed or area management objectives plan. The goal of this plan would be to meet source control management objectives that would reduce the threat to surface water quality from waste discharge associated with irrigated agriculture. In areas implementing a Central Valley Water Board–approved watershed or area management objectives plan, surface water monitoring would be reduced. The Central Valley Water Board may require revision of the plan to include additional management objectives (in an iterative approach to address identified water quality concerns), revoke approval, or decline to approve a plan and the associated reduction in monitoring for the following reasons.

a. Evidence exists that effective implementation of the plan may allow an exceedance, caused by waste discharge from irrigated agricultural lands, of applicable water quality objectives in surface waters.

b. Available surface water quality monitoring data shows continuing exceedances of applicable water quality objectives within the area or watershed (where agriculture is a contributing source).

c. Changes in agricultural operations or environmental conditions limit the plan's applicability within the area or watershed.

d. Evidence exists that growers are not implementing the plan.

The plan would specify optional water quality management practices that could be implemented to achieve plan objectives (see Attachment B). This plan would be developed consistent with the area or watershed commodity types, common agricultural practices, pesticides commonly used, and local land characteristics. Optional practices would be provided to allow growers to adapt to their specific conditions for compliance with the ILRP. The plan would also consider the results of previous water quality sampling, including results from monitoring conducted under the current ILRP. This plan need not include a requirement that every grower implement a list of specific practices. It could, for example, involve implementing management practices that serve a group of growers.

The plan would be developed by local agencies with expertise in agriculture. The third-party group would also be responsible for the following when developing and implementing the watershed or area management objectives plan.

1. Informing local growers of the requirements in the watershed or area management objectives plan through an education and outreach program.
2. Obtaining local grower input for plan development.
3. Determining local needs for compliance.
4. Facilitating and developing a verification program for ensuring implementation of the management plan.

Groundwater Quality Management Plans

Third-party groups would be required to develop groundwater quality management plans (GQMPs) designed to minimize waste discharge to groundwater from irrigated agricultural lands. As part of GQMP development, the third party would collect and evaluate available groundwater data, identify groundwater management areas (GMAs) of concern, identify constituents of concern within the GMAs, prioritize the GMAs and constituents of concern, identify agricultural practices that may be causing or contributing to the problem, and identify agricultural management practices that should be employed by local growers to address the constituents of concern. See Attachment C for additional GQMP requirements.

Periodic review of approved GQMPs: Every 5 years, the Central Valley Water Board and third-party groups would meet and confer to evaluate the sufficiency of GQMPs, and to determine whether and, generally, how they should be updated to reflect new priorities based on new information.

Where local agencies have developed local groundwater management plans (e.g., AB 3030, SB 1938, Integrated Regional Water Management plans) that meet the requirements shown in Attachment D, the Central Valley Water Board may approve the local groundwater management plan to be substituted for the GQMP. However, growers would still be required to enroll with an approved third-party group. The third-party group would be the responsible lead entity for ILRP administration, monitoring and reporting.

General Central Valley Water Board Role and Responsibilities

1. Require 100% ILRP participation.[8]
2. Review and approve monitoring plans.
3. Review and approve surface water quality management plans.
4. Review and approve GQMPs *(and, where applicable, local groundwater management plans requested to substitute for GQMPs)* and groundwater management areas.
5. Review and approve *optional* area or watershed management objectives plans.
6. Review monitoring reports.

7. Review overall program performance with regard to achieving ILRP objectives.
8. Respond to individual problems and complaints dealing with irrigation discharge and informing/coordinating with the responsible third-party group.
9. In an iterative process, require additional monitoring, information, and/or management measures where applicable water quality objectives are not being met.
10. Enforcing ILRP requirements.

Regulatory Requirements

In order to be eligible for this alternative, growers would be required to:

1. Submit an application to the third-party group to enroll in the program and pay applicable program fees. The third-party group would apply for coverage on behalf of members. Required application information would include name and contact information of owner/operator and parcel numbers. Coalition groups would collect the application information for each member grower and report the information to the Central Valley Water Board.
2. Implement water quality management practices in accordance with any water quality management plans, including GQMPs and/or watershed or area management practices plans. Water quality management practices could be instituted on an individual basis, or be installed to serve a group of growers discharging to a single location (e.g., combined tailwater return or wetlands serving a group of growers).
3. Prevent nuisance conditions and/or exceedance of water quality objectives in state waters associated with waste discharge from their irrigated agricultural lands.
4. Provide the third-party group with information requested for compliance with the ILRP.

Growers who do not meet the above requirements would be required to work directly with the Central Valley Water Board and obtain waste discharge requirements or an individual waiver of waste discharge requirements.

Monitoring Provisions

Growers would be required to track implemented management practices and submit the results to the third-party group. The third-party group would report summary results to the Central Valley Water Board.

The third-party group would be required to summarize ground and surface water monitoring and tracking results in an annual monitoring report to the Central Valley Water Board.

Surface Water

Surface water monitoring under this alternative would consist of **one** of the following options:

- Watershed-based assessment and core monitoring similar to the monitoring required under the current ILRP (Central Valley Water Board Order No. R5-2008-0005). Under this monitoring scheme, third-party groups would work with the Central Valley Water Board to develop monitoring plans for Central Valley Water Board Executive Officer approval. These plans would specify monitoring parameters and site locations.

- Optional watershed or area management objectives plan—Where the Central Valley Water Board has approved a watershed or area management objectives plan, monitoring would consist of tracking the progress in implementing the watershed or area management objectives plan and watershed-based assessment monitoring for one year every five years (similar to the assessment monitoring required under the current ILRP).

Groundwater

Where a local groundwater management plan has been substituted for a GQMP, monitoring would consist of groundwater quality monitoring for, at minimum, nitrates and salts.

For all other cases, groundwater monitoring under this alternative would consist of:

1. Tracking the level of GQMP management practice implementation through grower completion of acknowledgement forms. Growers completing acknowledgment forms would agree to implement GQMP-identified groundwater quality management practices to the maximum extent practicable.
2. Results of any focused studies of selected agricultural management practices, constituents, or physical settings to inform refinement of GMAs and constituent prioritization, or of practices that provide needed groundwater protection from degradation by constituents of concern.

Alternative 3—Individual Farm Water Quality Management Plan

In this alternative, growers would have the option to work directly with the Central Valley Water Board or another implementing entity (e.g., Agricultural Commissioners) in the development of a farm water quality management plan (FWQMP). Growers would individually apply for a conditional waiver or waste discharge requirements that would require they obtain Central Valley Water Board approval of their FWQMP.

On-farm implementation of effective water quality management practices would be the mechanism to reduce or eliminate waste discharged to state waters. This alternative would provide incentive for individual growers to participate by providing growers with Central Valley Water Board certification that they are implementing farm management practices to protect state waters.

This alternative relies on coordination with the DPR for regulating discharges of pesticides to groundwater.

Implementation Mechanisms and Lead Entity

Implementation mechanisms for this alternative could include conditional waivers of waste discharge requirements or waste discharge requirements.

Under this alternative, growers would be lead entities working directly with the Central Valley Water Board and would be responsible for applying for coverage, developing FWQMPs, and conducting any required reporting.

General Central Valley Water Board Role and Responsibilities:

1. Enroll growers.
2. Require 100% ILRP participation.[8]

3. Review applications and determine priorities for FWQMP review and approval. Criteria for priority would include size of operation, likelihood for water quality impacts (potential impacts to surface and groundwater would be considered), and operations in areas with documented problems. In the review and approval of FWQMPs, Central Valley Water Board staff would conduct inspections of ranch/farm operations, as needed, to evaluate existing irrigated production areas and management practices, and verify that management practices referenced in the FWQMP are accurate and appropriate. Any needed changes to existing operations would be discussed, negotiated, and documented in the FWQMP.
4. Negotiate and enter into a memorandum of understanding (MOU) with technical service providers wanting to assume the role of assisting growers in the development of an FWQMP. The Central Valley Water Board may choose to delegate FWQMP review and approval authority to the technical service entity.
5. Conduct a specified number of grower site inspections annually. Site inspection priority will be determined by the Central Valley Water Board using factors such as complaints received regarding discharge, size of operations, types of operations, and location of operations in regard to water quality problems. The Central Valley Water Board may work with, or contract with, another entity to conduct these inspections in the most efficient manner (e.g., County Agricultural Commissioners, or other entity). Site inspections would include evaluation of FWQMPs, management practices, etc.
6. Follow up and coordinate with growers to ensure that FWQMPs and implemented management practices are addressing identified water quality problems. This would include providing information to help focus grower-developed FWQMPs (e.g., results of monitoring and studies showing constituents of concern for different geographic areas).
7. Review monitoring reports (monitoring would be specified in the FWQMP).
8. Review overall program performance with regard to achieving ILRP objectives.
9. Respond to individual problems and complaints dealing with irrigation discharge.
10. Issue certification that the participating grower is implementing management practices that protect water quality (following FWQMP review and approval).
11. In an iterative process, require additional monitoring, information, and/or management measures where applicable water quality objectives are not being met.
12. Enforce ILRP requirements.

Regulatory Requirements

For program compliance, growers would be required to complete the following.

1. Submit an application to the Central Valley Regional Water Board to enroll in the program and pay fees. See Attachment E for application information requirements.
2. Working either directly with the Central Valley Water Board and/or with another implementing entity (coalition, private consultant, etc.), within **two years** of enrollment in the program, develop and implement an FWQMP aimed to minimize waste discharge to surface and groundwater (to include wellhead protection practices). Proposed FWQMP requirements are summarized in Attachment F.

3. Water quality management practices could be instituted on an individual basis, or be installed to serve a group of growers discharging to a single location (e.g., combined tailwater return or wetlands serving a group of growers).

4. Submit the FWQMP for review and approval by the Central Valley Water Board.

5. Maintain and update the approved FWQMP as operations and conditions change.

6. Prevent nuisance conditions and/or exceedance of water quality objectives in state waters associated with waste discharge from their irrigated agricultural lands.

7. Allow inspection of the production area by the Central Valley Water Board, or representative, to verify satisfactory implementation of management practices and accuracy of the FWQMP.

Monitoring Provisions

Unless specifically required in response to water quality problems, owners/operators would not be required to conduct water quality monitoring of adjacent receiving waters or underlying groundwater. Required monitoring would include evaluation of management practice effectiveness (e.g., monitoring that an installed tailwater return system is preventing off-site discharge, review of erosion prevention practices after storm events, visual monitoring of turbidity of field discharge, and review of nutrient applications and estimated crop uptake). An annual report to the Central Valley Water Board would be required that discusses the status of management practice implementation and an evaluation of the performance of those practices.

Requirements for individual ranch/farm monitoring would be agreed to by the owner/operator and the Central Valley Water Board and would be included in the FWQMP. The Central Valley Water Board and/or the MOU entity would conduct annual site inspections on a selected number of operations and review available applicable water quality monitoring data as additional means of monitoring the implementation of management practices and program effectiveness.

Alternative 4—Direct Oversight with Regional Monitoring

Under this alternative, the Central Valley Water Board would develop waste discharge requirements and/or a conditional waiver of waste discharge requirements for waste discharge from irrigated agricultural lands to ground and surface water. Growers, or legal entities[10] responsible for a group of growers' waste discharges, would apply directly with the Central Valley Water Board to obtain coverage ("direct oversight"). However, this alternative would also include an option for third-party–run regional monitoring instead of individual grower monitoring. This alternative would require that growers develop and implement individual FWQMPs to minimize discharge of waste to surface and groundwater from irrigated agricultural lands.

Under this alternative, discharge of waste to surface water and groundwater would be regulated using a tiered approach. Growers' fields would be placed under one of three tiers based on the field's threat to water quality. The tiers represent fields with minimal (Tier 1), low (Tier 2), and high (Tier 3) potential threat to water quality. Requirements to avoid or minimize discharge of waste would be

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[10] For example, a Joint Powers Authority. Under the Water Code, the discharger, as the party with operational control over waste discharges, is generally the party that is accountable for compliance with permit conditions. Accordingly, any proposal for a legal entity other than the discharger to assume responsibility for waste discharges under Alternative 4 would require careful legal scrutiny of the structure and powers of the entity to ensure consistency with the Central Valley Water Board's statutory mandates.

the least stringent for Tier 1 fields and the most stringent for Tier 3 fields. This would allow for less regulatory oversight for low threat operations while establishing necessary requirements to protect water quality from higher-threat discharges.

This alternative relies on coordination with the DPR for regulating discharges of pesticides to groundwater.

Criteria for Tier System[11]

Tier 1 (Minimal Threat)

Tier 1 fields would be those that have a minimal potential to affect water quality. Such fields are defined as those where the discharge is so minimal that it will not result in any detectable change in water quality.

Tier 1 applicability would be based on a site-specific evaluation of an agricultural waste discharge's potential impact to surface water and/or groundwater quality, considering such factors as the existing water quality, hydrogeologic conditions, nitrogen loading, crop types, irrigation practices, pesticides used, distance to surface water bodies, and whether the field is in a DPR Groundwater Protection Area.

Tier 2 (Low Threat)

Tier 2 fields would be those that have a low potential to affect water quality and would be defined as those fields that meet each of the following conditions:

1. Have low-threat pesticide and fertilizer use. Low-threat pesticide and fertilizer operations are those that (a) for groundwater, do not use pesticides that have been found in or have the potential to move to groundwater as evaluated by the DPR's Groundwater Protection Program (Title 3, California Code of Regulations section 6800) or for surface water, do not use pesticides that have the potential to cause exceedance of applicable surface water quality objectives as defined using monitoring data;[12] and (b) have fertilizer application rates that are not expected to result in nitrogen exceedances in a groundwater basin.

2. Are not located in a vulnerable hydrologic environment. Vulnerable hydrologic environments would be defined by:

   a. ***Groundwater.*** Square-mile sections of land where monitoring data from one well confirms any **one** of the following: (i) nitrate concentrations are greater than the maximum contaminant level (elevated nitrate levels), (ii) have measurable levels of agriculturally used pesticides, or (iii) salts, pathogens (where manure is used) are above an applicable water quality objective. DPR Groundwater Protection Areas would also be considered vulnerable hydrologic environments. Information on the DPR's Groundwater Protection Areas is available at: http://www.cdpr.ca.gov/docs/emon/grndwtr/gwp_regs.htm.

      Square-mile sections where agriculture is not a source of high levels of pesticides, salts, pathogens, or nitrate may not be considered "vulnerable hydrologic environments" under this alternative.

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[11] Attachment G includes a matrix summarizing the tier system.

[12] This is defined as any pesticide for which monitoring data has shown two or more exceedances of applicable water quality objectives in three or more subbasins (Federal Watershed Boundary Dataset).

b. ***Surface water***. Subwatersheds where monitoring data confirms two or more exceedances of an applicable water quality objective for agriculturally used pesticides, nutrients, salts, sediment, or pathogens within a 3-year period (where agriculture is a contributing source).

Tier 3 (High Threat)

Tier 3 fields would be those that have a high potential to affect surface water and/or groundwater quality and would be those fields that do not meet the Tier 1 or 2 criteria. Tier 3 fields would include fields that have low-threat fertilizer or pesticide use but are located in a vulnerable hydrologic environment. Tier 3 would also include fields that are not located in a vulnerable hydrologic environment, but have high-threat fertilizer and/or pesticide use. A field may move from Tier 3 to Tier 2 or vice versa depending upon changes in fertilizer or pesticide use or available information on groundwater vulnerability.

Growers could be in different tiers for surface water or groundwater discharge. For example, a field may be in a vulnerable environment for groundwater (Tier 3), but minimal threat to surface water (Tier 1) if all applied water immediately percolates, and does not run off.

Implementation Mechanisms and Lead Entity

Implementation mechanisms for this alternative could include waivers of waste discharge requirements and/or waste discharge requirements.

Under this alternative, growers would be lead entities in working directly with the Central Valley Water Board and would be responsible for applying for coverage, developing FWQMPs, and conducting any required monitoring and reporting. This alternative would also allow for the formation of responsible legal entities that could serve a group of growers that discharge to the same general location and share monitoring locations. In such cases, the legal entity would be required to assume responsibility for member grower waste discharge, be approved by the Central Valley Water Board, and would be ultimately responsible for compliance with ILRP requirements.[13]

For monitoring under this alternative, growers would have the option to enroll in a third-party group regional monitoring program instead of conducting individual monitoring. In cases where responsible legal entities are formed, these entities would be responsible for conducting monitoring.

Where third-party groups fail to adequately conduct monitoring, each grower would be responsible for conducting individual monitoring. Third-party monitoring groups must be approved by the Central Valley Water Board and would need to agree to assume the following responsibilities.

1. Provide members and the Central Valley Water Board an organizational or management structure identifying persons responsible for ensuring that monitoring requirements are fulfilled.
2. Agree to provide or make available to group members summaries of expenditures of fees for compliance with the ILRP.
3. Develop monitoring plans.
4. Conduct required water quality monitoring.

[13] See footnote 10.

5. Notify potentially affected third-party group members each time the group has received a notice of violation or other enforcement action from the Central Valley Water Board and provide information regarding the reason for the enforcement.

General Central Valley Water Board Role and Responsibilities:

1. Enroll growers and or responsible legal entities (where applicable).
2. Require 100% ILRP participation.[8]
3. Review and approve monitoring plans of third parties and any responsible legal entity.
4. Review monitoring reports.
5. Follow up and coordinate with growers to ensure that FWQMPs and implemented management practices are addressing identified water quality problems. This would include developing tier system information (e.g., delineating hydrologic vulnerable areas), informing the growers about the tiers that apply to them in regard to waste discharge, and providing information to help focus grower-developed FWQMPs (e.g., results of monitoring and studies showing constituents of concern for different geographic areas). Where responsible legal entities are formed, those legal entities would be responsible for follow-up and coordination with growers; the Central Valley Water Board would work with the legal entities.
6. Review overall program performance in regard to achieving ILRP objectives.
7. Respond to individual problems and complaints dealing with irrigation discharge.
8. Conduct a specified number of grower site inspections annually. Site inspection priority will be determined by the Central Valley Water Board using factors such as complaints received regarding discharge, size of operations, types of operations, and location of operations in regard to water quality problems. The Central Valley Water Board may work with or contract with another entity to conduct these inspections in the most efficient manner (e.g., County Agricultural Commissioners). Site inspections would include evaluation of FWQMPs, nutrient management plans (NMPs), management practices, monitoring information, nutrient budget, etc.
9. In an iterative process, require additional monitoring, information, and/or management measures where applicable water quality objectives are not being met.
10. Enforce ILRP requirements.

Regulatory Requirements

Specific regulatory requirements for *all* growers would include the following.

1. Submit an application to the Central Valley Water Board to enroll in the program or be a member of a legal entity that has assumed responsibility for their waste discharge. The legal entity would apply for coverage on behalf of members. Required application information would include the following in addition to the requirements shown in Attachment E.
    a. Available site-specific groundwater monitoring data for nitrates, salts, and pathogens.
    b. Information necessary to determine whether the operation would be in Tier 1, 2, or 3 in regard to each field's potential threat to water quality.

Where applicable, responsible legal entities would collect the application information for each member grower and report summary information to the Central Valley Water Board.

2. Within **two years** of enrollment in the program, prepare and implement an FWQMP aimed to minimize waste (e.g., nutrients, pesticides, sediment, and pathogens) discharge to surface water and groundwater (to include wellhead protection practices). This plan would also be kept on the site and submitted to the Central Valley Water Board upon request. Proposed FWQMP requirements are summarized in Attachment F. Where applicable, the FWQMP would be submitted to responsible legal entities upon request.

   Water quality management practices could be instituted on an individual basis, or be installed to serve a group of growers discharging to a single location (e.g., combined tailwater return or wetlands serving a group of growers).

3. Maintain and update the FWQMP as operations and conditions change.

4. Allow inspection of the production area by the Central Valley Water Board, or representative, to verify satisfactory implementation of management practices and accuracy of the FWQMP.

5. Prevent nuisance conditions and/or exceedance of water quality objectives in state waters associated with waste discharge from their irrigated agricultural lands.

6. Keep and maintain facility records of each field's nutrient budget. These records would be made available to the Central Valley Water Board (or, where applicable, responsible legal entity) during an inspection or upon request.

7. Within **two years** of enrollment in the program, complete 15 hours of farm water quality education.

8. Submit an annual certified statement to the Central Valley Water Board (or, where applicable, responsible legal entity) indicating whether changes have been made to fertilizer or pesticide use or if additional information is available on existing water quality that would change a field's potential impact to surface or groundwater, thus allowing (or requiring) the field to move from one tier to another.

Additional Requirements—Tier 1 Operations Only:

Submit a site-specific evaluation to the Central Valley Water Board or, where applicable, responsible legal entity, demonstrating that waste discharge from irrigated agricultural operations has minimal potential impact to surface water and/or groundwater quality. The site-specific evaluation would include the following information:

1. ***For waste discharge to groundwater—***information on operations, existing groundwater quality, depth to groundwater, groundwater flow direction, description of subsurface sediments, nutrient and irrigation management practices.

2. ***For waste discharge to surface water—***information on operations, existing surface water quality, distance to surface water bodies, identification of conduits to surface water (e.g., pipes, ditches, canals), estimated volume and waste composition of water discharged off the site, nutrient and irrigation management practices.

This evaluation would be tailored to the discharge considered a minimal threat. For example, where surface water discharge is considered a minimal threat, the required information would be tailored to the surface water discharge. These site-specific evaluations would be subject to Central Valley Water Board review and approval.

Additional Requirements—Tier 3 Operations Only:

1. Where Tier 3 characterization is based on fertilizer application rate or the section of land is defined as a vulnerable hydrologic environment in regard to nitrate: Develop and implement an NMP, if commercial fertilizers or manure are used, that is certified by a crop specialist and that provides protection for both surface and groundwater. Certified crop specialist is defined as a specialist certified in developing NMPs. The definition includes professional soil scientists, professional agronomists, professional crop scientists, or crop advisors certified by the American Society of Agronomy; technical service providers certified in nutrient management in California by the Natural Resources Conservation Service; or other specialists approved by the Executive Officer. The NMP must consider the rate, timing, and method of nutrient applications that do not exceed the crop's nutrient requirements considering the stage of plant growth; all nutrient sources; soil and climatic conditions; crop water use requirements, and minimum leaching requirements to reduce deep percolation of irrigation water to groundwater.

   Growers would be required to update and maintain the NMP at the facility and submit it to the Central Valley Water Board upon request. Where applicable, the NMP must be submitted to responsible legal entities upon request.

2. ***Where the section of land is defined as a vulnerable hydrologic environment in regard to pesticides:*** Develop and implement management practices to minimize the potential discharge of pesticides to surface water and groundwater (e.g., DPR-recommended management practices for using the pesticide). These additional practices would be included in the FWQMP.

Growers who do not meet these requirements would work directly with the Central Valley Water Board and obtain waste discharge requirements or an individual waiver of waste discharge requirements.

Monitoring Provisions

All growers would be required to conduct the following tracking and submit the results to the Central Valley Water Board (or an approved third-party monitoring group) annually.

1. Nutrient Tracking:
   a. All nutrients applied (commercial fertilizers, manure, irrigation water, etc.).
   b. Ratio of nutrients applied to the needs of the crop(s) (as recommended by the University of California Western Fertilizer Handbook [9th Edition] or from historic crop removal rates).
2. Pesticide Tracking:
   a. Types and amounts of pesticides applied—The Central Valley Water Board would coordinate with the DPR and Agricultural Commissioners to gather this information.
3. Implemented Management Practices Tracking

In addition to these tracking requirements, growers in Tiers 2 and 3 would have the option of conducting individual monitoring **or** forming third-party groups to conduct regional monitoring programs (see below).

Surface Water Monitoring

All growers in Tiers 2 and 3 for surface water discharge may elect to conduct individual monitoring **or** participate in regional monitoring by a third-party group or responsible legal entity.

Individual Monitoring

Individual monitoring would consist of the following for ***Tier 3 operations:***

1. Discharge Monitoring:
    a. Tailwater discharges (constituents of concern[14]) during the first discharge of the irrigation season and once mid-season.
    b. Stormwater discharges (constituents of concern) during the first event of the wet season (between October 1 and May 31) and once during the peak storm season (typically February).
    c. Discharges of subsurface (tile) drainage systems (constituents of concern) annually.

Tier 2 operations would be required to conduct the above monitoring for 1 year every 5 years (additional monitoring would apply where exceedances of applicable water quality objectives are found if agricultural discharges are a contributing source).

Monitoring results would be submitted in an annual report to the Central Valley Water Board.

Regional Monitoring

Growers could form third-party groups to conduct regional monitoring programs. These groups would work with the Central Valley Water Board to identify monitoring sites and specific monitoring parameters (e.g., visual, chemical, etc.). Growers would be ultimately responsible for ensuring that monitoring requirements are carried out according to the requirements in the regional monitoring program. If legal entities are formed that serve a group of growers, the legal entity would be responsible for regional monitoring.

Regional monitoring would include regional water quality monitoring for constituents of concern[14]. Monitoring locations would be limited to waters of the state that are mainly runoff/discharge from irrigated agricultural operations in order to determine whether they are meeting applicable water quality objectives and to determine if agricultural discharges are causing or contributing to a violation of applicable water quality objectives.

Tier 2 growers would be required to participate in water quality monitoring (e.g., water chemistry monitoring) for only 1 year every 5 years.

Monitoring would also include gathering nutrient/pesticide use and management practices tracking information from member growers and summarizing the information. Monitoring and tracking results would be submitted in an annual report to the Central Valley Water Board.

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[14] Constituents of concern may be prioritized for monitoring using the tier system. For example, where a grower is in Tier 3 for nutrient use, but does not have high threat pesticide use, monitoring may be reduced to Tier 2 for pesticide use.

Groundwater Monitoring

All growers in Tiers 2 and 3 for groundwater discharge would be required to conduct the following groundwater monitoring.

Individual Monitoring

Tier 3 operations would be required to conduct individual monitoring. Individual monitoring would consist of semiannual (spring/fall) sampling of each existing domestic well and/or monitoring well present on each field parcel for nitrate, phosphorus, total dissolved solids, and pathogens (when manure is applied). Each grower would be required to submit an annual report on their monitoring results to the Central Valley Water Board.

Tier 2 operations would be required to conduct the above individual monitoring **or** participate in regional monitoring.

Regional Monitoring

All ***Tier 3 operations*** would be required to participate in a regional monitoring program in addition to the individual monitoring described above. ***Tier 2 operations*** that do not conduct individual monitoring would also be required to participate in a regional monitoring program. Regional monitoring would consist of:

1. Regional monitoring for constituents of concern to provide baseline groundwater information and track trends in groundwater quality over time.
2. Targeted site-specific studies to evaluate the effects of changes in management practices on groundwater quality (this would occur only at a selected number of sites—the Fertilizer Research and Education Program [FREP] would be approached as a potential funding source for this monitoring).
3. Gathering nutrient/pesticide use and management practices tracking information from member growers.
4. Submitting an annual report to the Central Valley Water Board summarizing nutrient, pesticide, and management practice tracking and the regional and targeted site-specific monitoring results.
5. Utilizing a database system to compile existing groundwater quality data and data collected during regional and site-specific monitoring (e.g., the State Water Resources Control Board's Groundwater Ambient Monitoring and Assessment [GAMA]/GeoTracker database could be used).

The Central Valley Water Board, the agricultural industry, and other stakeholders would identify organization(s) or entities, such as the U.S. Geological Survey, the University of California, Lawrence Livermore National Laboratory, or the DWR, suitable to conduct the regional monitoring and the criteria for this monitoring. These organizations or entities could be funded by additional annual fees, dues, or other funding mechanisms such as grant money.

Where legal entities are formed to take responsibility of waste discharge from a group of growers, these entities would be responsible for regional monitoring.

Alternative 5—Direct Oversight with Farm Monitoring

This program would consist of general waste discharge requirements designed to protect surface water and groundwater from discharges associated with irrigated agriculture.

All growers would be required to apply for and obtain coverage under the general waste discharge requirements. This alternative would include requirements to (1) develop and implement an FWQMP; (2) monitor discharges of tailwater, drainage water, and storm water to surface water; applications of irrigation water, nutrients, and pesticides; and groundwater; (3) keep records of irrigation water and pesticide applications and nutrients applied, harvested, and moved off the site; and (4) submit an annual monitoring report.

This program would rely on coordination with the DPR Groundwater Protection Program for protecting groundwater from agricultural use of pesticides.

Implementation Mechanisms and Lead Entity

Under this alternative, the Central Valley Water Board would develop general waste discharge requirements for irrigated agriculture.

In this alternative, growers would be the lead entity in working with the Central Valley Water Board. The Central Valley Water Board would adopt the waste discharge requirements, enroll individual operations under the program, provide regulatory oversight and enforce the requirements of the program.

General Central Valley Water Board Role and Responsibilities:

1. Enroll growers.
2. Require 100% ILRP participation.[8]
3. Review monitoring reports.
4. Develop a prioritization scheme for determining where monitoring wells would be required in order to assess potential impacts to groundwater quality and overall program effectiveness.
5. Follow up and coordinate with growers to ensure that FWQMPs and implemented management practices are addressing identified water quality problems. This would include providing information to help focus grower-developed FWQMPs (e.g., results of monitoring and studies showing constituents of concern for different geographic areas).
6. Review overall program performance in regard to achieving ILRP objectives.
7. Responding to individual problems and complaints dealing with irrigation discharge.
8. Conduct a specified number of grower site inspections annually. Site inspection priority will be determined by the Central Valley Water Board using factors such as complaints received regarding discharge, size of operations, types of operations, and location of operations in regard to water quality problems. The Central Valley Water Board may work with, or contract with, another entity to conduct these inspections in the most efficient manner (e.g., County Agricultural Commissioners). Site inspections would include evaluation of FWQMPs, NMPs, management practices, monitoring information, nutrient budget, etc.

9. In an iterative process, require additional monitoring, information, and/or management measures where applicable water quality objectives are not being met.

10. Enforce ILRP requirements.

Regulatory Requirements

Specific regulatory requirements for growers would include the following.

1. Submit an application to the Central Valley Water Board to enroll in the program. Required application information would include the following in addition to the requirements shown in Attachment E.

    a. Available site-specific groundwater monitoring data for nitrates, salts, and pathogens.

    b. Information to determine the whole farm nitrogen balance (estimated total nitrogen applied to crops, acreages of crops grown and the crop nitrogen needs).

2. Within **two years** of enrollment in the program, prepare and implement an FWQMP aimed to minimize waste (e.g., nutrients, pesticides, sediment, and pathogens) discharge to surface water and groundwater (to include wellhead protection practices)—this plan would also be kept on the site and submitted to the Central Valley Water Board upon request. Proposed FWQMP requirements are summarized in Attachment F.

3. Maintain and update the FWQMP as operations and conditions change.

4. Develop and implement an NMP, if commercial fertilizers or manure are used, that is certified by a crop specialist and that provides protection for both surface and groundwater. *Certified crop specialist* is defined as a specialist certified in developing NMPs. The definition includes professional soil scientists, professional agronomists, professional crop scientists, or crop advisors certified by the American Society of Agronomy; technical service providers certified in nutrient management in California by the Natural Resources Conservation Service; or other specialists approved by the Executive Officer. The NMP must consider the rate, timing, and method of nutrient applications that do not exceed the crop's nutrient requirements considering the stage of plant growth; all nutrient sources; soil and climatic conditions; crop water use requirements; and minimum leaching requirements to reduce deep percolation of irrigation water to groundwater.

    Growers would be required to update and maintain the NMP at the facility and submit it to the Central Valley Water Board upon request.

5. Allow inspection of the production area by the Central Valley Water Board, or representative, to verify satisfactory implementation of management practices and accuracy of the FWQMP and NMP.

6. Prevent nuisance conditions and/or exceedance of water quality objectives in state waters associated with waste discharge from their irrigated agricultural lands.

7. Keep and maintain facility records of each field's nutrient budget. These records would be made available to the Central Valley Water Board during an inspection or upon request.

Monitoring Provisions

Each operation would be required to conduct the following monitoring for each field and submit the results to the Central Valley Water Board annually.

1. Discharge Monitoring:
   a. Tailwater discharges (constituents of concern) monthly.
   b. Stormwater discharges (constituents of concern) during the first event of the wet season (between October 1 and May 31) and once during the peak storm season (typically February).
   c. Discharges of subsurface (tile) drainage systems (constituents of concern) annually.
2. Nutrient Tracking:
   a. All nutrients applied (commercial fertilizers, manure, irrigation water, etc.).
   b. Soil nitrogen and phosphorus once every 5 years.
3. Pesticide Tracking: Types and amounts of pesticides applied—The Central Valley Water Board will coordinate with the DPR and Agricultural Commissioners to gather this information.
4. Groundwater Monitoring:
   a. Sample all supply wells annually for nitrate and electrical conductivity (or total dissolved solids) and for major cations and anions if elevated concentrations of nitrate or electrical conductivity are detected.
   b. Install monitoring wells, or use a Central Valley Water Board approved alternative technology (e.g., well point or direct push method) to collect groundwater quality samples semiannually if requested by the Executive Officer. Locations chosen for groundwater monitoring will be prioritized based on Central Valley Water Board staff-developed vulnerability factors. These factors would include nitrate concentrations in the supply wells, nitrate concentrations in domestic wells adjacent to the property, location of property relative to a DPR Groundwater Protection Area, distance from an artificial recharge area as identified by the DWR or Central Valley Water Board, distance between the property and the nearest off-property domestic well, distance from the property to the nearest off-property municipal well, number of crops grown per year per field, NMP completed by deadline, and whole farm nitrogen balance.

Attachment A
Alternatives Matrix

Attachment A
Alternatives Matrix

No.	Alternative Description and Summary	Lead Entity	Lead Entity Responsibilities	CVWB Responsibilities	Growers' Regulatory Requirements	SW Monitoring	GW Monitoring	Tracking
1	**No Change** - CEQA "No Project" alternative. Renewal and continuation of the current program. Coalition groups function as lead entities. Where monitoring indicates a problem, third-party groups and growers implement management practices in response.	Coalition groups	1. Enroll member growers. 2. Develop monitoring plans. 3. Conduct monitoring. 4. Develop and implement surface water quality management plans where monitoring data shows two or more exceedances of an applicable water quality objective. 5. Inform/coordinate with growers.	1. Require 100% participation. 2. Review and approve monitoring plans. 3. Review monitoring reports. 4. Review and approve surface water quality management plans. 5. Review ILRP performance. 6. Respond to complaints. 7. Enforce ILRP.	1. Submit application and pay fees. 2. Implement water quality management practices. 3. Prevent nuisance conditions and/or exceedance of WQOs. 4. Provide requested information to Coalition group.	Watershed-based (same as current ILRP)	None	None
2	**Third-Party Lead Entity** - Third-party groups would function as lead entities representing growers. Regulation of discharges to surface water would be similar to Alternative 1. This alternative allows for a reduction in surface water monitoring under lower threat circumstances and where management plans are developed. This alternative also requires the development of groundwater quality management plans to minimize discharge of waste to groundwater.	Third-party groups	1. Enroll member growers and provide member information to the CVWB. 2. Provide members and CVWB an organizational or management structure. 3. Make ILRP expenditure summaries available to members. 4. Notify affected group members of CVWB enforcement against the third-party. 5. Develop monitoring/management practice tracking plans. 6. Conduct monitoring. 7. Develop and implement surface water quality management plans where monitoring data shows two or more exceedances of an applicable water quality objective. 8. Develop groundwater quality management plans within four-years of adoption of the ILRP. 9. Inform/coordinate with growers.	1. Require 100% participation. 2. Review and approve monitoring plans. 3. Review and approve surface water quality management plans. 4. Review and approve groundwater quality management plans. 5. Review and approve *optional* watershed/area management objectives plans. 6. Review monitoring reports. 7. Review ILRP performance. 8. Respond to complaints. 9. Require additional monitoring and practices where WQOs are not being met. 10. Enforce ILRP.	1. Submit application and pay fees. 2. Implement water quality management practices in accordance with any approved plans. 3. Prevent nuisance conditions and/or exceedance of WQOs. 4. Provide ILRP information to third-party group.	Watershed-based (same as current ILRP) with option for reduced monitoring where *optional* watershed/ area management plan is developed.	Regional monitoring for at a minimum nitrates and salts (under a local groundwater management plan). ***or*** Tracking implementation of required management practices along with a limited number of site specific studies (under third-party developed groundwater quality management plans).	Management practice tracking.
3	**Individual Farm Water Quality Management Plans** - Individual growers would work with the CVWB, or designated implementing agency, to develop an individual farm water quality management plan, The CVWB would approve the plan.	CVWB	See CVWB responsibilities.	1. Enroll growers. 2. Require 100% participation. 3. Review applications, prioritize review of farm water quality management plans. 4. Negotiation MOUs with technical service providers. 5. Conduct grower site inspections. 6. Coordinate with growers to ensure plans/practices are addressing water quality problems. 7. Review monitoring reports. 8. Review ILRP performance. 9. Respond to complaints. 10. Certify participating growers are implementing practices that protect water quality. 11. Require additional monitoring and practices where WQOs are not being met. 12. Enforce ILRP.	1. Submit application and pay fees. 2. Within 2-years, develop and implement a farm water quality management plan. 3. Submit plan for CVWB approval. 4. Maintain and update plan as needed. 5. Prevent nuisance conditions and/or exceedance of WQOs. 6. Allow inspection by CVWB or representative.	Monitoring of management practices (e.g., visual monitoring, inspection of proper operation).	Monitoring of management practices (e.g., visual monitoring, inspection of proper operation).	Management practice tracking.

Attachment A
Alternatives Matrix

No.	Alternative Description and Summary	Lead Entity	Lead Entity Responsibilities	CVWB Responsibilities	Growers' Regulatory Requirements	SW Monitoring	GW Monitoring	Tracking
4	**Direct Oversight with Regional Monitoring -** Individual growers or "legal entities" assuming responsibility for waste discharge would work directly with the CVWB. This alternative provides the option for third-party group conducted monitoring and reporting. Under this approach, regulatory requirements would be scaled using tiered, threat-based criteria. Higher threat operations would be required to implement additional management practices and more extensive monitoring than lower threat operations. Under this alternative all growers would be required to develop an individual farm water quality management plan.	CVWB or "legal entity"	Third-party monitoring group: 1. Provide members and CVWB an organizational or management structure. 2. Make ILRP expenditure summaries available to members. 3. Notify affected group members of CVWB enforcement against the third-party. 4. Develop monitoring/tracking plans. 5. Conduct monitoring.	1. Enroll growers or "legal entities." 2. Require 100% participation. 3. Review and approve monitoring plans. 4. Review monitoring reports. 5. Coordinate with growers to ensure plans/practices are addressing water quality problems; assign growers to appropriate tier or tiers. 6. Review ILRP performance. 7. Respond to complaints. 8. Conduct grower site inspections. 9. Require additional monitoring and practices where WQOs are not being met. 10. Enforce ILRP.	1. Submit application and pay fees. 2. Within 2-years, develop and implement a farm water quality management plan - the plan would be kept onsite and submitted to the CVWB upon request. 3. Maintain and update plan as needed. 4. Allow inspection by CVWB or representative. 5. Prevent nuisance conditions and/or exceedance of WQOs. 6. Maintain facility records of each field's nutrient budget. 7. Complete 15 hrs of farm water quality education within 2-years. 8. Submit annual certified statement to CVWB regarding appropriate tier application. **Tier 1 Only**: submit site-specific evaluation to CVWB demonstrating minimal potential impact of waste discharge to SW and/or GW. **Tier 3 Only:** develop a nutrient management plan and/or implement additional pesticide management practices.	Tiers 2 and 3 would conduct individual monitoring, or participate in regional monitoring, with Tier 2 operations having reduced monitoring requirements.	Tier 3 operations would conduct individual monitoring *and* participate in regional monitoring; Tier 2 operations would choose individual or regional monitoring.	Nutrient/ pesticide applications, management practices.
5	**Direct Oversight with Farm Monitoring -** Individual growers would work directly with the CVWB. Growers would be required to develop and implement a farm water quality management plan and nutrient management plan.	CVWB	See CVWB responsibilities.	1. Enroll growers. 2. Require 100% participation. 3. Review monitoring reports. 4. Develop prioritization scheme for installation of monitoring wells. 5. Coordinate with growers to ensure plans/practices are addressing water quality problems. 6. Review ILRP performance. 7. Respond to complaints. 8. Conduct grower site inspections. 9. Require additional monitoring and practices where WQOs are not being met. 10. Enforce ILRP.	1. Submit application and pay fees. 2. Within 2-years, develop and implement a farm water quality management plan - the plan would be kept onsite and submitted to the CVWB. 3. Maintain and update the plan as needed. 4. Develop and implement a nutrient management plan if commercial fertilizer or manure are used. 5. Allow inspection by CVWB or representative. 6. Prevent nuisance conditions and/or exceedance of WQOs. 7. Maintain facility records of each field's nutrient budget.	Individual farm monitoring for constituents of concern in tailwater and stormwater.	Individual supply well monitoring. Installation and sampling of monitoring wells where CVWB requires -based on vulnerability factors.	Nutrient/ pesticide applications, management practices.

Attachment B
Area or Watershed Management Objectives Plans

The implementation of water quality management practices is based on the premise that individual group members will be actively involved in implementing an area or watershed management objectives plan. Throughout much of the Central Valley Regional Water Board area, watershed management plans have been or are being developed by local management entities (RCDs, watershed alliances, district organizations, etc.). These plans typically include the identification of principal watershed issues and concerns and describe appropriate actions to address those issues and concerns. While they may include water quality impacts from agricultural discharge as a watershed concern, these plans are usually more general than envisioned for an ILRP area or watershed management objectives plan.

For an ILRP area or watershed management objectives plan, the expectation would be the identification of a set of management objectives and management practices that, if implemented, would be effective in addressing agricultural discharge-related impacts to water quality. Typically these management objectives and practices would be developed for crop types (e.g. wild rice, vineyards, and citrus) or general agricultural operations (e.g. livestock management with irrigated pasture and other animal forage production, i.e. ranch operations) that are common to that geographic or watershed area. Management objectives tend to be more general (e.g. "manage irrigation water to eliminate, reduce, or slow the direct discharge of tailwater to adjacent watercourses"), while management practices are the more specific method used to achieve the management objective (e.g. collect tailwater in ponds or wetlands, recycle tailwater, discharge tailwater to vegetated buffers zones, and modify irrigation methods). Selection of the appropriate management practice is typically done on a site-specific or property-specific basis.

In summary, an area or watershed management objectives plan would include management objectives (by crop type or type of agricultural operation), common management practices that could be used to achieve the management objective, the approach to be used by the coalition (or other third party) to promote the implementation of management objectives and practices, and the approach to be used to track the watershed-wide level of management practice implementation and its effectiveness.

Where watershed management plans already exist, these more specific area or watershed management practice plans could be made part of that broader watershed management plan.

Attachment C
Groundwater Quality Management Plans

Groundwater quality management plans (GQMPs) for third-party group identified groundwater management areas (GMAs) would include the following:

- Identification of GMAs and constituents of concern based on available data from existing groundwater management programs, including but not limited to the State Water Resources Control Board's Groundwater Ambient Monitoring and Assessment , the U.S. Geological Survey, the DPH, the DPR, and the DWR.
- Prioritization of GMAs and constituents of concern for implementation of agricultural management practices based on available data, and also based on the risk of contamination due to soil type, known agricultural practices, crops grown, climate, proximity to wells, aquifer condition and uses, and other factors determined to be relevant and appropriate by the third party. Where an identified constituent of concern is a pesticide that is subject to the DPR's ground water protection program, the GQMP would defer to DPR's regulatory program for that pesticide and any requirements associated with the use of that pesticide.
- Identification of appropriate agricultural practices for high-priority constituents in high-priority GMAs.
- Describe how information regarding agricultural practices would be distributed to growers in high-priority areas. For example, such information would be prepared by the third parties for distribution by the county agricultural commissioner (CAC) offices at the time that growers file pesticide use reports, when they file an application for a private applicator's license, or when they obtain a restricted materials permit. When the information is distributed by the CAC or other identified entity, growers would sign a form acknowledging that they have received information regarding agricultural management practices for the protection of groundwater in the high-priority area, and that they will implement the practices to maximum extent practicable. Once executed, the CAC or other entity would then transmit completed forms back to the third party for assembly and annual reporting purposes.
- Include a tracking and reporting program that annually documents to the Central Valley Water Board implementation of agricultural management practices within the high-priority areas. Implementation of agricultural practices would be inferred by acknowledgement forms from the CACs office.
- The GQMP may include focused studies of selected agricultural management practices, constituents, or physical settings to inform refinement of GMA and constituent prioritization, or of practices that provide needed groundwater protection from degradation by constituents of concern. The results of focused studies would be documented in the annual report.
- The GQMP would not include or address issues related to groundwater supply, including issues regarding the volume of groundwater pumped or used by growers within a groundwater management area.

Attachment D
Local Groundwater Management Plan

In order to be substituted for GQMPs under Alternative 2, local groundwater management plans would be required to contain the following elements:

1. Program goals must be consistent with Basin Plan water quality objectives for groundwater.
2. Monitoring for groundwater quality.
3. Reporting of monitoring results in an aggregated manner.
4. Where necessary, recommended groundwater quality management practices.
5. Evaluation of effectiveness of existing groundwater management policies/practices.
6. Ability to amend the plan if objectives are not being met.

Attachment E
Minimum ILRP Application Requirements

Minimum required information for application[15] for coverage under Alternatives 3, 4, and 5 would include:

a. Name and contact information of owner/operator.

b. Discharge location and operations.

c. Receiving water information.

d. Irrigation method(s).

e. Site map.

f. Parcel numbers, acreages, and crop types.

g. Location of any potential conduits to groundwater (e.g., active, inactive, or abandoned wells; dry wells, recharge basins, or ponds, etc.).

[15] This "application" would be a Notice of Intent to comply with program requirements.

Attachment F
FWQMP Requirements

Alternatives 3, 4, and 5 would require that irrigated agricultural operations develop individual farm water quality management plans (FWQMPs). For guidance and consistency, the Central Valley Water Board would develop a standard FWQMP template, but it is expected that, at a minimum, plans would describe those practices needed or currently in use to achieve water quality protection. Growers would be encouraged to work with technical service organizations such as resource conservation districts and the University of California Cooperative Extension in the development of FWQMPs.

FWQMP content would at a minimum include 1) name and contact information of owner/operator; 2) description of operations including number of irrigated acres, crop types, and chemical/fertilizer application rates and practices; 3) maps showing the location of irrigated production areas, discharge points and named water bodies; 4) applicable information on water quality management practices used to achieve general ranch/farm management objectives and reduce or eliminate discharge of waste to ground and surface waters; 5) measures instituted to comply with California Code of Regulations, Title 3, Section 6609 requirements for wellhead protection (from pesticide contamination) along with methods for wellhead protection from fertilizer use; and 6) identification of any potential conduits to groundwater aquifers on the property (e.g. active, inactive, or abandoned wells; dry wells, recharge basins, or ponds) and steps taken, or to be taken, to ensure all identified potential conduits do not carry contamination to groundwater.

Attachment G
Alternative 4 Tier System Matrix

	Tier 1	Tier 2	Tier 3
Definition[a]	Fields with minimal potential to affect water quality	Fields with low potential to affect water quality: 1. *Surface water*-not a potential source of a water quality problem within the sub-watershed; does not use pesticides that have been identified as causing water quality problems in three or more sub-basins 2. *Groundwater*-low threat fertilizer use; no use of Title 3, California Code of Regulations section 6800 pesticides; not within a vulnerable hydrologic one mile section of land as identified by well data	Fields with waste discharge to surface and/or groundwater that do not meet Tier 1 or 2
Specific requirements[b]	Submit site specific information demonstrating minimal potential to affect surface and/or groundwater quality		Nutrient management plans and/or additional pesticide management practices
Surface water monitoring[b]		*Individual* tailwater, stormwater, tile drainage monitoring for constituents of concern one year out of every five years ***Or*** *Regional* ambient water quality monitoring for constituents of concern one year out of every five years	*Individual* tailwater, stormwater, tile drainage monitoring for constituents of concern ***Or*** *Regional* ambient water quality monitoring for constituents of concern

	Tier 1	Tier 2	Tier 3
Groundwater monitoring[b]		*Individual* semiannual monitoring of onsite wells for nitrate, phosphorus, total dissolved solids, and pathogens ***Or*** *Regional* groundwater monitoring for constituents of concern	*Individual* semiannual monitoring of onsite wells for nitrate, phosphorus, total dissolved solids, and pathogens ***And*** *Regional* groundwater monitoring for constituents of concern

a. An operation may be in a different tier for surface and groundwater discharges.
b. The requirements summarized in this matrix are those specific to each tier. See Alternative 4, Regulatory Requirements, for requirements that apply to all tiers.

APPENDIX B

CENTRAL VALLEY WATER BOARD
DRAFT GROUNDWATER NITRATE SUMMARY REPORT

APPENDIX B

Draft Groundwater Nitrate Summary Report

A. Abstract

Nitrate derived from both agricultural and non-agricultural sources has resulted in degradation of groundwater beneath agricultural areas in California's Central Valley. Such discharges must be considered when developing a long-term irrigated lands regulatory program and an Environmental Impact Report (EIR) to protect State waters. The first step in this evaluation process is to conduct a review of available nitrate literature for information on: source identification techniques, nitrate leaching factors, vulnerability studies, known areas of impact and trends.

Determining the specific source(s) of nitrate contained in groundwater requires the use of a variety of chemical and physical methods that have been demonstrated to be effective for this purpose.

While some disagreement exists between the investigators, a common group of physical and chemical factors has been identified as affecting nitrate leaching beneath agricultural lands. Physical factors include: nitrogen application rates, water inputs (rainfall, type of irrigation, and frequency of irrigation), leaching rates (soil type and structure), evapotranspiration, and depth to groundwater. Chemical factors include: soil mineralogy, pH, bulk density, soil organic matter, and denitrification.

Comparisons of nitrate and non-nitrate vulnerability maps with maps depicting areas in the Central Valley where groundwater quality has been affected by nitrates show general agreement. However, sampling-induced bias (sampling deeper waters below shallow nitrate-affected waters or sampling wells with long screen intervals) coupled with the lack of sampling in some regions may distort or underestimate the area of impact.

Studies of trends in nitrate concentrations in groundwater in the Central Valley have focused predominantly on the eastern side of the San Joaquin Valley. Increases in nitrate concentrations in these focused areas corresponded to fertilizer application rates.

B. Introduction

Agricultural waste discharges can impact groundwater quality. Consequently, potential impacts on groundwater attributable to such discharges must be considered when developing a long-term irrigated lands regulatory program and an EIR to protect State waters. Identification of areas where groundwater quality already has been affected by constituents associated with irrigated agriculture is an important consideration. Identifying such areas in the Central Valley can help the California Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board) and affected stakeholders in the prioritization and development of programs to protect groundwater from agricultural waste discharges.

Nitrate was selected as the indicator parameter for this study because of its widespread use in agriculture, groundwater's vulnerability to nitrate degradation, and the relatively large amount of data that has been published regarding nitrate impacts in the Central Valley. The choice to focus on nitrate as the topic of this study does not mean that it is the only agriculturally derived substance known to affect groundwater quality. Pesticides, nutrients, salts, and pathogens all have been shown to negatively affect groundwater quality as a result of agricultural operations. However, nitrate is arguably the most studied of these constituents with hundreds of published reports providing information on a variety of nitrate sources, leaching factors, vulnerability areas, known areal impact in the Central Valley, and trends of impacts over time.

1. Report Objectives

The objectives of this report are to:

1. identify the major sources of nitrate that may affect groundwater in the Central Valley;
2. investigate methods that may be used to identify a specific source of nitrate;
3. evaluate factors that affect the leaching of nitrate and its detection;
4. review published nitrate vulnerability studies for the Central Valley;
5. identify areas in the Central Valley where groundwater quality has been affected by nitrates; and
6. provide a discussion of trends in nitrate concentrations in groundwater in the Central Valley.

C. Nitrogen Cycle

The nitrogen cycle (Figure B-1) is the process by which nitrogen is converted between its various chemical forms. This transformation can be carried out through both biological and non-biological processes.

1. Nitrogen

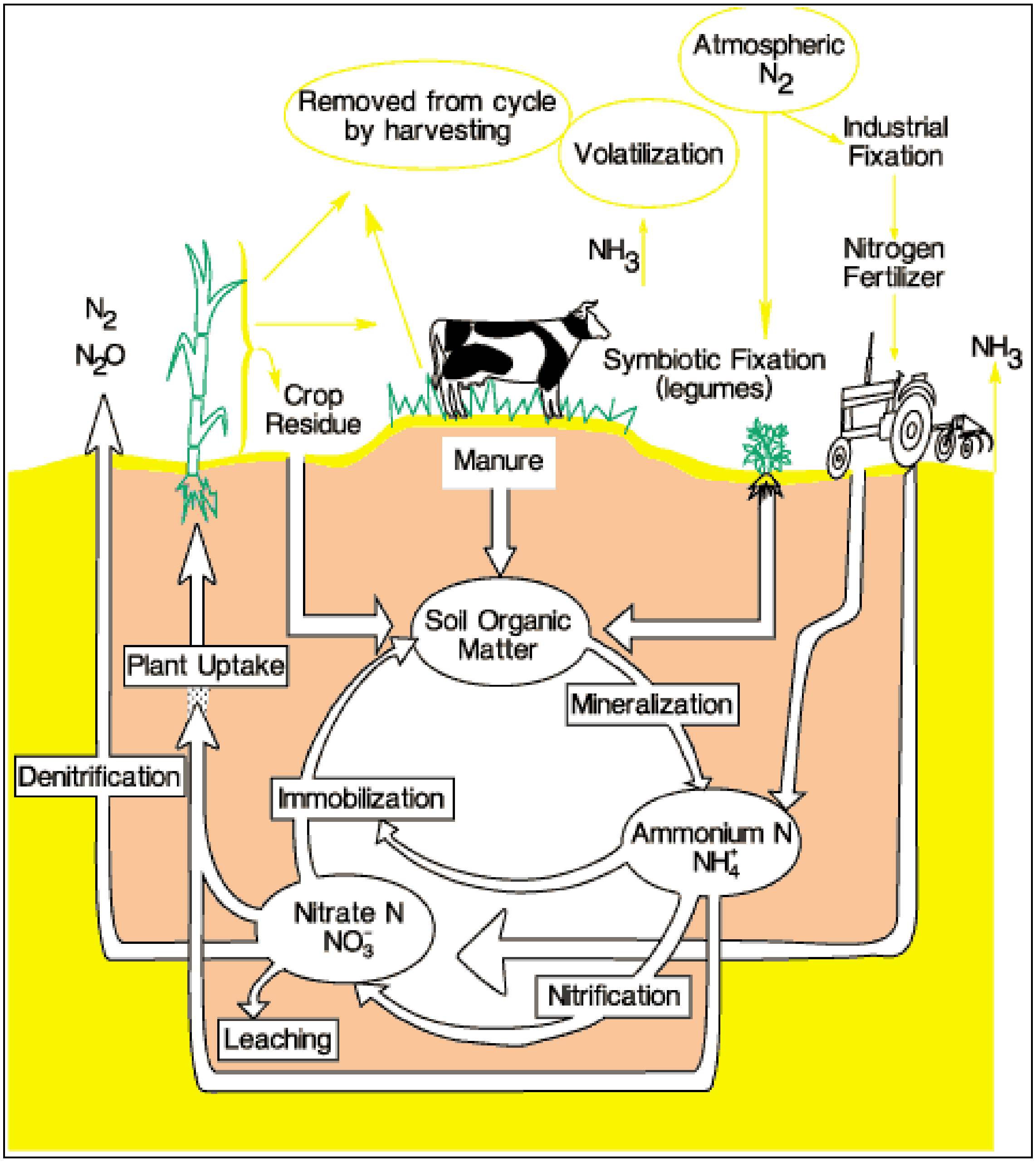
Nitrogen (N_1) is an essential element for life, composing one of the primary building blocks for amino acids and proteins. Nitrogen in the form of nitrogen gas

(N_2) is the most abundant component in the earth's atmosphere, making up approximately 78 percent by volume. However, gaseous nitrogen must be 'fixed' (converted from N_2 into ammonia [NH_3]) so that it can be used by plants. There are two main ways that nitrogen fixation occurs: biological and non-biological. Biological fixation is performed by bacteria converting nitrogen into ammonia and ammonium.

$N_2 + 3\ H_2^- > 2\ NH_3$ or $H^+ + NH_3 > NH^+_4$

Non-biological processes include lightning and industrial formation. Lightning produces energy that combines nitrogen (N_2) and water (H_2O) to form ammonia (NH_3) and nitrates (NO_3). Industrial formation uses nitrogen gas (N_2) combined with hydrogen (H), a catalyst, very high pressure, and high temperature to produce ammonia (NH_3).

Figure B-1. The Nitrogen Cycle in the Soil and Vadose Zone in an Agricultural Setting



Source: From Lawrence Livermore National Laboratory 2002.

Nitrification

Nitrification occurs by the following reactions:

$2 NH_3 + 3 O_2{}^{-} > 2 NO_2 + 2 H^+ + 2 H_2O$
$2 NO_2^- + O_2{}^{-} > 2 NO_3^-$

Aerobic bacteria use oxygen to convert ammonia and ammonium. Nitrosomonas bacteria convert nitrogen into nitrite (NO_2^-), and then nitrobacteria convert nitrite to nitrate (NO_3^-). Plants use the nitrate as a nutrient and animals obtain nitrogen by eating plants.

Decay or Ammonification

When plants and animals die, bacteria convert nitrogen nutrients back into ammonium salts and ammonia. This conversion process is called ammonification.

Denitrification

Denitrification is the process through which oxidized forms of nitrogen such as nitrate (NO_3^-) and nitrite (NO_2^-) are converted to dinitrogen (N_2) and, to a lesser extent, nitrous oxide gas (N_2O), which is returned to the atmosphere, completing the cycle. Denitrification is an anaerobic process that is carried out by denitrifying bacteria (pseudomonas, alkaligenes and bacillus), which convert nitrate to dinitrogen in the following sequence:

$NO_3^- > NO_2^- > NO > N_2O > N_2$

D. Sources of Nitrate in Groundwater

There are many sources of nitrogen, both natural and anthropogenic, that potentially could lead to the increased nitrate concentrations in groundwater (Figure B-2). Natural sources of nitrate include: nitrate contained in buried soil layers (caliche), nitrate contained in sedimentary rocks, nitrate produced by microorganisms in soils (fixation by bacteria), nitrate produced by lightning during thunderstorms, and nitrates contained in forested soils (decayed organic matter). Natural sources of nitrate that may contribute a high concentration of nitrate to the groundwater usually are derived from an anthropogenic disturbance. One example of this is the effect of logging in forested areas. Natural, mature forests conserve nitrogen, but human disturbances (logging) and fire can lead to nitrate leaching and potential increases of nitrogen in groundwater (Meixner et al. 2003; Kubin 1998).

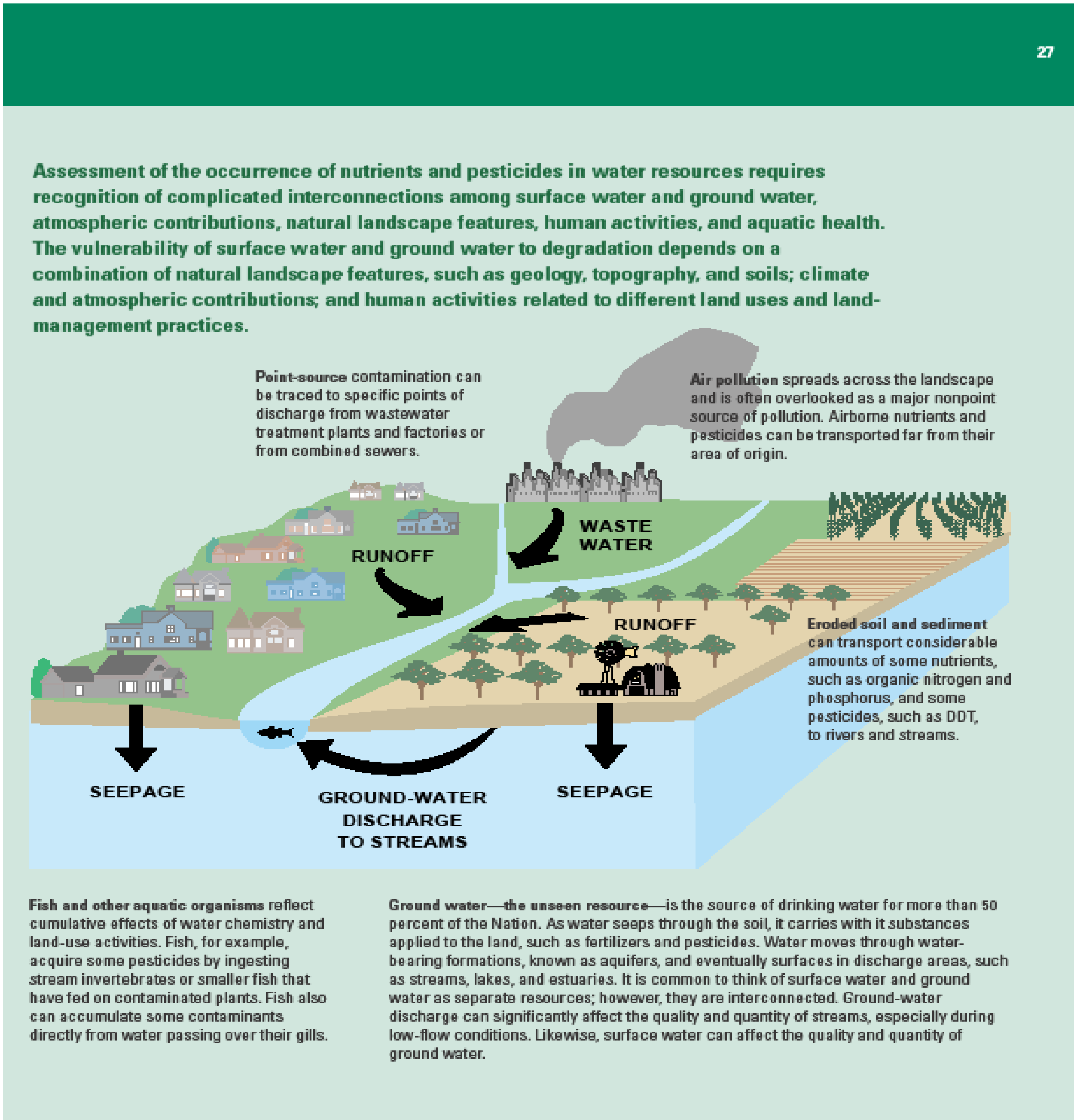
1. Major Non-Agricultural Sources of Nitrate

Studies have identified various forms of non-agriculturally derived nitrogen (nitrate, nitrite, ammonia, kjeldahl nitrogen) in aquifers in predominantly agricultural regions (Wakida and Lerner 2005; Paul et al. 2007; Central Valley Water Board 2008). The most significant sources for non-agricultural nitrate include: leakage from septic tanks, residential use of fertilizers, leakage from sewage pipes and mains, landfills, and food processing facilities.

Septic Systems

According to the United States Environmental Protection Agency (USEPA), the concentration of total nitrogen in effluents from a typical septic tank system ranges from 26 to 75 milligrams per liter (mg/l), with ammonia making up 4–13 mg/l and nitrite/nitrate composing <1 mg/l (U.S. EPA, *Onsite Wastewater Treatment Systems Manual*, February 2002).

Figure B-2. From: Fuhrer, G.J., et al., 1999, The Quality of Our Nation's Waters—Nutrients and Pesticides: U.S. Geological Survey Circular 1225, 27 p



The USEPA estimates that up to 20 percent of the septic systems nationwide do not function properly because of poor location, improper design, or lack of maintenance (USEPA 2002). While leaking from individual septic systems does contribute to nitrate loading into groundwater, the most important factor affecting groundwater contamination by septic tank failures is the density of systems per given area: the more numerous the systems the higher potential for nitrate groundwater impact (Pang et al. 2006; Wallace and Lowe 1998).

Residential Fertilizer Use

Studies have been conducted to investigate nitrogen inputs to groundwater from residential lawn care. One such study (Law et al. 2004) found that approximately 53 percent of the total nitrogen budget in a portion of Baltimore County, Maryland, was from lawn fertilization. A second study conducted in southern New England (Gold et al. 1990) identified soil water percolate concentrations from fertilized and unfertilized lawn treatments as having concentrations of less than 1.7 mg/l of nitrate as nitrogen. Bowman and others (2002) tested a variety of grasses under worst-case conditions (sand-filled column irrigated twice a day). The results of the study found that initial leaching losses were high following the first nitrogen applications (ranged from 48 to 100 percent of the applied NO_3-N [nitrate as nitrogen] and 4 to 16 percent of the applied NH_4-N [ammonium as nitrogen]). Subsequent nitrogen applications resulted in substantially reduced nitrate losses (1-3 mg/l NO_3-N), while NH_4 leaching was essentially eliminated. This low-threat level for nitrate leaching from turfgrass also has been reported by Engelsjord et al. (2004); Frank et al. (2005); and Raciti et al. (2008).

Leaking Sewage Pipes/Mains and Landfills

Very little has been published regarding the nitrate contribution to groundwater beneath developed areas resulting from leaking sewage pipes or sewer mains. However, both of these sources are cited in a variety of publications as being potential significant sources of nitrate to groundwater (Wakida 2008; Thios 1999—USGS Fact Sheet 106-00).

Nitrate impact on groundwater from landfill leachate is a well known problem (Wakida and Lerner 2005; Wakida 2008; Longe and Enekwechi 2007). Leachate results from percolation of water and liquid waste through solid waste. Generally, leachate is a high-saline liquid, containing metals and rich in ammonium and organic matter. In landfills where leachate enters groundwater, the high levels of ammonium may oxidize to form nitrate (Longe and Enekwechi 2007).

Food Processing Facilities

In California, the leaching of nitrate from food processing facilities is well documented in the State Water Resources Con troll Board (State Water Board) and the Central Valley Water Board files. An informational item presented to the Central Valley Water Board (March 17, 2006) detailed groundwater monitoring data collected from 105 food processing facilities that documented that almost half had affected groundwater with nitrates. A Central Valley Water Board staff report (February 26, 2008) documented nitrate impacts on groundwater from wineries, vegetable processors, and a processor of rice and soy products.

2. Agricultural Sources of Nitrate: Nursery and General Agricultural Use of Fertilizer and Animal Wastes

Nursery Use of Fertilizers

Container production of nursery crops is a potential source of nitrate release to the environment. The frequent irrigations in conjunction with high nutrient applications result in a high potential for the leaching of nitrate through the soil (Ristvey et al. 2004; Colangelo and Brand 2000; Brand et al. 1993). Colangelo and Brand (2000) studied irrigation volumes and associated nitrate concentration produced by overhead sprinkler and trickle irrigation systems (drip irrigation). They found that the frequent high-volume irrigation of the overhead sprinkler system resulted in lower nitrate concentrations in the leachate, but rapid nitrate leaching through the soil columns (more water produced a dilute solution that rapidly migrated through the soil column). Drip irrigation produced a higher nitrate concentration in the leachate, but a lower leaching rate through the soil column (less water produced a higher nitrate concentration that moved slowly through the soil column). Concentrations of nitrate-N (nitrate as nitrogen) in leachate from both irrigation methods approached or exceeded the 10 mg/l USEPA drinking water standard either late in the growing season or during the early winter months in both years of the study (Colangelo and Brand 2000).

General Agricultural Use of Fertilizers

A large number of investigators have researched the occurrence of nitrate in groundwater beneath agricultural operations (Burow et al. 1998; Suen 2008; Moran et al. 2005; Green et al. 2008; Harter et al. 2001; Fuhrer et al. 1999). High concentrations of nitrate in shallow groundwater were found to be widespread and strongly related to agricultural land use. Based on comparisons with background concentrations, human activities have increased nitrate concentrations in groundwater in the continental United States for about two-thirds of agricultural areas studied, compared to about one-third of urban areas (Fuhrer et al. 1999).

The National Water-Quality Assessment Program (NAWQA) reported that nitrate concentrations in shallow groundwater samples collected from domestic wells in agricultural areas in the San Joaquin–Tulare Lake Basins were among the highest in all of its study areas (Dubrovsky 1998). The study investigated groundwater quality in alluvial fans of the eastern San Joaquin Valley by collecting samples from three sets of wells: 30 domestic wells representative of the regional aquifer, 60 shallow domestic wells (median well depth 150 feet) situated in almond, vineyard, and row crops, and 20 multilevel monitoring wells in a 3.5-mile transect along a ground-water flow path. Nitrate concentrations were found to vary significantly beneath areas with different crops types (Dubrovsky 1998; Burow et al. 1998; and Spalding et al. 2001). Groundwater susceptibility to nitrate impact because of existing sediment texture was described as high for almond and vineyard crops and low for corn, alfalfa, and vegetables. Nitrate drinking-water standards were exceeded in 40 percent of the wells in almond producing areas and 15 percent of wells in the vineyard areas (Dubrovsky 1998 - USGS Circular 1159).

In 2000, monitoring wells screened near the water table in agricultural areas in the eastern San Joaquin Valley had nitrate concentrations ranging from 0.04 to 34 milligrams per liter (mg/L), with a median of 16 mg/l (Burow and Green 2008). Nitrate concentrations were greater than the MCL of 10 mg/l of nitrogen in 67 percent of the wells tested.

Dairies and Confined Animal Feeding Operations

In 1992, animal feeding operations in the continental United States produced approximately 133 million tons of manure (on a dry weight basis). This is 13 times the amount of human sanitary waste produced in the same year (USEPA 1998). Waste from agricultural livestock operations (beef, dairy, poultry, pork, sheep, goats, and horses) has been a longstanding concern with respect to contamination of water resources, particularly with respect to nutrients and pathogens.

In California, dairies constitute the largest population of confined feeding operations. Two main concentrations of dairies exist in California's Central Valley—one in the Kings/Tulare County area, and the second in the Merced/Stanislaus County area. Dairy facilities and similar confined animal operations pose a significant nitrate contamination threat to groundwater via oxidation of animal wastes and subsequent transport through the subsurface (Esser et al. 2009). Recent research shows that dairy operations are affecting underlying groundwater quality in California's San Joaquin Valley (Esser et al. 2009; Van der Schans et al. 2009; McNab et al. 2007; Singleton et al. 2007; Watanabe et al. 2008).

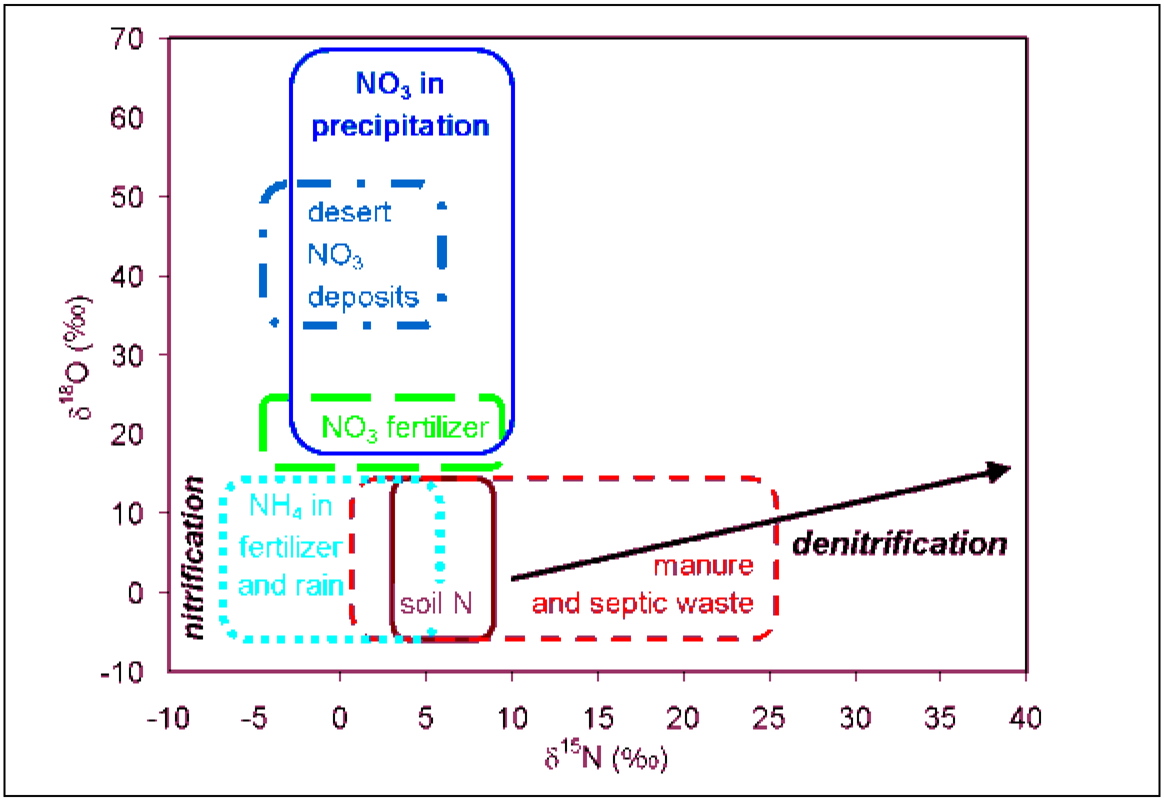
E. Methods Used for Identification of Nitrate Sources

The variety of potential sources of nitrate both natural and anthropogenic make determining the exact source of nitrate in an aquifer difficult. However, investigators have developed a suite of techniques that may be applied for sourcing nitrate in groundwater. These include:

- determination of the nitrate isotopic composition of the groundwater,
- establishment of the mean age of the groundwater,
- identification of the presence or absence of co-contaminants, and
- identification of the major and trace element chemical composition of the water.

The nitrate molecule contains nitrogen, with stable isotopes ^{14}N and ^{15}N, and oxygen, with stable isotopes ^{16}O, ^{17}O, and ^{18}O. Measuring the isotopic composition of both elements can be diagnostic for distinguishing atmospheric and synthetic fertilizer sources from organic fertilizer and septic sources (Widory, et al. 2005; Panno et al. 2006; Moran et al. 2007). However, overlap in the nitrogen and oxygen isotopic compositions of the various sources does occur particularly with respect to sources of nitrate from septic tank and manure application (Figure B-3). Because of this isotopic overlap, additional methods must be used to distinguish between the various sources of nitrate in groundwater.

Figure B-3. Nitrogen and Oxygen Isotopic Compositions of Various Nitrate Sources (after Kendall 1998)



Determining the age and location where groundwater is recharged aids in the identification of the nitrate source(s). Because nitrate travels without significant attenuation in oxygen-rich groundwaters, natural tracers of groundwater flow can help distinguish between ongoing and historical sources of nitrate. Tritium and chlorofluorocarbons typically are used as groundwater tracers and as a means for estimating groundwater age (Esser et al. 2009, Buszka et al. 2006). Tritium is a short lived radioactive isotope of hydrogen that is produced in the atmosphere naturally and by aboveground nuclear weapons testing. Tritium is incorporated into the water molecule, making it a suitable tracer for groundwater flow. Chlorofluorocarbons are anthropogenic organic compounds that have been produced since the 1930s for a number of industrial and domestic purposes ranging from aerosol propellants to refrigerants. By measuring chlorofluorocarbon concentrations in groundwater and determining or estimating the recharge temperature of the groundwater, an age can be assigned to the groundwater sample (USGS chlorofluorocarbon [CFC] Lab http://water.usgs.gov/lab/3h3he/ background/).

Trace concentrations of co-contaminants can be used to distinguish between nitrate derived from septic tanks and that produced by fertilizer sources (Esser et al. 2009; California GAMA Program 2006). Chemicals associated with high nitrate concentrations in groundwater from septic tanks include: N,N-diethyl-3-methylbenzamide (DEET), caffeine, ibuprofen, surfactants, triclosan (antibacterial agent), steroid estrogens, and widely prescribed antiepileptics such as carbamazepine (Seiler et al. 1999; Mills et al. 2007; Standley et al. 2008). In contrast, groundwater in surrounding farmlands may contain pesticides and their degradation products.

Waters associated with specific sources can often be distinguished by their major and trace element chemical compositions. Specific chemicals used for source identification are dissolved by water moving through the rock/soil matrix that composes the aquifer, or mixed with connate waters to provide a unique chemical signature. Graphical representations such as trilinear plots and pattern diagrams (Piper, Stiff) can be used to identify source areas and changes within water types. Nitrate isotope data in combination with other water quality variables, such as ions and ionic ratios, may be effective in distinguishing between various nitrogen sources and water types.

F. Factors That Affect Nitrate Leaching and Detection

A large number of investigations have been conducted to evaluate the factors that affect nitrate leaching (CDFA 1989; State Water Board 1994; Green et al. 2007; Harter et al. 2005; Fuhrer et al. 1999; Burow and Green 2008; Burow et al. 2008; Domagalski et al. 2008; and Dinnes et al. 2002). While some disagreement exists between investigators, a common group of physical and chemical factors have been identified that have the potential to affect nitrate leaching. Physical factors include: nitrogen application rates, water inputs (rainfall, type of irrigation, and frequency of irrigation), leaching rates (soil type and structure), evapotranspiration, and depth to groundwater. Chemical factors include: soil mineralogy, pH, bulk density, soil organic matter, and denitrification.

1. Nitrogen Fertilizer Application

Studies have shown that the rate/amount of nitrogen fertilizer applied is often, but not always, related to the concentration of nitrate in the soil pore water and in shallow groundwater (Zhao et al. 2009; Harter 2009; Kaown et al. 2007; Scanlon et al. 2005; Munoz-Arboleda et al. 2008; and Spalding et al. 2001). Under ideal conditions, only the amount of fertilizer used by the plant would be applied. However, in most cases, not all of the applied nitrogen is taken up by the plant, allowing some to move below the root zone. Nitrogen in the soil that is not returned to the atmosphere in the form of nitrogen gas or ammonia generally is converted to the nitrate form by bacteria. The mobility of nitrate in the soil profile is dependent on the soil composition, soil structure, evapotranspiration, and the amount of water (see discussion below).

2. Water

Water inputs have been shown to greatly affect nitrate leaching rates. Because nitrate is soluble in water and it is not readily absorbed by certain soils, its movement below the root zone is controlled partly by the volume of water percolating per unit of time (CDFA 1989). The amount of water that is available for percolation is dependent on the type of irrigation and the amount of precipitation (Green et al. 2008; Spalding et al. 2001; Central Valley Water Board 1994). A field study conducted by Powers and others (2001) concluded that nitrate leaching was greatly reduced by changing from furrow to sprinkler irrigation. A study of water movement through the unsaturated zone by Fisher and Healy (2008) found that the timing and intensity of precipitation and irrigation are major factors affecting the rate of groundwater recharge. In California, Fisher and Healy's study (conducted in an almond orchard in the San Joaquin Valley) found that virtually all groundwater recharge occurred when irrigation rates exceeded evapotranspiration for some period of time, typically 1 to 2 days. Rainfall was not a factor in groundwater recharge for this location; however, rainfall has been documented to be a major factor in nitrate leaching in areas with higher precipitation (Fisher and Healy 2008; Green, et al. 2008). Precipitation variability may result in cycles of nitrate leaching below the root zone, at times producing significant nitrate flux (Peralta and Stocke 2001). In addition to normal leaching through irrigation or precipitation events, nitrate may be moved below the root zone during pre-planting water application or through additional water applied for salinity control or frost protection (CDFA 1989).

3. Soil

Soil type and texture greatly influence the potential for nitrate leaching. Soils have varied nitrate-retentive properties depending on their texture, organic matter content, and cation exchange capacity (Barton et al. 2005; Power et al. 2001; Onsoy et al. 2005; Green et al. 2008).

Coarse-grained soils are soils in which sand- to gravel-sized particles predominate. These soils contain relatively large grains with voids or spaces (porosity) between the grains. High porosity coupled with high permeability (interconnections between the pore spaces) allows water to move relatively freely through the soil matrix. Because these soils typically contain little organic matter and have a low cation exchange capacity, nitrate that is in the soil pore water will move downward with little impediment (Wiederholt and Johnson 2005). A coarse-grained soil above an aquifer usually is seen as a threat to the quality of the water in the aquifer (Nolan et al. 2002, 2006; Green at al. 2007; Central Valley Water Board 1994).

Fine-grained soils are composed of silt- or clay-sized particles. These soils, while high in porosity, are low in permeability and thus poorly drained. Fine-grained soils typically contain abundant organic material and have a high cation exchange capacity. Water characteristically moves very slowly through the matrix of such soils, and consequently this soil type is considered to pose a reduced threat to the quality of the water in the aquifer. However, many of these soils shrink when dry and swell when wet, producing cracks. These, cracks together with wormholes, sediment heterogeneity, and root traces produce preferential pathways through which practically all the flow of water occurs. Because water flows through a very small proportion of the soil volume, it can move very rapidly, carrying nitrate with it (Williams et al. 2003; Harter et al. 2005).

4. Evapotranspiration

A study of nitrogen movement through the unsaturated zone in five agricultural settings in the continental United States concluded that evapotranspiration rates greatly affect pore water nitrate concentrations (Green et al. 2008). Among areas with similar fertilizer and water inputs, locations with high evapotranspiration rates had high soil water nitrate concentrations and a corresponding low flux rate (the rate of flow of the nitrate concentration contained in the soil pore water per second per unit area). Through the process of repeated irrigation events, areas with high evapotranspiration rates, sandy soils, and shallow depth to groundwater were found to have high groundwater nitrate concentrations (Green et al. 2008). Areas with low evapotranspiration rates and high flux rates were associated with relatively constant, moderate groundwater nitrate concentrations.

5. Depth to Groundwater

The depth to groundwater is a major factor in nitrate impact (Eimers and Spruill 1997; Burow and Green 2008; Nolan and Hitt 2006; Green et al. 2008). Nitrate concentrations are highest and most variable near the water table, and variability and concentration decrease with depth (Burow et al. 2008; Dubrovsky et al. 1998) (Figure B-4). Concentrations of nitrate are higher in the shallow part of the aquifer system where domestic wells are typically screened, whereas concentrations are lower in the deep part of the aquifer system where public-supply wells are typically screened.

6. Denitrification

Denitrification is one of the major chemical factors affecting nitrate leaching and potential groundwater impact (Spalding and Parrott 1994; Schmidt and Nieman 1997; Puckett et al. 2008). Denitrification consists of a series of oxidation-reduction reactions that ultimately involve electron transfer between an electron donor and nitrate. Through denitrification, oxidized forms of nitrogen such as nitrate (NO_3^-) and nitrite (NO_2^-) are converted to nitric oxide (NO), nitrous oxide (N_2O), and dinitrogen gas (N_2). Potential changes or limiting conditions that affect denitrification include the amount of organic matter, soil water content, soil oxygen supply, soil temperature, soil nitrate levels, and soil pH.

Once nitrate is in groundwater, denitrification can be an important process in controlling the nitrogen concentration over time. Groundwater can be classed as oxidizing, reducing, or a mixture of the two. The oxidation-reduction condition of a specific groundwater is a controlling factor in providing a source(s) of electron donors that react with nitrate in shallow aquifers. In denitrification, nitrate serves as the terminal electron acceptor for bacteria that derive energy from the oxidation of a reduced substance (Puckett et al. 2008). For electron donors, microbes commonly rely on organic carbon or, in the case of autolithotrophs, reduced forms of sulfur or iron (Green et al. 2008). Dissolved organic carbon (DOC) in recharging groundwater also can serve as an electron donor. N-species concentration data indicate that nitrogen gas (N_2) is the primary end product of nitrate reduction in aquifers (Green et al. 2008; Esser et al. 2009).

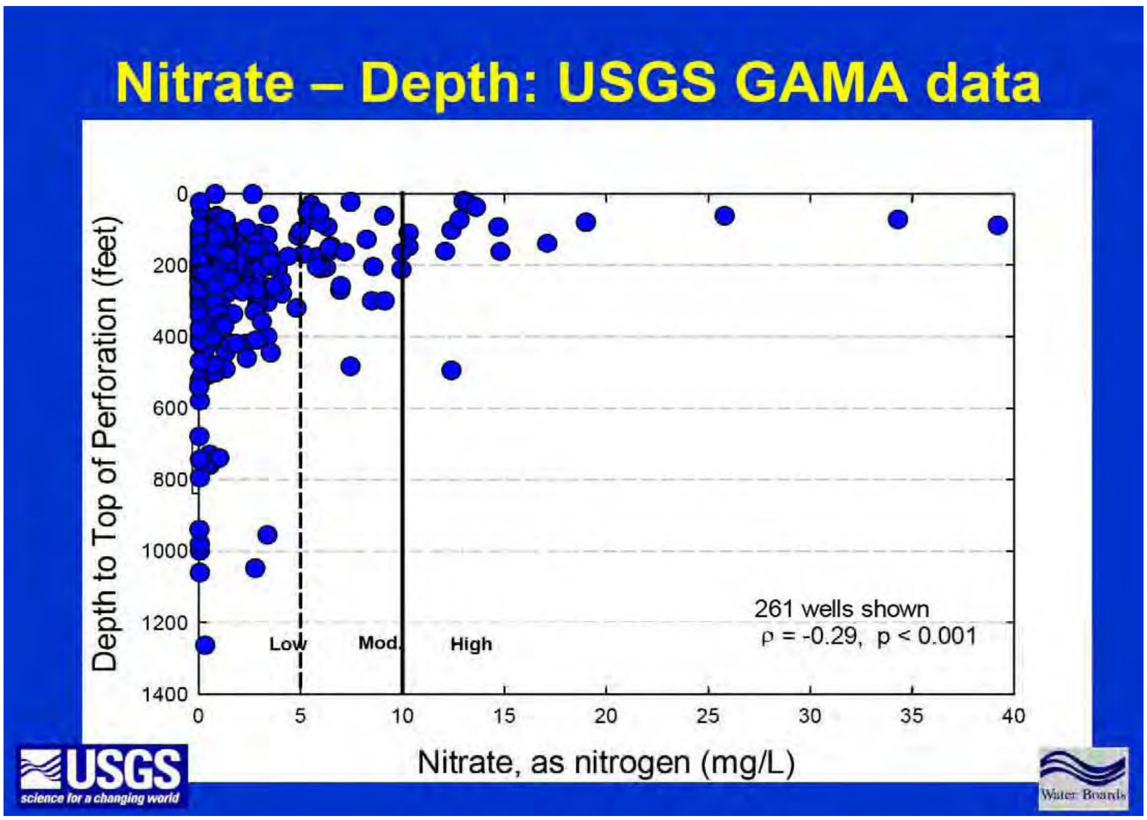
7. Detection

In assessing nitrate impact on a single well or across a geographical area, the most important factors are: (1) sampling of first encountered groundwater (shallowest depth) and (2) sampling from wells constructed with short screen intervals (screen lengths) where the screen is positioned across the water table (Burow et al. 2007; California GAMA Program; Fuhrer et al. 1999). Fuhrer and others' (1999) discussion of nutrients detected in groundwater contains the statement on page 3 that *"Nitrate levels in shallow ground water can change throughout the year, but typically the seasonal changes are noticeable only in the upper 5–10 feet below the water table in surficial aquifers."*

Nitrate concentration versus depth to top of the perforated portion of wells sampled by the GAMA program in the Central Valley is shown on Figure B-4. The graph shows that the highest concentrations of nitrate exist in the shallow groundwater (shallow perforation portion of the wells sampled). As the depth to the top of the well perforations increases, the nitrate concentration in the groundwater decreases. A similar graph has been produced by Burow and others (1998) in their study of the eastern San Joaquin Valley.

The importance of nitrate sampling in shallow wells with short screen intervals can be seen in the results of groundwater samples collected by the GAMA program from wells in the Kings study area of the Southeast San Joaquin study unit. Thirteen wells scattered across the study area were sampled and analyzed for nitrite plus nitrate as nitrogen. None of the sampled wells contained concentrations of nitrate above the nitrate MCL. All but one of the 13 wells was screened below 150 feet beneath ground surface (median top of screen depth was 269 feet below ground surface) and had screened intervals ranging from 120 to 320 feet in length (median screen length of 190 feet). Seven out of 15 flow path wells (generally shallow, short-screened wells used to evaluate effects of groundwater flow and aquifer characteristics) sampled in the same area had nitrate concentrations above the nitrate MCL value (the eight flow path wells that were below the nitrate MCL were screened more than 150 feet below ground surface with a median screen length of 153 feet). The seven flow path wells that exceeded the nitrate MCL averaged a depth to the top of the screened interval of 104 feet with a median screen length of 32 feet. This same pattern was observed for the Central Eastside GAMA study unit (Merced, Modesto, and Turlock area) where 20 wells were sampled with no detections of nitrate above the MCL value, but nine shallower flow path wells in the same area exceeded the MCL for nitrate.

Figure B-4. Nitrate Concentrations vs. Depth to the Top of the Well Screen: from Landon and Fram 2009



G. Published Nitrate Vulnerability Studies/Maps for Nitrate Impacts on Groundwater in the Central Valley

1. Nitrate Working Group

The California Department of Food and Agriculture's (CDFA's) Nitrate Working Group produced a report entitled *Nitrate and Agriculture in California* in February 1989 (Nitrate Working Group Report). The report investigated the major sources of nitrate in groundwater, the concentration of nitrate in groundwater in specific regions, and potential controls for crop and livestock production to reduce nitrate impact on groundwater.

The Nitrate Working Group Report concluded with a series of five recommendations. Those recommendations became the mission of CDFA's Nitrate Management Program (NMP), which later developed into the Fertilizer Research and Education Program (FREP). They included those below.

1. Identify nitrate-sensitive areas throughout California.

2. Prioritize those areas where action is most needed.

3. Organize voluntary nitrate management programs in high-priority areas in cooperation with local governments and agriculture.

4. Develop nitrate-reducing farming practices tailored to the high-priority areas that fit into the management programs, in cooperation with growers and other government agencies.

In implementing the first recommendation of the Nitrate Working Group, CDFA developed a map of nitrate-sensitive areas in California (Figure B-5). The map was developed using seven factors that are described below.

Groundwater Use

Nitrate concentration is considered to be critical if groundwater is used for domestic or animal drinking supplies. If it is used only for cleaning, cooling, or irrigation of most crops, there is less concern.

Soil Type

Sandy or other coarse-textured soils transmit water downward more rapidly, and nitrate with it. Also, these soils are less likely to create conditions in which nitrate turns to a gas and escapes from the soil (denitrification).

Irrigation Practices

Inefficient irrigation systems that lead to large volumes of subsurface drainage increase the leaching of nitrates. Typically, these are surface flow systems with long irrigation runs. Well-managed sprinkler or drip systems, or surface flow systems with short runs, reduce the threat of nitrate leaching to groundwater.

Type of crop

Crops most likely to increase nitrate leaching are those that (1) need heavy nitrogen fertilization and frequent irrigation, (2) have high economic value, so the cost of fertilizer is relatively small compared to revenue produced, (3) are not harmed by excess nitrogen, and (4) tend to take up a smaller fraction of the nitrogen applied. Many vegetable, fruit, nut, and nursery crops fit these criteria and therefore have more potential for nitrate leaching. Those with less potential include field crops such as alfalfa, wheat, and sugar beets.

Climate

High total rainfall, concentrated heavy rains, and mild temperatures lead to more leaching of nitrates.

Distance from the Root Zone to Groundwater

Less distance means a more immediate problem.

Potential Impact

This depends on such factors as population density and availability of an alternate water supply.

Figure B-5. Nitrate Sensitive Areas: from California Department of Food and Agriculture (1989)

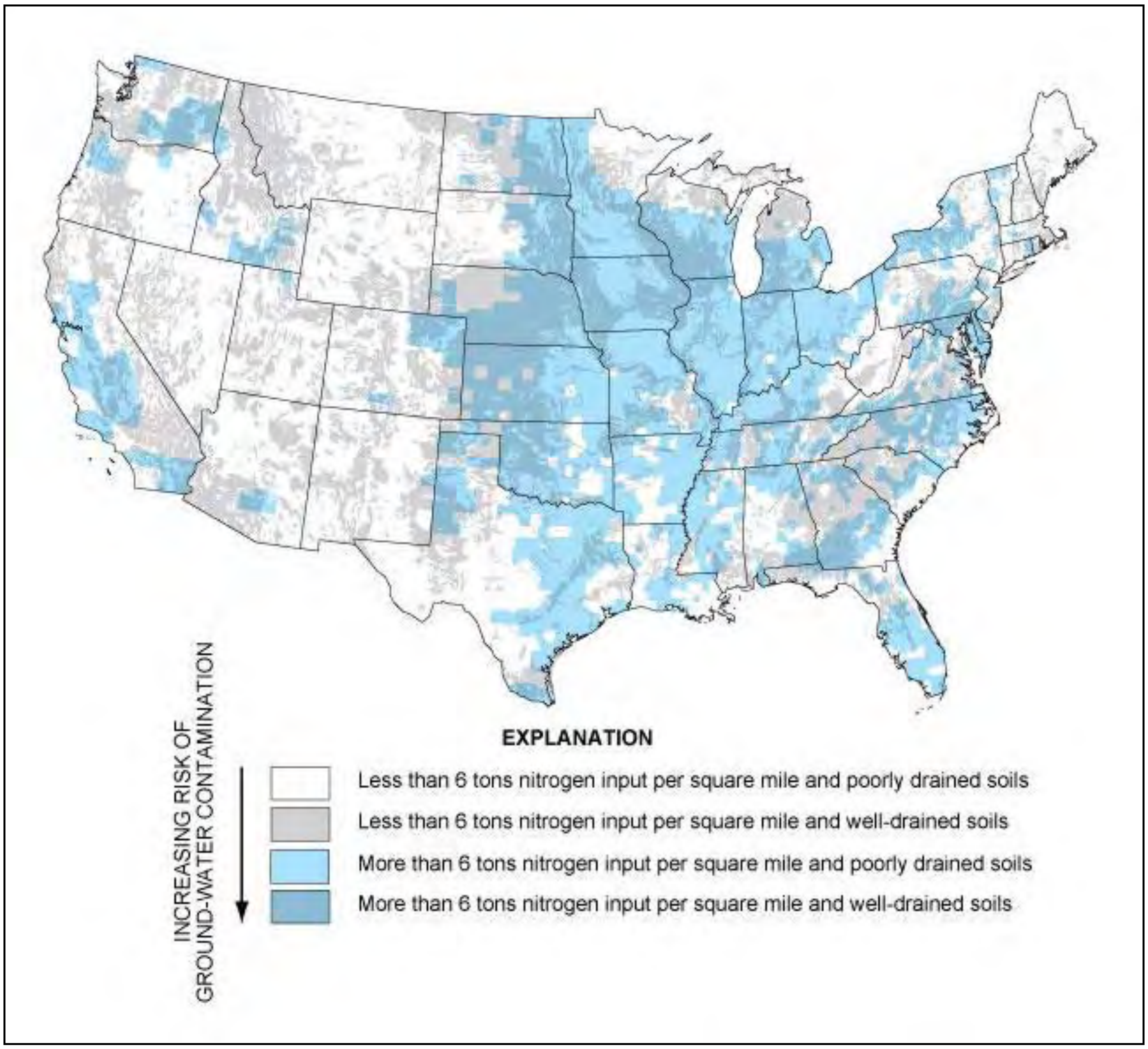
Nitrate-Sensitive Areas

2. National Water Quality Assessment Program

In 1991, the U.S. Geological Survey (USGS) began NAWQA to address the need for consistent and scientifically sound information for managing the nation's water resources.

In 1996, Nolan and Ruddy used NAWQA data to produce a Fact Sheet (FS-092-96) entitled, *Nitrate in Ground Water of the United States—Assessing the Risk.* The Fact Sheet contained a map of the continental United States that depicted areas that were deemed to be the most vulnerable to nitrate contamination of groundwater (Figure B-6). Almost the entire portion of California's Central Valley is shown to be at a moderate to high risk of nitrate impact on groundwater.

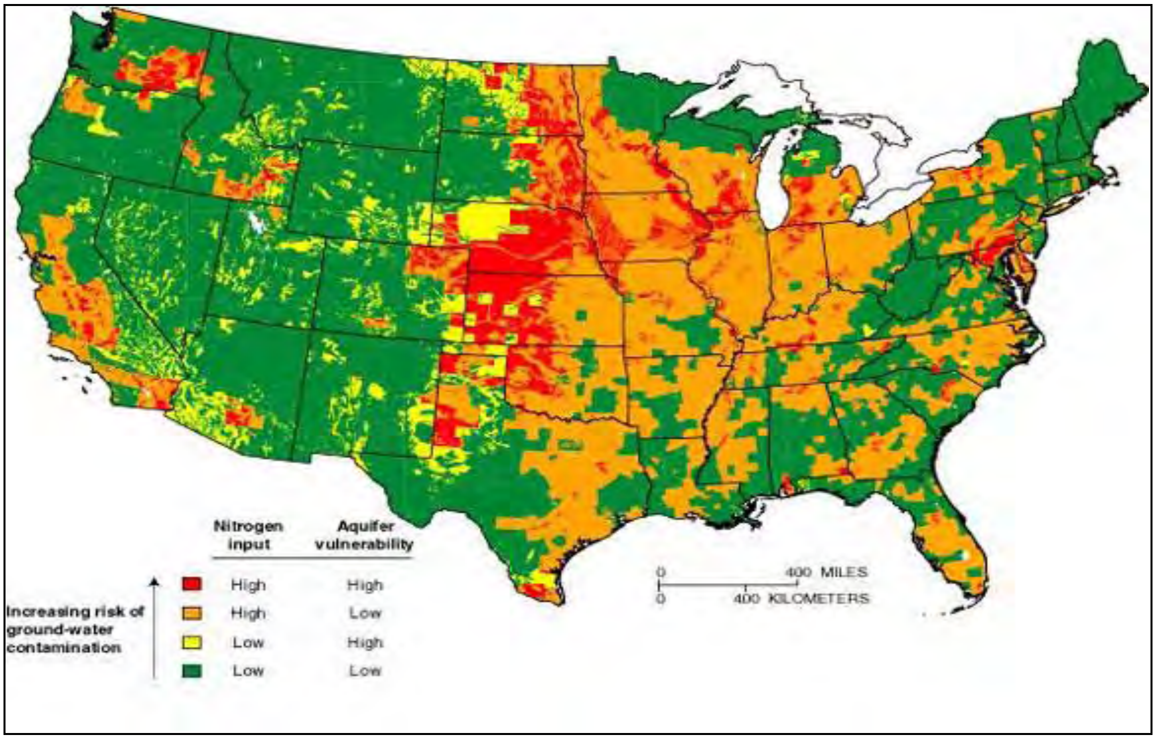
Figure B-6. Nitrate Vulnerability Map: from Nolan and Ruddy 1996



In 1999, the USGS produced a report entitled *The Quality of Our Nation's Waters— Nutrients and Pesticides* (USGS Circular 1225). A map contained in the report shows areas in the continental United States that were considered to be vulnerable to nitrate impact on shallow groundwater (Figure B-7). Shallow groundwater nitrate data (less than 100 feet deep) collected through 1992 were used to confirm the risk pattern shown on the national map.

As depicted on Figures B-6 and B-7, California's Central Valley is shown as high nitrogen input area with two parallel bands of high aquifer vulnerability extending along both sides of the Central Valley from the Bakersfield area to just north of Fresno. A second discontinuous band of high aquifer vulnerability extends through the center of the Central Valley from near Merced northward to the area around Colusa. A separate area of high vulnerability is depicted near Redding.

Figure B-7. Nitrate Vulnerable Areas: from USGS, The Quality of Our Nation's Waters—Nutrients and Pesticides; USGS Circular 1225 (1999)



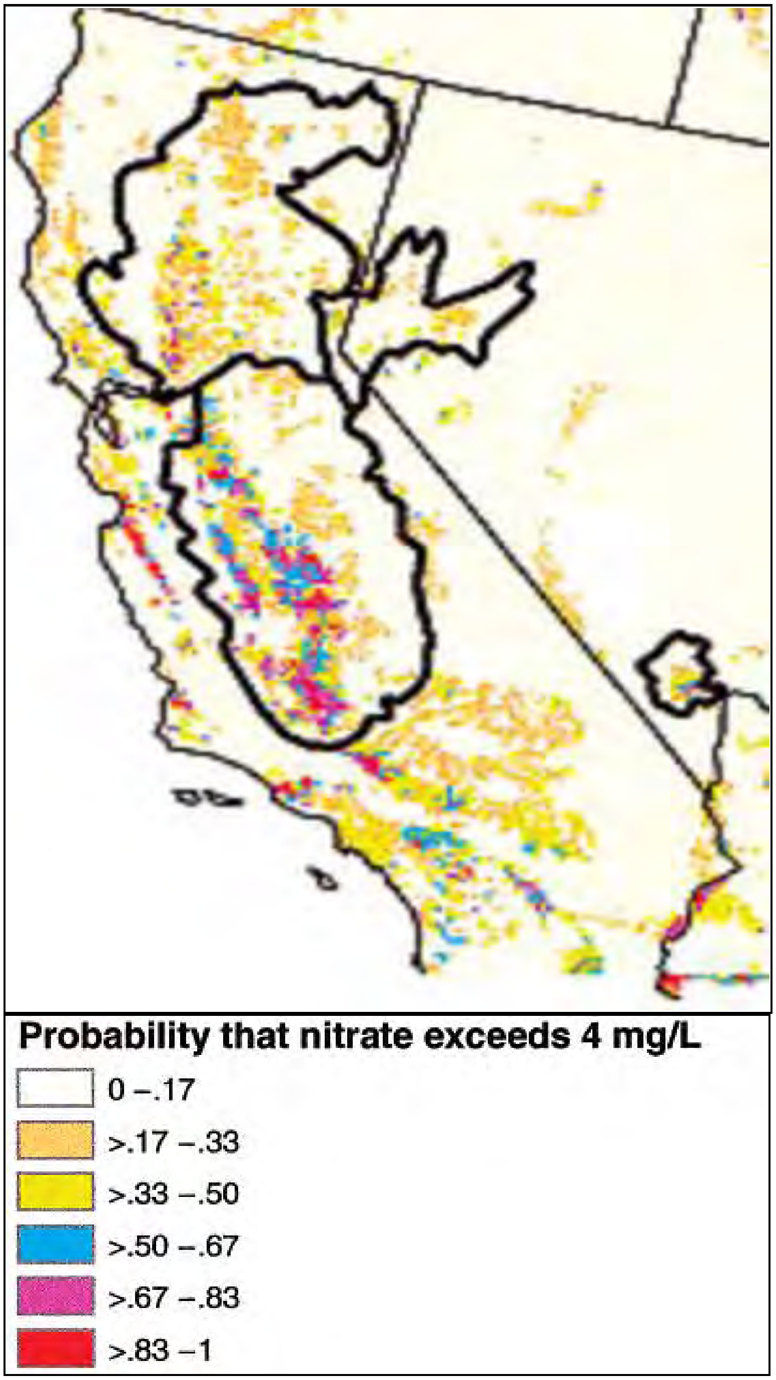
USGS Circular 1225 reported that "Nitrate in groundwater commonly originates from nonpoint sources such as fields on which inorganic fertilizer and animal manure are applied." Contamination was found generally to decrease with increasing depth to groundwater, and areas with a high risk of groundwater contamination by nitrate generally were found to have high nitrogen loading or high population density, well-drained soils, less extensive woodland relative to cropland, and shallow groundwater (less than 100 feet deep).

In 2002, Nolan and others produced *Probability of Nitrate Contamination of Recently Recharged Groundwaters in the Continental United States* (Nolan et al. 2002). This study used a logistic regression model to predict the probability of nitrate concentrations exceeding 4 mg/l in shallow groundwater in the continental

United States. The model included information such as: (1) nitrogen loading from inorganic fertilizer to the land surface, (2) percent crop land, (3) population density, (4) percentage of well-drained soils, (5) depth to seasonally high water table, and 6) presence or absence of rock fractures in the surficial aquifer.

The report by Nolan and others included a probability map for nitrate concentration in shallow groundwater in the continental United States (a portion of the map is presented as Figure B-8).

Figure B-8. Modified from: Probability of Nitrate Contamination of Recently Recharged Groundwaters in the Conterminous United States (Nolan et al. 2002)



Nolan and others' probability map was calibrated using a dataset of wells sampled between 1996 and 1999. The map appears to mirror the physical trends depicted in the 1996 and 1999 studies referenced above (two high probability parallel regions in the southern Central Valley and a single central discontinuous belt extending into the northern portion of the valley).

Additional Vulnerability Studies

While not developed specifically for nitrates, two additional vulnerability maps are included in this discussion of published data: (1) State Water Board Map of Hydrogeologically Vulnerable Areas and (2) California Department of Pesticide's (DPR's) Groundwater Protection Areas.

Figure B-9. Map of Hydrogeologically Vulnerable Areas: from State Water Resources Control Board (2000)

The State Water Board created a map displaying areas where published hydrogeologic information indicated conditions that may be more vulnerable to groundwater contamination (Figure B-9).

Data used to generate the map were derived primarily from California Department of Water Resources (DWR) bulletins (principally Bulletin 118 from 1975) and the USGS water supply, water resource, and open file reports. The justification for including or excluding specific groundwater basins/subbasins into the vulnerable category was based on infiltration rate; depositional soil type (alluvium, lacustrine, dune or channel deposits); whether the basin was developed or undeveloped; high or low population density; type of recharge; level of groundwater usage; and aquifer type (confined or unconfined aquifers).

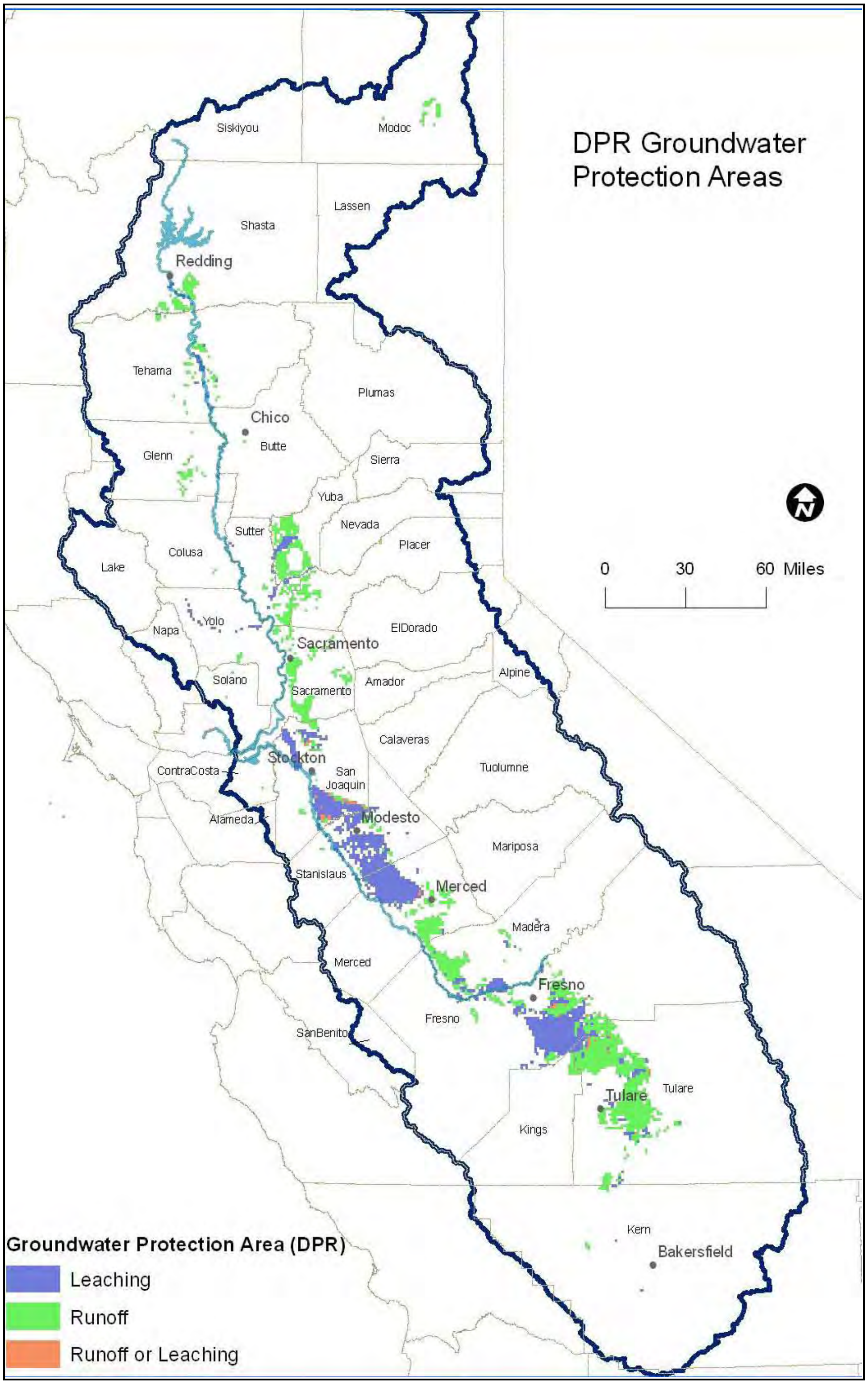
DPR's Groundwater Protection Areas are shown on Figure B-10. DPR used its dataset of wells containing pesticide residues from legal agricultural use to evaluate whether there was a correlation between detections and local climate, soil, and depth to groundwater characteristics. Given the wide range of climatic and soil conditions associated with pesticide contamination of groundwater, DPR used an empirical statistical approach to determine whether vulnerable areas could be described. The results of the initial study were subsequently refined using an alternative procedure (canonical variates analysis) to improve characterization of vulnerable areas.

In 2008, DPR released the results of an investigation conducted to evaluate the relationship between nitrate and pesticide residues in groundwater (Suen 2008). The investigation was conducted in a portion of eastern San Joaquin Valley (Fresno and Tulare Counties). The study used nitrate isotope and anionic mixing trends to evaluate the source of groundwater nitrate. Suen concluded that the main source of nitrate in groundwater in the study area was the result of fertilizer application in the form of ammonium nitrate, with a secondary source attributed to nitrate from animal or human waste. With respect to pesticides, the study did not identify a significant correlation between nitrate and herbicide residues, but did find a correlation between herbicide metabolites and nitrate. Based on these results, the study concluded,

> *Hence, the concentrations of groundwater nitrate and other agrichemicals may provide a reasonably significant proxy for determining travel pathways for the movement of herbicide residues and metabolites in the vadose zone, thus provide additional data for groundwater transport model development and calibration (Suen 2008).*

A much stronger correlation between pesticide and nitrate movement through the vadose zone has been reported by a variety of investigators (Burrow et al. 2007; Loper et al. 2009; Minnesota Department of Agriculture 2006).

Figure B-10. California Department of Pesticide Regulations Groundwater Protection Areas



H. Known Groundwater Areas in the Central Valley That Have Been Affected by Nitrate

The Nitrate Working Group Report used the STORET database (short for STOrage and RETrieval) to investigate the occurrence of nitrate in California groundwater (CDFA 1989). Nitrate data collected between 1975 and 1987 was used to produce a map that depicts nitrate concentrations at or above the nitrate MCL (Figure B-11).

The discussion of the occurrence of nitrate contained in the Nitrate Working Group Report separated the State into nine geographical areas: (1) Southern California Coastal Area, (2) San Joaquin Valley, (3) Sacramento Valley, (4) Central Coast, (5) San Francisco Bay Area, 6) North Coast, 7) Northeastern Counties, 8) Mountain Counties, and 9) Desert Areas. This review focuses on two of these areas: the San Joaquin Valley and the Sacramento Valley).

1. The San Joaquin Valley

The geographical area was broken down further into San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern Counties. In San Joaquin County, nitrate above the MCL was reported to be concentrated in the Lodi, Manteca, Ripon, Escalon, and Tracy areas (central portion of the valley) as well as Westley and Crows Landing on the western side of the valley. The source of the nitrate was unknown but suspected to be fertilizer and animal waste.

Elevated nitrate concentrations in Merced County centered along Highway 99 (Atwater, Winton, Livingston, Delhi, and Hilmar) and in the vicinity of Gustine, Los Banos, and near Dos Palos along the western portion of the valley. The source of the nitrates was dairy waste and fertilizers.

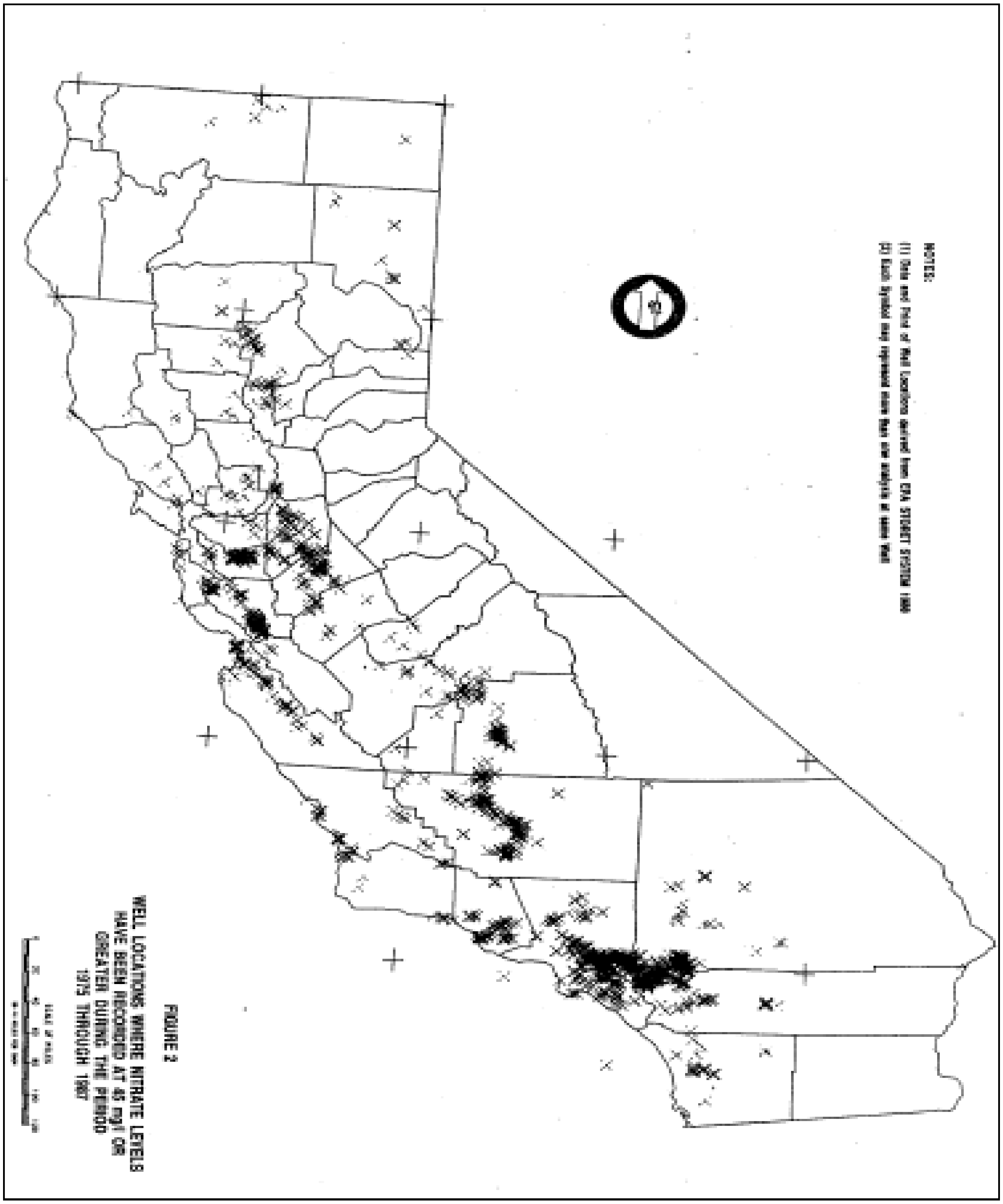
In Madera County, nitrate levels above background were reported for Chowchilla, Dairyland, Berenda, and in Ripperdan near the San Joaquin River.

High nitrate concentrations in Fresno County included (listed from east to west): Kingsburg, Reedley, Orange Cove, the Fresno-Clovis area, Raisin City, Caruthers, Kerman, Mendota, Firebaugh, Cantua, Creek, and Coalinga. The majority of the nitrate problem was attributed to agricultural use of fertilizer with the exception of the Fresno-Clovis area, where it was attributed to septic tanks, winery waste, fertilizer use, and urban runoff.

Kings County was reported to be relatively free of high nitrate concentrations with the exception of the Hanford and Lemoore areas and the area of Avenal on the west side.

In Tulare County a discontinuous belt of high nitrate groundwater associated with a zone of unconsolidated sandy soils and agricultural operations was reported to extend through Dinuba, Yettem, Lemon Cove, Woodlake, Strathmore, Porterville, Ducor, and Richgrove. Isolated high nitrate groundwater also was reported near Traver, Goshen, Visalia, and Tulare.

Figure B-11. Public Supply Wells with Nitrate Concentrations above the Nitrate MCL during the Period 1975–1978: from California Department of Food and Agriculture, February 1989



Kern County was reported to have high nitrate concentrations near Delano, McFarland, Wasco, Shafter, Famosa, Rosedale, Bakersfield, Arvin, Edison, and Lamont. Additional areas of high nitrate groundwater were reported for the Buena Vista Lake bed near Maricopa and Taft and in the area northwest of Lost Hills. With respect to the high nitrate concentrations in Kern County, the February 1989 Report states (page 18),

> *In a 1982 ground water quality study performed by the Kern County Water Agency (KCWA) and the Kern County Health Department, it was shown that the areas of greatest nitrate concentrations in the unconfined ground waters were found to be in the sandy soils along the east side of the basin where agricultural development began many years ago. Areas where nitrate levels approached or exceeded the State MCL increased in size from an estimated 49 square miles in 1958 to 372 square miles in 1979.*

2. The Sacramento Valley

The Nitrate Working Group Report subdivided the Sacramento Valley into Tehama, Butte, Glenn, Lake, Colusa, Sutter, Yolo, and Sacramento Counties. Page 19 of the February 1989 Report states,

> *U.S. Geological Survey studies (1984) of about 700 wells in this area, concluded that nearly one-third of the wells in the Sacramento Valley are undergoing significant increases in nitrate concentrations. Data suggests the following most probable sources: (1) surface contamination in shallow wells; (2) pollution from septic systems; and (3) leaching of fertilizers applied to cropland, particularly orchard areas.*

The report states that Chico, Sutter, Knights Landing, Arbuckle, Yuba City, Gridley, Red Bluff, and Corning all have elevated nitrate concentrations in the groundwater.

The Sutter County Environmental Health Department conducted a limited sampling of private wells in the county in 1986. The sampling results indicated that 75 percent of the wells sampled were above the MCL for nitrate.

The Nitrate Working Group Report also:

- Looked at the problem of animal production in relation to nitrate pollution and concluded that dairies, beef feedlots and poultry ranches were significant sources. Counties containing the majority of these facilities were San Bernardino and Riverside (the Chino area) and Imperial in the south; Merced, Stanislaus, Fresno, Kern and Tulare in the San Joaquin Valley; and Sonoma County on the coast.

- Analyzed the mechanisms of nitrate movement through the soil. The report concluded that the best way to slow the migration of nitrate is to reduce the amount of water that drains out of the crop root zone.
- Reviewed the potential of fertilizer BMPs, the sources of nitrogen and the types of fertilizers, and application rates and methods.

3. State Water Resources Control Board—Division of Clean Water Programs

The State Water Board, Division of Clean Water Program, Groundwater Special Studies Unit, produced a *Draft Groundwater Information Sheet, Nitrate/Nitrite* in October 2002. The draft information sheet was produced to provide general information regarding nitrate in groundwater.

California Department of Health Services (DHS) data for public supply wells were used to identify wells that exceeded the MCL for nitrate. Approximately 16,000 public supply wells were sampled; of these, 616 wells were identified as having nitrate concentrations above the MCL (Figure B-12). The top three regions identified as having public supply wells with nitrate concentrations above the MCL were the Central Valley, Los Angeles, and Santa Ana.

Nitrate impacts in the Central Valley (from south to north) appear as a discontinuous band of high nitrate groundwater extending northwestward from southern Kern County along the eastern side of the valley to the southern end of Madera County. A second, central band of high nitrate groundwater extends from the southeast to the northwest across the entire width of Stanislaus County. A southwest-to-northeast band of affected groundwater runs through Solano County and into Yolo County, and a forked band of impact extends along the Sutter/Yuba County line into the southern portion of Butte County.

The Nitrate/Nitrite Occurrence section of the draft information sheet points out that shallow groundwater unaffected by human activities generally contains less than 2 mg/l of nitrate. The major contributors of nitrate contamination to groundwater were stated to be fertilizer application, industry, septic systems, wastewater holding ponds, leaking sewer lines, sludge and manure application, and explosives.

A Revised Groundwater Information Sheet for Nitrate/Nitrite was issued by the State Water Board in February 2008. The revised information sheet used California Department of Public Health (CDPH) data from 1994 forward to evaluate nitrate impacts in approximately 15,000 active and standby public drinking water wells throughout California. Eight hundred and fifty-two (852) wells were identified as having nitrate concentrations above the MCL value (Figure B-13).

A comparison of the 2008 CDPH map with Nolan and others' (2002) map for *Probability of Nitrate Contamination of Recently Recharged Groundwaters in the*

Conterminous United States and the State Water Board's Map of Hydrogeologically Vulnerable Areas indicates general agreement with regard to potential versus actual nitrate impacts on groundwater.

Figure B-12. State Water Resources Control Board 2002

Active and Standby DHS Wells (616 Total) with at Least One Detection of Nitrate (as NO3) >= 45 PPM MCL

Source: 1984 - 2000 DHS Data (Map Revised 10/02/02)

The band of affected groundwater extends from Bakersfield northward into southern Madera County. Beginning in northern Merced County, a broader band of impact is seen through central Stanislaus County and into San Joaquin County. In San Joaquin County, the area of affected groundwater splits into three discontinuous north-trending bands. The westernmost band trends along the western edge of San Joaquin and Sacramento Counties, through the center of Solano and Yolo Counties, and along the border between Colusa and Sutter Counties.

Figure B-13. State Water Resources Control Board 2008

Active and Standby CDPH Wells with at Least One Detection of Nitrate (as NO_3) > 45 mg/L MCL (852 wells)

Source 1994 - November 2006 CDPH Data
(Map revised October 25, 2007)

The central band extends through the center of Stanislaus, San Joaquin, and Sacramento Counties, then along the boundary between Sutter and Yuba Counties to it's termination in southern Butte County. The eastern band roughly follows the boundary between San Joaquin and Calaveras Counties; the boundary of Sacramento, Amador, and El Dorado Counties; and passes through the western portions of Placer and Yuba Counties.

4. State Water Resources Control Board—305b Report

In 2002, the State Water Board submitted a water quality report to the USEPA pursuant to Section 305(b) of the federal Clean Water Act. The report provided water quality information to the general public and served as the basis for USEPA's National Water Quality Inventory Report to Congress. A portion of the nitrate exceedances contained in the 2002 305(b) report were used by the State Water Board to produce its 2008 nitrate map (Figure B-13 above).

The 305(b) report provided groundwater data for individual hydrologic regions that were composed of groundwater basins and subbasins as defined by DWR's Bulletin 118. Groundwater in the Central Valley was subdivided into three hydrologic regions: the Sacramento River Hydrologic Region; the San Joaquin River Hydrologic Region, and the Tulare Lake Hydrologic Region. Figures 4-2 through 4-4 of the Existing Conditions Report (Central Valley Water Board and ICF Jones and Stokes 2008) show the boundaries of these basins.

Sacramento River Hydrologic Region

Nine groundwater basins/subbasins were reported to have had at least one well that exceeded the nitrate MCL value based on water quality data obtained from public supply wells sampled by the DHS. The nine basins/subbasins were identified as: Scotts Valley, one well out of nine (1 [9]) tested exceeded the nitrate MCL, Colusa (2 [109]), Vina (4 [56]), East Butte (2 [32]), North Yuba (1 [35]), East Sutter (4 [41]), South American (1 [170]), Solano (8 [96]), and Yolo (1 [67]).

San Joaquin River Hydrologic Region

Seven groundwater basins/subbasins in this hydrologic region were reported to have had at least one well that exceeded the nitrate MCL value. These basins/subbasins were: the Eastern San Joaquin (7 [189]); Modesto (3 [114]); Turlock (8 [90]); Merced (2 [64]); Madera (1 [43]); Delta-Mendota (4 [51]); and Tracy (2 [36]).

Tulare Lake Hydrologic Region

Six groundwater basins/subbasins within this hydrologic region were reported to have had at least one well that exceeded the nitrate MCL value. These basins/subbasins were: Kings (23 [463]); Kaweah (13 [165]); Tule (6 [71]); Kern County (38 [475]); Kern River Valley (5 [76]); and Tehachapi Valley west (2 [30]).

5. Survey's National Water-Quality Assessment Program

In 1996, the USGS sampled 29 domestic wells and 2 monitoring wells in the southeastern Sacramento Valley as part of the USGS's NAWQA Program (Dawson 2001a). The groundwater samples were analyzed for a variety of constituents, including nitrate. Dawson reported that the MCL for nitrate was exceeded in 1 of 31 wells (3 percent). Eight of the wells (26 percent) had nitrate values greater than 3 mg/l, which Dawson considered to represent background nitrate concentrations.

The NAWQA Program investigated the shallow ground-water quality beneath rice areas in the Sacramento Valley, California (Dawson 2001b). In 1997, the USGS installed and sampled 28 wells in rice areas in the Sacramento Valley to assess the shallow groundwater quality and to determine whether any effects on water quality could be related to human activities and particularly rice agriculture. None of the samples collected from the 28 wells had concentrations above the nitrate MCL value. Three wells had nitrate concentrations greater than 3 mg/l, a level that Dawson considered may indicate impact from human activities.

The San Joaquin Valley was also one of the hydrologic areas selected for study by the USGS NAWQA Program. The results of the groundwater quality investigations, and for nitrate in particular, were reported by Burow and others (1998a; 1998b) and are summarized by Dubrovsky and others (1998).

Dubrovsky and others (1998) in *Water Quality in the San Joaquin–Tulare Basins, California,* reported that 24 percent (21 of 88) of the domestic wells sampled during the 1993–95 study had nitrate concentrations that exceeded MCL value for nitrate and that 77 percent of the wells had nitrate concentrations greater than 2 mg/l, which they considered to represent background nitrate concentrations.

6. Groundwater Ambient Monitoring and Assessment

The GAMA Program was created by the State Water Board in 2000. In 2003, the USGS prepared a report entitled *Framework for a Ground-Water Quality Monitoring and Assessment Program for California*. The report cites Assembly Bill 599, (Ground-Water Quality Monitoring Act of 2001) as identifying the need for developing and maintaining a monitoring program to assess the quality of California's groundwater. The major groundwater supply basins are a specific focus of the GAMA program.

The main goals of GAMA program are:

1. to improve Statewide groundwater monitoring; and

2. to increase the availability of groundwater quality information to the public.

In order to accomplish these goals, the GAMA program was divided into four projects: Priority Basin Project, Domestic Well Project, Special Studies Project and GeoTracker GAMA Project.

The Priority Basin Project was designed to provide a spatially unbiased assessment of raw groundwater quality in specific groundwater basins/subbasins, as well as to provide a statistically consistent basis for comparing water quality between basins throughout California. Samples were collected from water supply wells in each basin/subbasin using a randomized grid-based method to provide statistical representation of the study unit (grid wells). Additional wells were selected to evaluate changes in water chemistry along selected lateral or vertical ground-water flow paths in the aquifer (flow-path wells).

The GAMA Priority Basin Project was developed to assess groundwater quality (including nitrate) in key groundwater basins that account for more than 90 percent of all groundwater used in the State. Within the Central Valley, seven Priority Basins were investigated: Kern County Subbasin, the Southeast San Joaquin Valley, Madera-Chowchilla, Central Eastside, Northern San Joaquin Basin, Southern Sacramento Valley, and Middle Sacramento.

The results of the chemical analyses for nitrate in groundwater collected by the Priority Basin Project for the Central Valley region are as follows:

- **Kern County Subbasin**—two out of 17 samples had a nitrate concentration that exceeded the nitrate MCL value (sample set included 14 wells and three flow-path wells);
- **Southeast San Joaquin Valley**—six out of 44 samples had a nitrate concentration that exceeded the nitrate MCL value (28 wells and 16 flow-path wells). All six detections that exceeded the nitrate MCL value occurred in flow-path wells;
- **Madera-Chowchilla**—two out of 35 samples had a nitrate concentration that exceeded the nitrate MCL value (30 wells and five flow-path wells);
- **Central Eastside**—nine out of 39 samples had a nitrate concentration that exceeded the nitrate MCL value (20 wells, eight flow-path wells, and 11 monitoring wells). All nine detections that exceeded the nitrate MCL value occurred in the monitoring or flow-path wells;
- **Northern San Joaquin Basin**—zero out of 18 samples had a nitrate concentration that exceeded the nitrate MCL value (five wells, five flow-path wells, three monitoring wells, and five depth dependant samples);
- **Southern Sacramento Valley**—one out of 47 samples had a nitrate concentration that exceeded the nitrate MCL value (28 wells, 15 flow-path wells, and four depth-dependent samples); and

- **Middle Sacramento**—two out of 60 samples had a nitrate concentration that exceeded the nitrate MCL value (13 wells, 15 flow-path wells, and 22 wells completed beneath rice growing areas).

The GAMA Program includes a Domestic Well Project. This project is a voluntary groundwater monitoring program that provides water quality information on private (domestic) wells. Domestic wells were chosen for study for several reasons; domestic wells are generally shallower, are privately owned, supply a single household, and tend to be located in more rural settings where public water supply systems are not available. As of June 2009, this project has sampled five county focus areas: Yuba (2002), El Dorado (2003–2004), Tehama (2005), Tulare (2006), and San Diego (2008–2009). Two of these studies are situated in the Central Valley in areas of agricultural operations (Tehama [2005] and Tulare [2006]).

Tehama County was selected as a Domestic Well Project Focus Area because of the number of domestic wells in the county and the availability of well owner data. Two hundred and twenty-three (223) domestic wells were sampled, mostly near the county's major population centers. Well construction details (well depths only, no information provided regarding screen depth or water levels) were available for almost two-thirds of the wells sampled (144 out of 223). Based upon the available data, eighty-one (81) of the sampled wells are completed at depths less than 125 feet deep with the remaining sixty-three (63) wells completed below 125 feet, up to or exceeding 500 feet in depth.

The results of the Tehama County study found that nitrate was detected in 208 of the 223 samples at concentrations ranging from 1.1 to 60 mg/l (Figure B-14). Both nitrate (NO_3^-) and nitrite (NO_2) were detected at concentrations above their respective MCL values in two of the 223 wells sampled.

The results of the Tulare County study are being reevaluated and a written report is not currently available. However, Figure B-15 shows the nitrate concentrations obtained from the GAMA domestic well sampling program conducted in Tulare County. One hundred and eighty-one (181) domestic wells were sampled; 75 of which exceeded the nitrate MCL value (41 percent).

The results of the NAWQA and GAMA domestic well programs were combined by Bartholomay and others (2007) to produce a map of California depicting nitrate concentrations in groundwater in the Central Valley aquifer system (Figure B-16). The map distinguishes between the sources of the groundwater data by using circles (NAWQA) and squares (GAMA).

In 2009, Ekdahl and others used GeoTracker GAMA to investigate nitrate concentrations in California (Figure B-17). The GeoTracker GAMA system is an online database that uses Google Maps and databases generated by State and Regional Water Boards, DPH, DPR, Department of Water Resources (DWR), USGS, and Lawrence Livermore National Laboratory (LLNL). The GeoTracker

GAMA system provides data for more than 100,000 sampling locations and analytical results for a variety of constituents, including nitrate.

Figure B-14. GAMA Voluntary Domestic Well Project—Tehama County (2005)

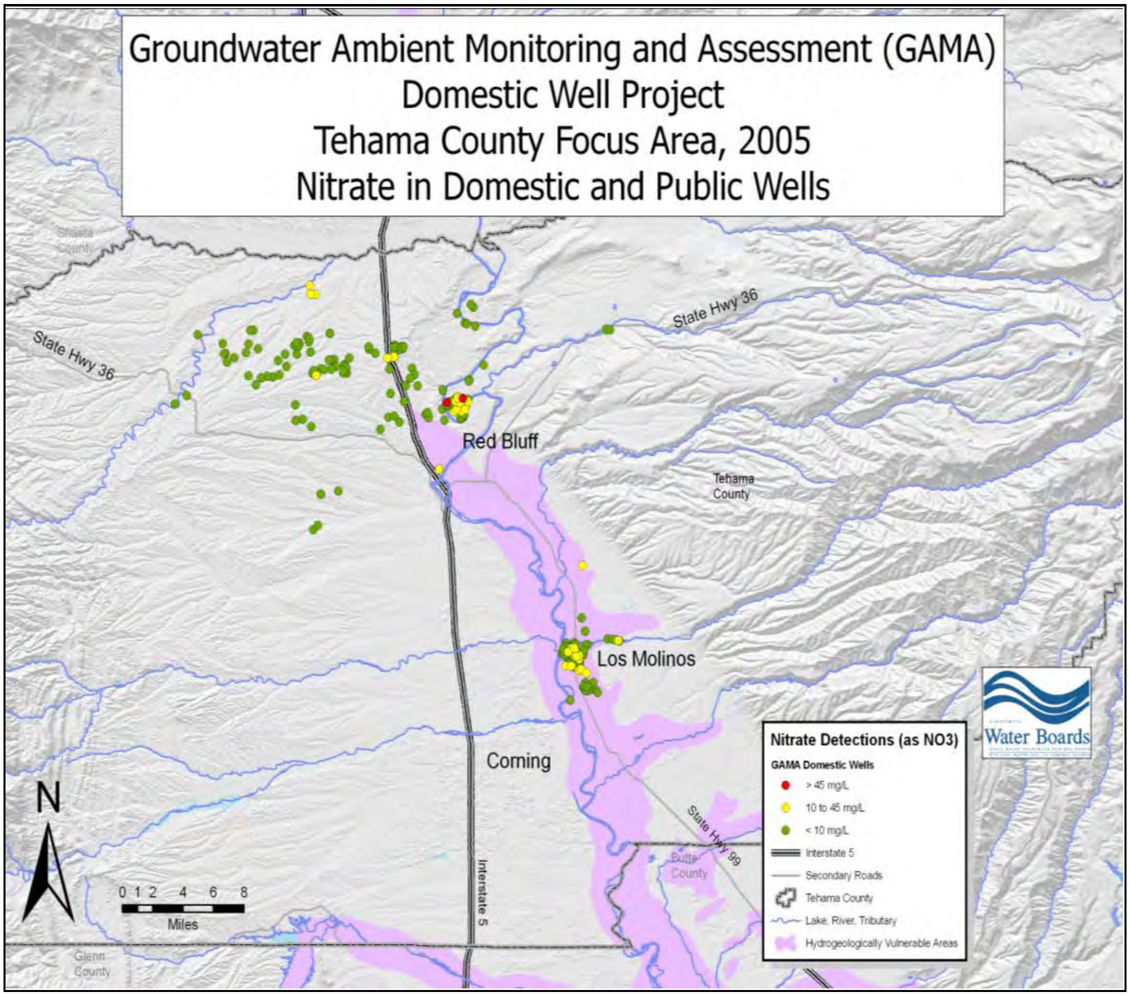


Figure B-15. GAMA Voluntary Domestic Well Project—Tulare County (2006)

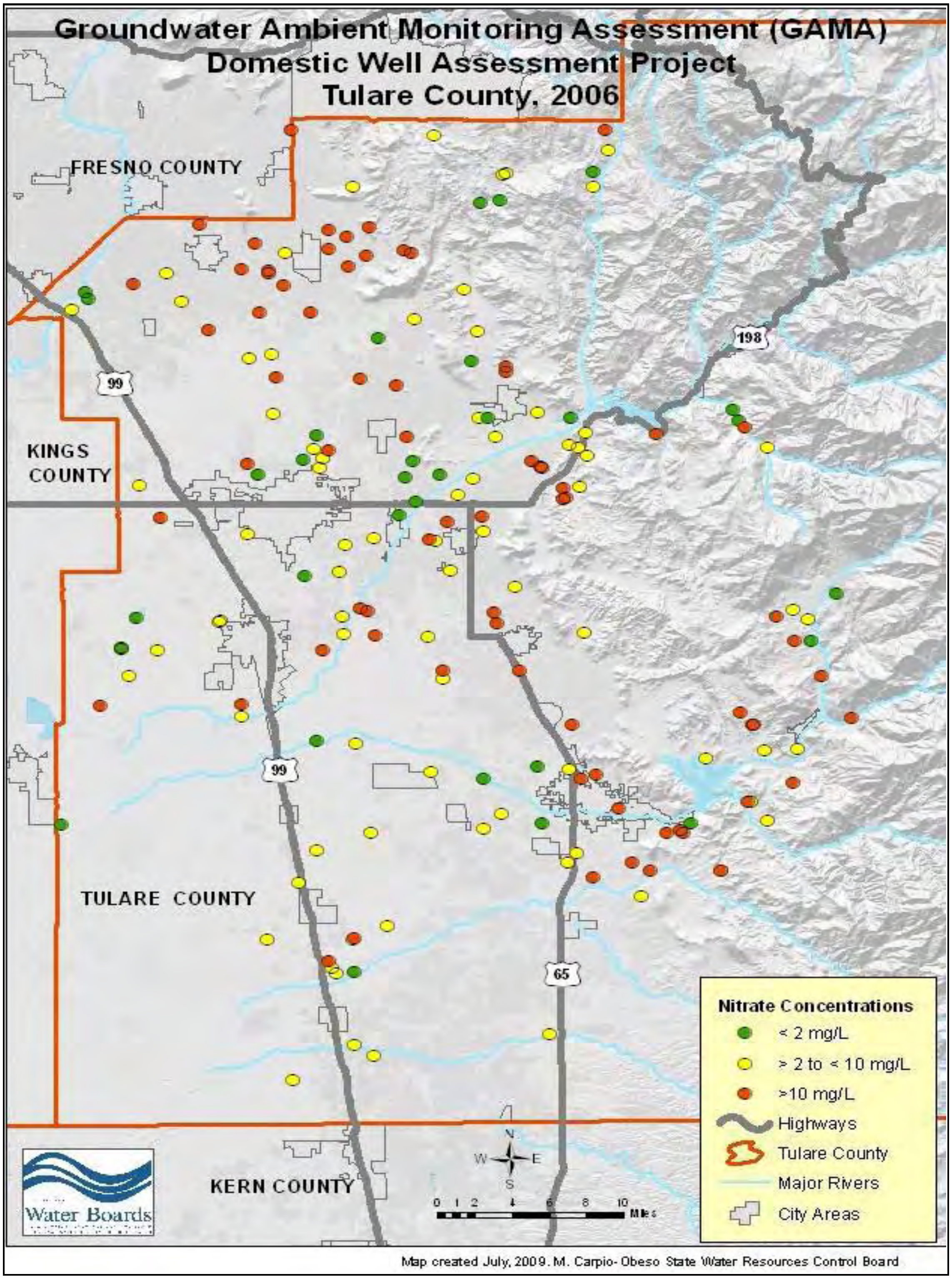


Figure B-16 Concentration of nitrate in groundwater in California from Bartholomay and Others 2007, USGS Scientific Investigations Report 2007-5213

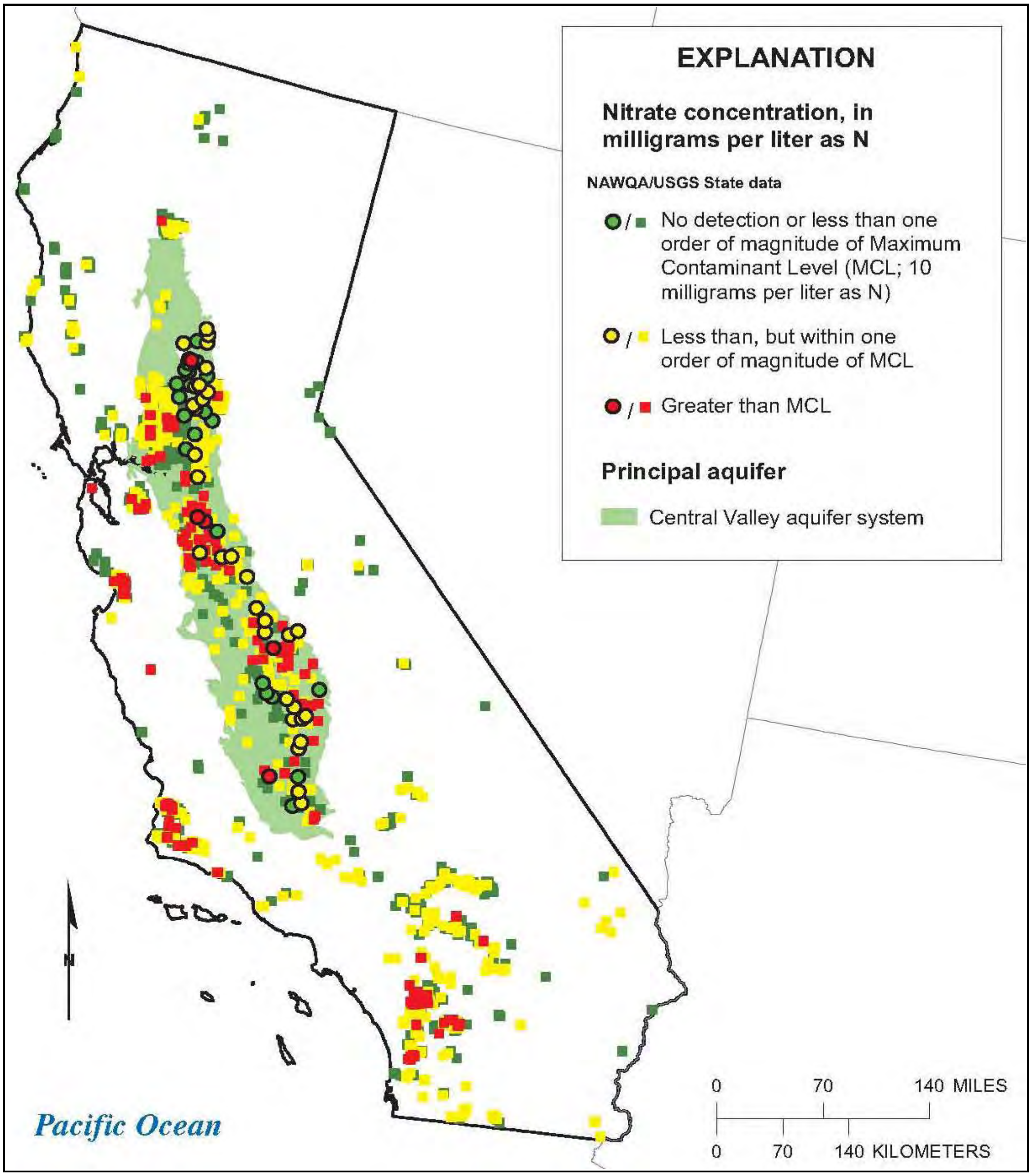
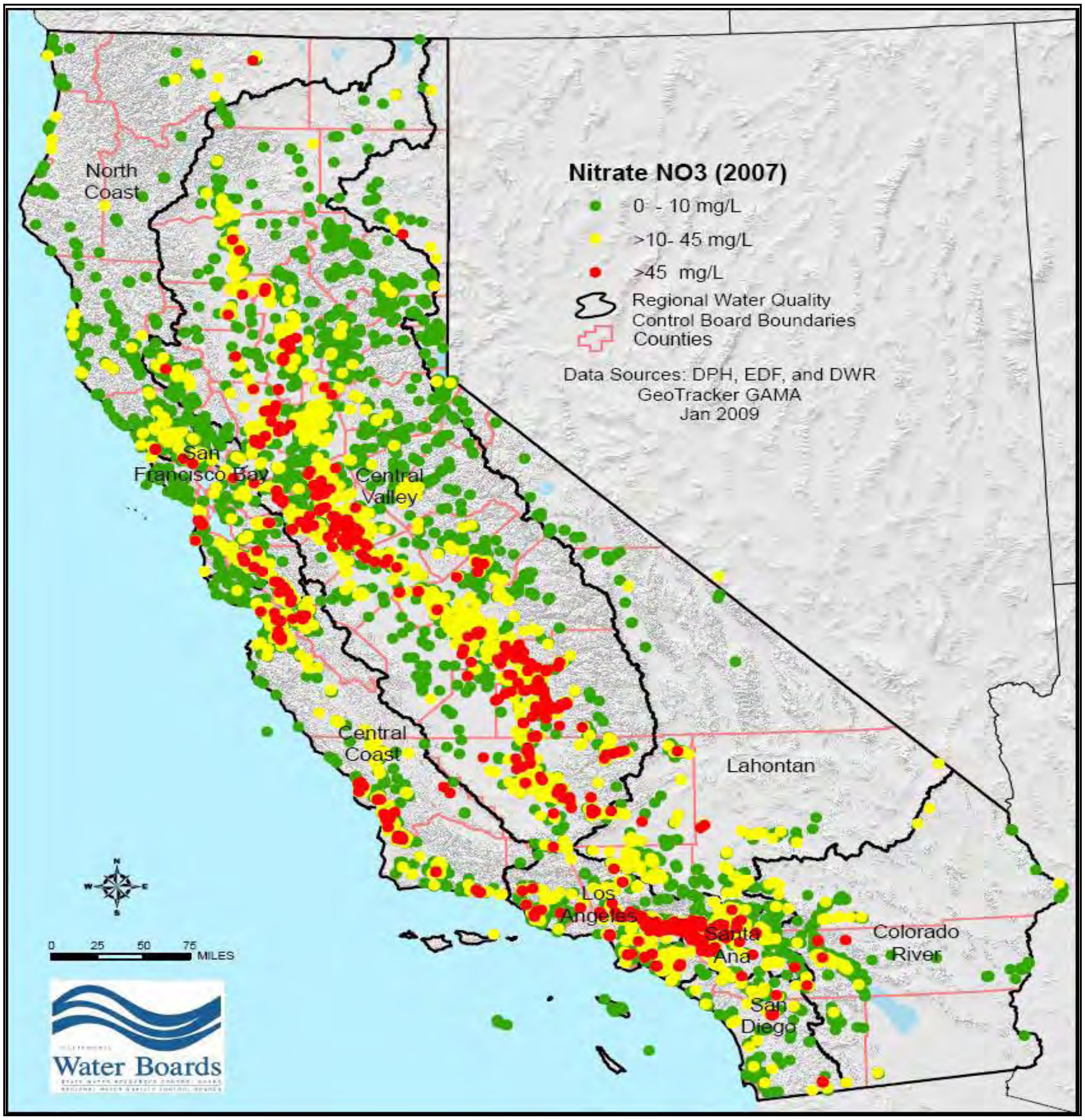


Figure B-17. Nitrate in Groundwater. From: Erik J. Ekdahl, Maria de la Paz Carpio-Obeso, and John Borkovich, California State Water Resources Control Board 2009; in: Harter, T. 2009. Agricultural impacts on groundwater nitrate, Southwest Hydrology, July/August 2009, p.23–25



I. Trends in Nitrate Groundwater Concentrations in Portions of the Central Valley

A variety of investigators have looked at the San Joaquin Valley groundwater nitrate concentrations over time (Burow et al. 1998, 2007, 2008; Rupert 2008; Rosen and Lapham 2008). In 1995, NAWQA (Burow et al. 1998) resampled 30 domestic supply wells in the eastern San Joaquin Valley that previously had been sampled by the USGS between 1986 and 1987 (Figure B-18). The median nitrate concentration for 23 of the 30 wells in 1986–87 was 2.4 mg/l, (seven wells had no nitrate sample data) and in 1995 the median concentration for the full 30 wells was 4.6 mg/l. Nitrate exceeded the MCL value in two wells in 1986–87 and in five wells in 1995.

Figure B-18. Eastern San Joaquin Study Area; from Burow et al. 1998

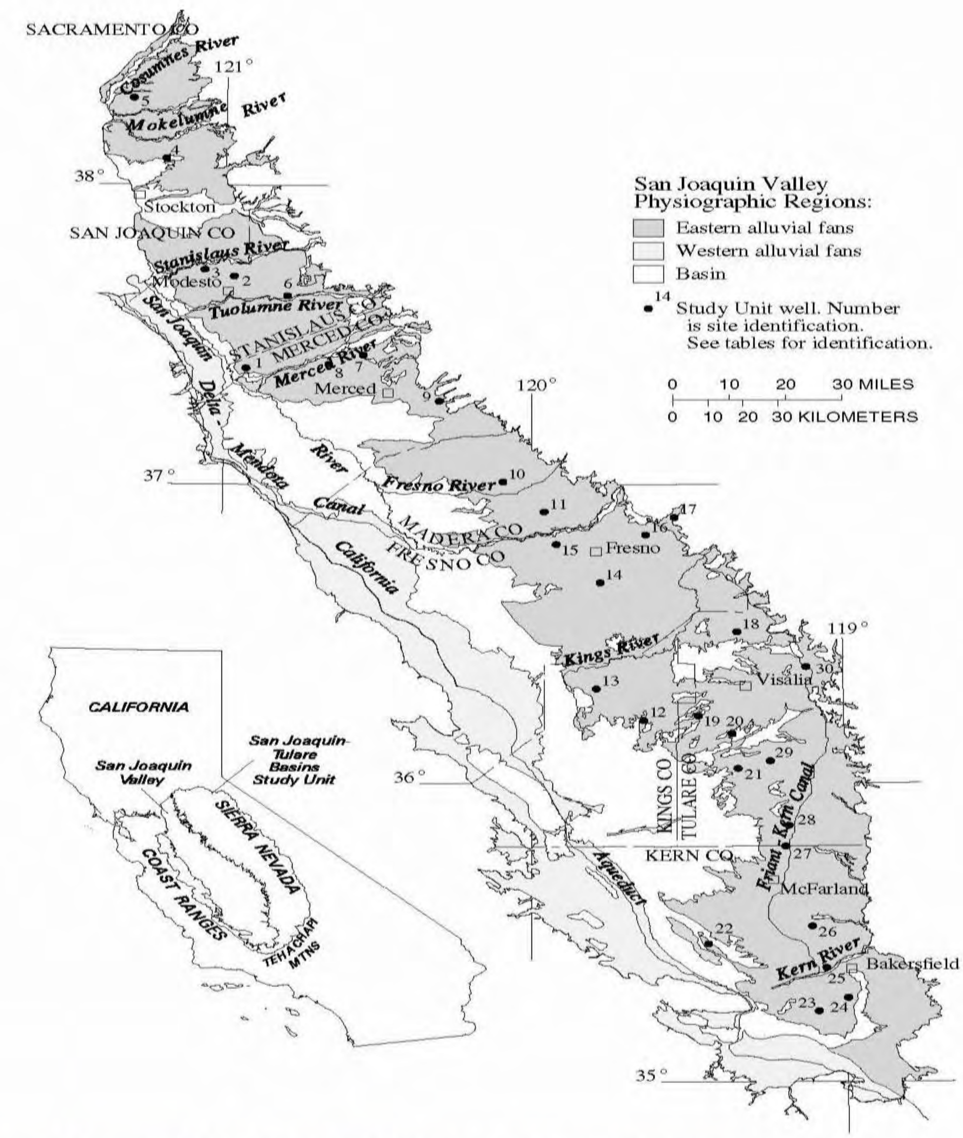


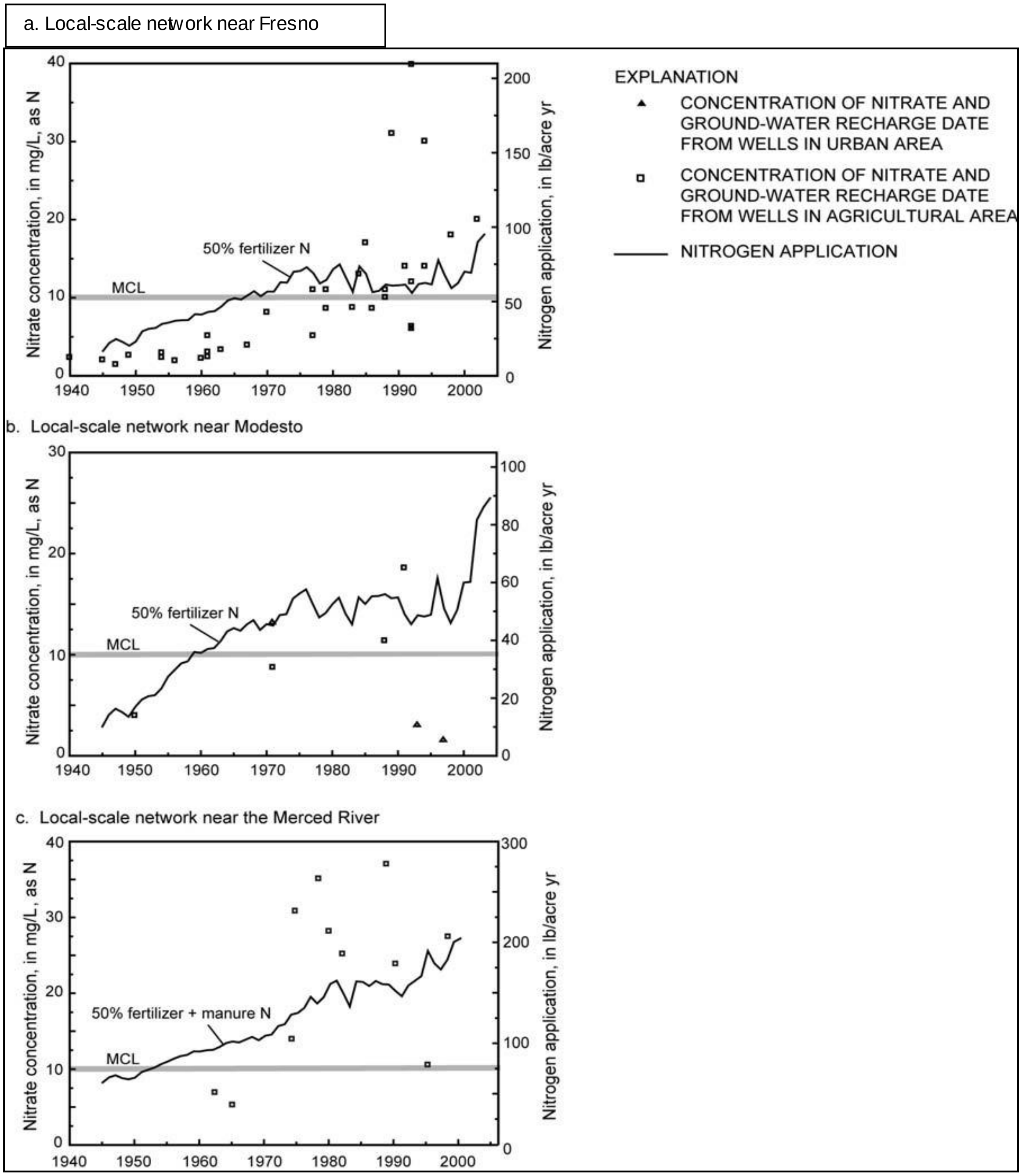
Figure 1. Location of study area and San Joaquin Valley physiographic regions.

Introduction 3

In 2002, 29 of the original 30 domestic wells in the regional aquifer were re-sampled for the third time (Burow et al. 2008). The median nitrate concentration for the re-sampled wells had risen from 2.3 mg/l in 1986–87 to 5.4 mg/l in 2003. Burow and others (2008) concluded that, *The results of the analysis of regional- and local-scale nitrate concentration data indicate that widespread high concentrations of nitrate in the shallow part of the San Joaquin Aquifer system are likely to move to deeper parts of the ground-water flow system.*

The trend of nitrate concentrations in the shallow groundwater portion of the Eastern San Joaquin Study Area also has been investigated by means of focused studies using monitoring wells in three geographical areas: near Fresno, near Modesto, and near the Merced River (Burow and Green 2008).

Figure B-19. Nitrate Concentration vs. Fertilizer Application over Time; from *Burow and Green 2007*



Nitrogen fertilizer data were coupled with the results of groundwater sampling to show that nitrate concentrations increased over time and corresponded to fertilizer application rates in all three focus study areas (Figure B-19).

Burow and Green (2008) reported that,

> *Analysis using county-level nitrogen applications and a wide range of chemical data from sampling vertical monitoring well transects showed that reconstructed nitrate concentrations are consistent with 50% of the applied nitrogen reaching the water table.*

Burow and others (2007) produced a report that expanded upon the data evaluation for the focused study areas of the Eastern San Joaquin Study Area. This study reported that the nitrate concentrations in monitoring wells completed in the shallowest part of the aquifer increased in concentration from 8 to 23 mg/l during the period of time from 1994–1995 to 2003. Nitrate concentrations varied considerably with groundwater depth, ranging from 2mg/l in the deepest monitoring wells to 30 to 40 mg/l in the shallow wells. This change in concentration versus depth is attributable in part to the age of the water. Based on CFC concentrations, groundwater less than 10 meters (m) below the water table is approximately 15 years old. The mean age of groundwater deeper than 60m below the water table is approximately 45 years old (Burow et al. 2007). Burow and others concluded that,

> *Nitrate concentrations were highest and most variable in the shallow monitoring wells in the regional areal monitoring networks; the variability in nitrate concentrations and median values decreased with depth. Because of intensive pumping and irrigation recharge, the dominant groundwater flow paths in the aquifer system are vertically downward. High concentrations in the shallow part of the aquifer could be expected to move downward over time, which would result in increasing concentrations in the deeper domestic and public-supply wells in the future as water with high nitrate concentrations moves deeper in the groundwater system.*

Short-circuiting of the normal stratification (younger water at the top of the water table and progressively older water as you go deeper) also has been observed to occur in certain wells. Multiple completion wells (wells that have more than one screened interval) can allow younger, nitrate-affected water to enter in the upper portions of the well and be pulled down into deeper older levels because of vertical gradients or as a result of pumping. Wells that have insufficient or nonexistent well seals also allow vertical movement of younger water into deeper older water by migration through the filter pack material or native soil (vertical migration outside of the well casing).

J. Conclusions

Nitrate derived from both agricultural and non-agricultural sources has resulted in degradation and/or pollution of groundwater beneath agricultural areas in California's Central Valley (Burow et al. 1998, 2008; Suen 2008; Green, et al. 2008; Harter et al. 2005; Singleton et al. 2007; Esser et al. 2009; McNab et al.

2007). The most significant sources of non-agricultural nitrate detected in groundwater in agricultural areas include leakage from septic tanks, residential and commercial use of fertilizers, leakage from sewage pipes and mains, leakage beneath landfills, and discharges from food processing facilities (Paul et al. 2007; Central Valley Water Board 2008). Major sources of agriculturally derived nitrate consist of fertilization using natural (manure) or synthetic nitrogen sources (chemical fertilizers) and concentrated animal feeding operations (Burow et al. 1998, 2008; Suen 2008; Green et al. 2008; Harter et al. 2001; Singleton et al. 2007; Esser et al. 2009).

Nitrate impacts on groundwater beneath agricultural areas are most effectively determined by means of shallow (installed in first encountered groundwater) monitoring wells constructed with short screen lengths (Burow et al. 1998, 2007; Fuhrer et al. 1999; California GAMA Program 2008). While nitrate impacts may be most effectively detected in shallow wells, intensive pumping and recharge through irrigation can result in a vertically downward groundwater flux. This downward migration of nitrate may result in increasing concentrations in the deeper domestic and public-supply wells over time (Burow et al. 2007).

Determining the specific source(s) of nitrate contained in groundwater may be difficult, however; a variety of chemical and physical methods have been developed for this purpose. Nitrate isotopic composition, age determination of the water, presence or absence of co-contaminants, and major and trace element chemical composition of the groundwater have been used to successfully identify multiple sources of nitrate within a plume of affected groundwater (Kendall 1998; Esser et al. 2009; Buszka et al. 2006; Suen 2008).

While some disagreement exists among the investigators, a common group of physical and chemical factors has been identified as affecting nitrate leaching beneath agricultural lands (California Department of Food and Agriculture 1989; State Water Board 1994; Green et al. 2007; Harter et al. 2005; Fuhrer et al. 1999; Burow and Green 2008; Burow et al. 2008; Domagalski et al. 2008; Dinnes et al. 2002). Physical factors include: nitrogen application rates, water inputs (rainfall, type of irrigation, and frequency of irrigation), leaching rates (soil type and structure), evapotranspiration, and depth to groundwater. Chemical factors include soil mineralogy, pH, bulk density, soil organic matter, and denitrification.

Nitrate vulnerability maps developed for the nation and exclusively for California, depict two parallel bands of high aquifer vulnerability extending along both sides of the Central Valley from the Bakersfield area to just north of Fresno. A third discontinuous band of high aquifer vulnerability extends through the center of the Central Valley from near Merced northward to the area around Colusa. A separate area of high vulnerability is depicted near Redding.

Non-nitrate vulnerability maps prepared by the Sate Water Board (Hydrogeologically Vulnerable Areas) and DPR (Groundwater Protection Areas) are analogous to the nitrate vulnerability maps with the exception of the southwestern portion of the Central Valley (nitrate vulnerability maps have both an eastern and western band of high vulnerability, while the State Water Board and DPR maps depict only the eastern band).

State Water Board and USGS Maps depicting areas in the Central Valley where groundwater quality has been affected by nitrates are in general agreement with the vulnerability maps. Caution must be exercised, however, in using these maps to evaluate the extent of nitrate impacts in the Central Valley. Sampling-induced bias (sampling deeper waters below shallow, nitrate-affected waters or sampling wells with long screen intervals), coupled with the lack of sampling in some regions, may distort or underestimate the actual area of impact.

Studies of trends in nitrate concentrations in groundwater in the Central Valley have focused predominantly on the eastern side of the San Joaquin Valley. Nitrogen fertilizer data were compared with the results of groundwater sampling to show that increases in nitrate concentrations over time corresponded to fertilizer application rates in focused study areas (Burow and Green 2008).

K. Selected References and Bibliography

Anning, D.W., S.A. Thiros, L.M. Bexfield, T.S. McKinney, and J.M. Green. 2009. National Water Quality Assessment program, Southwest Principal Aquifers Regional Ground-Water Quality Assessment: US Geological Survey Fact Sheet 2009–3015, March 2009.

Bartholomay R.C., J.M. Carter, S.L. Qi, P.J. Squillace, and G.L. Rowe. 2007. Summary of Selected U.S. Geological Survey Data on Domestic Well Water Quality for the Centers for Disease Control's National Environmental Public Health Tracking Program: U.S. Geological Survey, Scientific Investigations Report 2007–5213, 57 p. Available: http://pubs.usgs.gov/sir/2007/5213/downloads/sir2007–5213web.pdf

Barton L., L.A. Schipper, G.F. Barkle, M. McLeod, T.W. Speir, M.D. Taylor, A.C. McGill, A.P. van Schaik, N.B. Fitzgerald, and S.P. Pandey. 2005. Land Application of Domestic Effluent onto Four Soil Types: *Journal of Environmental Quality*, Vol. 34:p. 635–643.

Bennett, G.L., K. Belitz, and B.J. Milby Dawson. 2006. California GAMA Program—Ground-water quality data in the northern San Joaquin basin study unit, 2005: U.S. Geological Survey Data Series 196, 122 p. Available: http://pubs.usgs.gov/ds/2006/196/ds_196.pdf

Bowman, D.C., C.T. Cherney, and T.W. Rufty, Jr. 2002. Fate and Transport of Nitrogen Applied to Six Warm-Season Turfgrasses: *Crop Science Society of America*, Vol. 42, p. 833–841.

Brand, M.R., R.J. McAvoy, and E.G. Corbett. 1993. Nitrate loading to the soil profile underlying two containerized nursery crops supplied controlled release fertilizer: *Journal of Environmental Horticulture* Vol. 11, p. 82–85.

Burow, K.R., J.L. Shelton, and N.M. Dubrovsky. 1998. Occurrence of nitrate and pesticides in groundwater beneath three agricultural land-use settings in the eastern San Joaquin Valley, California: USGS Water-Resources Investigations Rep. 97-4284. USGS, Sacramento, CA

Burow, K.R., S.V. Stork, and N.M. Dubrovsky. 1998. Nitrate and Pesticides in Ground Water in the Eastern San Joaquin Valley, California: Occurrence and Trends: USGS Water-Resources Investigations Rep. 98-4040A.

Burow, K.R., N.M. Dubrovsky, and J.L. Shelton. 2007. Temporal trends in concentrations of DBCP and nitrate in groundwater in the eastern San Joaquin Valley, California, USA: *Hydrogeology Journal* (2007) 15: 991–1007.

Burow, K.R., and C.T. Green. 2008. Spatial and Temporal Trends in Nitrate Concentrations in the Eastern San Joaquin Valley Regional Aquifer and Implications for Nitrogen Fertilizer Management, California Plant and Soil Conference: Conservation of Agricultural Resources, February 5 & 6, 2008, Visalia, California, 47–52 p.

Burow, K.R., J.L. Shelton, N.M. Dubrovsky. 2008. Regional Nitrate and Pesticide Trends in Ground Water in the Eastern San Joaquin Valley, California: *Journal of Environmental Quality*, Vol. 37: 249–263 p.

Burton, C.A., and K. Belitz. 2008. Ground-water quality data in the southeast San Joaquin Valley, 2005– 2006—Results from the California GAMA Program: U.S. Geological Survey Data Series 351, 103 p. Available: http://pubs.usgs.gov/ds/351/

Buszka, P.M., L.R. Watson, and T.K. Greeman. 2006. Hydrogeology, Ground-Water-Age Dating, Water Quality, and Vulnerability of Ground Water to Contamination in a Part of the Whitewater Valley Aquifer System near Richmond, Indiana, 2002–2003: U.S. Geological Survey Scientific Investigations Report 2006–5281, 120 p. Available: http://pubs.usgs.gov/sir/2006/5281/pdf/sir2006–5281.pdf

California Department of Food and Agriculture. 1989. Nitrate and Agriculture in California: Nitrate Working Group, February 1989.

California Department of Food and Agriculture, About Fertilizers, Criteria for Nitrate-Sensitive Areas, Map 2.

California Regional Water Quality Control Board, Central Valley Region. 2008. Staff Report, Regulation of Food Processing Waste Discharges to Land.

California Regional Water Quality Control Board, Central Valley Region, and Jones and Stokes. 2008. Irrigated Lands Regulatory Program Existing Conditions Report. Available: <http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/long_term_program_development/rev_existing_conditions_report/>.

California State Water Resources Control Board, Division of Clean Water Programs, Groundwater Special Studies Unit, Groundwater Information Sheet—Nitrate/Nitrite Revised: October 23, 2002.

California State Water Resources Control Board, Division of Water Quality, GAMA Program, Groundwater Information Sheet—Nitrate / Nitrite Revised: February 2008.

Colangelo, D.J., and M.H. Brand. 2001. Nitrate Leaching beneath a Containerized Nursery Crop Receiving Trickle or Overhead Irrigation: Journal of Environmental Quality, Vol. 30, p. 1564–1574.

Daughton, C.G. 2007. Pharmaceuticals in the Environment: Sources and Their Management, Chapter 1, 1–58, *In* Analysis, Fate and Removal of Pharmaceuticals in the Water Cycle (M. Petrovic and D. Barcelo, Eds.), *Wilson & Wilson's Comprehensive Analytical Chemistry* series (D. Barcelo, Ed.), Volume 50, Elsevier Science, 564p.

Dawson, B.J. 2001. Ground-Water Quality in the Southeastern Sacramento Valley Aquifer, California, 1996: U.S. Geological Survey, Water-Resources Investigations Report 01-4125, p.30.

Dawson, B.J. 2001a, 2001. Shallow ground-water quality beneath rice areas in the Sacramento Valley, California, 1997: U.S. Geological Survey Water-Resources Investigations Report 2001-4000, 33p.

Dawson, B.J., G.L.Bennett, and K. Belitz. 2008. Ground-Water Quality Data in the Southern Sacramento Valley, California, 2005—Results from the California GAMA Program: U.S. Geological Survey Data Series 285, 93 p. http://pubs.usgs.gov/ds/285/ds285.pdf

Dinnes, D.L., D.L. Karlen, D.B. Jaynes, T.C. Kaspar, J.L. Hatfield, T.S. Colvin, and C.A. Cambardella. 2002. Nitrogen Management Strategies to Reduce Nitrate Leaching in Tile-Drained Midwestern Soils: *Agronomy Journal*, Vol. 94, p. 153–171.

Dubrovsky, N.M., C.R. Kratzer, L.R. Brown, J.M. Gronberg, and K.R. Burow. 1998. Water quality in the San Joaquin–Tulare Basins, California, 1992–95: USGS Circ. 1159.

Dubrovsky, N.M., S. Ator, R. Coupe, K. McCarthy, D. Lampe, M. Sandstrom, and N. Baker. 2008. Comparative Study of Transport Processes of Nitrogen, Phosphorus, and Herbicides to Streams in Five Agricultural Basins, USA: Journal of Environmental Quality, Vol. 37, p. 1158–1169.

Eimers, J.L., and T.B. Spruill. 1997. Relating Minimum Soil Infiltration Rate to Nitrate-Nitrogen Concentrations in Shallow Ground Water in the Coastal Plain of Albemarle-Pamlico Drainage Basin, North Carolina and Virginia: Albemarle-Pamlico Estuarine Study Comprehensive Conservation and Management Plan Implementation Forum, June 5–6.

Engelsjord, M.E., B.E. Branham, and B.P. Horgan. 2004. The Fate of Nitrogen-15 Ammonium Sulfate Applied to Kentucky Bluegrass and Perennial Ryegrass Turfs: Crop Science Society of America, Vol. 44, p. 1341–1347.

Esser, B.K., H.R. Beller, S.F. Carle, G.B. Hudson, S.R. Kane, R.N. Leif, T.E. LeTain, W.M. McNab, and J.E. Moran. 2009. California GAMA Program: Impact of Dairy Operations on Groundwater Quality: Lawrence Livermore National Laboratory under Contract W-7405-ENG-48, August 17, 2009.

Fisher, L.H., and R.W. Healy. 2008. Water movement within the unsaturated zone in four agricultural areas across the United States: *Journal of Environmental Quality*, Vol. 37, p. 1051–1063.

Frank, K.W., K.M. O'Reilly, J.R. Crum, and R.N. Calhoun. 2005. The Fate of Nitrogen Applied to a Mature Kentucky Bluegrass Turf: Crop Science Society of America, Vol. 46, p. 209–215.

Fuhrer, G.J., Gilliom, R.J., Hamilton, P.A., Morace, J.L., Nowell, L.H., Rinella, J.F., Stoner, J.D., Wentz, D.A., 1999. The Quality of our Nation's Waters: Nutrients and Pesticides: U.S. Geological Survey Circular; 1225.

Gold, A.J., W.R. DeRagon, W.M. Sullivan, and J.L. Lemunyon. 1990. Nitrate-nitrogen Losses to Groundwater from Rural and Suburban Land Uses: *Journal of Soil and Water Conservation*, March–April1990, Vol. 45, Number 2.

Green, C.T., L.H. Fisher, and B.A. Bekins. 2008. Nitrogen Fluxes through Unsaturated Zones in Five Agricultural Settings across the United States: *Journal of Environmental Quality*, May–June 2008, Vol. 37, pp. 1073–1085.

Haller, L, P. McCathy, T. O'Brien, J. Riehle, and T. Stuhldreher. 1996. Nitrate Pollution of Groundwater. http://www.reopure.com/nitratinfo.html

Harter, T., H. Davis, M.C. Mathews, and R.D. Meyer. 2001. Monitoring Shallow Groundwater Nitrogen Loading from Dairy Facilities with Irrigated Forage Crops: American Society of Agricultural Engineers Meeting Presentation, ASAE Paper Number 01-2103*, 2001 ASAE Annual International Meeting, Sacramento, CA, July 30–August 1, 2001*.

Harter, T., Y.S. Onsoy, K. Heeren, M. Denton, G. Weissmann, J.W. Hopmans, and W.R. Horwath. 2005. Deep vadose zone hydrology demonstrates fate of nitrate in eastern San Joaquin Valley: California Agriculture, Vol. 59, No.2, p.124–132.

Harter, T. 2009. Agricultural Impacts on Groundwater Nitrate: Southwest Hydrology, July/August 2009, p. 22–23 and 35.

Helperin, A.N., D.S. Beckman, and D. Inwood. 2001. California's Contaminated Groundwater—Is the State Minding the Store? : National Resources Defense Council, April 2001.

Jagucki, M.L., B.C. Jurgens, K.R. Burow, and S.M. Ebets. 2009. Assessing the Vulnerability of Public-Supply Wells to Contamination: Central Valley Aquifer System near Modesto, California: U.S. Geological Survey Fact Sheet 2009-3036, April 2009.

Kaown, D., Y. Hyun, G. Bae, and K. Lee. 2007. Factors Affecting the Spatial Pattern of Nitrate Contamination in Shallow Groundwater: *Journal of Environmental Quality*, Vol. 36 p. 1479–1487.

Kendall, C. and J.J. McDonnell. 1998. Tracing nitrogen sources and cycling in catchments: *In Isotope Tracers in Catchment Hydrology*, Amsterdam, Elsevier, pp. 519–576.

Kubin, E. 1998. Leaching of nitrate nitrogen into the groundwater after clear felling and site preparation: Boreal Environmental Research, Vol. 3, p. 3–8, July 1998.

Law, N.L., L.E. Band, and J.M. Grove. 2004. Nutrient Input from Residential Lawn Care Practices: *Journal Environmental Planning and Management*, Vol. 47: p.737–755.

Landon, M.K., and K. Belitz. 2008. Ground-water quality data in the Central Eastside San Joaquin Basin 2006: Results from the California GAMA Program: U.S. Geological Survey Data Series 325, 88 p.

Landon, M.K., and M.S. Fram. 2009. Occurrence and Distribution of Nitrate in Groundwater in the Central Valley: presentation Irrigated Lands Regulatory Program Workshop, April 15, 2009.

Longe, E.O., and L.O. Enekwechi. 2007. Investigation on potential groundwater impacts and influence of local hydrogeology on natural attenuation of leachate at a municipal landfill: *International Journal of Science and Technology*, Vol. 4 (1), p. 133–140.

Loper, C.A., K.J. Breen, T.M .Zimmerman, and J.W. Clune. 2009. Pesticides in ground water in selected agricultural land-use areas and hydrogeologic settings in Pennsylvania, 2003–07: U.S. Geological Survey Scientific Investigations Report 2009–5139, 121 p. http://pubs.usgs.gov/sir/2009/5139/sir2009-5139.pdf

McNab, W.W., M.J. Singleton, J.E. Moran, and B.E. Esser. 2007. Assessing the Impact of Animal Waste Lagoon Seepage on the Geochemistry of an Underlying Shallow Aquifer: Environmental Science & Technology, Vol. 41, p. 753–758.

Meixner, T., M.E. Fenn, and P.M. Wohlgemuth. 2003. Fire Disturbance and Nitrogen Deposition Impacts at the Watershed Scale in Southern California: U. S. Department of Agriculture, Agriculture Research Service, First Interagency Conference on Research in the Watersheds, Oct. 27–30, 2003.

Mills, G.A., B. Vrana, I. Allan, D.A. lvarez, J.N. Huckins, and R. Greenwood. 2007. Trends in monitoring pharmaceuticals and personal-care products in the aquatic environment by use of passive sampling devices: Anal Bioanal Chem, Vol. 387 p.1153–1157.

Minnesota Department of Agriculture. 2006. A Co-occurrence of Nitrate and Pesticides.

Moran, J.E., B.K. Esser, G.B. Hudson, and M.J. Singleton. 2005. The Effects of Agricultural Nitrate Sources on Groundwater Supplies in California: Geological Society of America *Abstracts with Programs*, Vol. 37, No. 7, p. 247, October 2005.

Moran J.E., M.J. Singleton, S.F. Carle, and B.K. Esser. 2007. Intrinsic and Extrinsic Chemical and Isotopic Tracers for Characterization of Groundwater Systems: Illinois State Geological Survey: 3D workshop. http://www.isgs.illinois.edu/research/3DWorkshop/2007/pdf-files/moran.pdf.

Munoz-Arboleda, F., R. Mylavarapu, C. Hutchinson, and K. Portier. 2008. Nitrate-Nitrogen Concentrations in the Perched Ground Water under Seepage-Irrigated Potato Cropping Systems: *Journal of Environmental Quality*, Vol. 37 p. 387–394.

Nolan, B.T., and B.C. Ruddy. 1996. Nitrate in Ground Water of the United States—Assessing the Risk: U.S. Geological Survey Fact Sheet FS-092-96.

Nolan, B.T., B.C. Ruddy, K.J. Hitt, and D.R. Helsel. 1997. Risk of nitrate in groundwaters of the United States—a national perspective: Environmental Science and Technology, v. 31, n. 8, p. 2229–2236.

Nolan B.T., B.C. Ruddy, K.J. Hitt, and D.R. Helsel. 1998. A national look at nitrate contamination of ground water: Water Conditioning and Purification Magazine, vol. 39, number 12, p. 76–79.

Nolan, B.T., K.J. Hitt, and B.C. Ruddy. 2002. Probability of Nitrate Contamination of Recently Recharged Groundwaters in the Coterminous United States: Environmental Science & Technology, Vol. 36, No. 10, p. 2138–2145.

Nolan, B.T., and K.J. Hitt. 2006. Vulnerability of Shallow Groundwater and Drinking-Water Wells to Nitrate in the United States: Environmental Science & Technology, Vol. 40, No. 24, p. 7834–7840.

Onsoy, Y.S., T. Harter, T.R. Ginn, and W.R. Horwath. 2005. Spatial Variability and Transport of Nitrate in a Deep Alluvial Vadose Zone: *Vadose Zone Journal* Vol. 4, p. 41–54.

Pang, L., C. Nokes, J. Sumunek, H. Kikkert, and R. Hector. 2006. Modeling the Impact of Clustered Septic Tank Systems on Groundwater Quality: *Vadose Zone Journal*, Vol. 5, P. 599–609.

Panno, S.V., K.C. Hackley, W.R. Kelly, and H. Hwang. 2006. Isotopic Evidence of Nitrate Sources and Denitrification in the Mississippi River, Illinois: *Journal of Environmental Quality*, Vol. 35 p. 495–504.

Paul, A.P., R.L. Seiler, T.G. Rowe, and M.R. Rosen. 2007. Effects of agriculture and urbanization on quality of shallow ground water in the arid to semiarid western

Peralta, J.M., and C.O. Stockle. 2002. Dynamics of nitrate leaching under irrigated potato rotation in Washington State: a long-term simulation study: Agriculture, Ecosystems & Environment, Vol. 88, Issue 1, p. 23–34.

Power, J.F., R. Wiese, and D. Flowerday. 2001. Managing Farming Systems for Nitrate Control: A research Review from Management Systems Evaluation Areas: *Journal of Environmental Quality*, Vol. 30 p. 1866–1880.

Puckett, L.J., and W.B. Hughes. 2005. Transport and Fate of Nitrate and Pesticides: Hydrogeology and Riparian Zone Processes: *Journal of Environmental Quality*, Vol. 34 p. 2278–2292.

Puckett, L.J., C. Zamora, H. Essaid, J.T. Wilson, H.M. Johnson, M.J. Brayton, and J.R. Vogel. 2008. Transport and Fate of Nitrate at the Ground-Water / Surface-Water Interface: *Journal of Environmental Quality*, Vol. 37 p. 1034–1050.

Raciti, S.M., P.M. Groffman, and T.J. Fahey. 2008. Nitrogen Retention in Urban Lawns and Forests. *Ecological Applications*: Vol. 18, No. 7, pp. 1615–1626.

Ristvey, A.G., J.D. Lea-Cox, and D.S. Ross. 2004. Nutrient Uptake, Partitioning and Leaching Losses from Container-Nursery Production Systems: *Acta Horticulturae*, Vol. 630, p. 321–328.

Rosen, M.R., and W.W. Lapham. 2008. Introduction to the U.S. Geological Survey National Water-Quality Assessment (NAWQA) of Ground-Water Quality Trends and Comparison to Other National Programs: *Journal of Environmental Quality*, Vol. 37 p. S190-S198.

Rupert, M.G. 2008. Decadal-Scale Changes of Nitrate in Ground Water of the United States, 1988–2004: *Journal of Environmental Quality*, Vol. 37 p. 240–248.

Scanlon, B.R., R.C. Reedy, D.A. Stonestrom, D.E. Prudic, and K.F. Dennehy. 2005. Impact of land use and land cover change on groundwater recharge and quality in the southwestern US: *Global Change Biology* (2005) Vol. 11, p.1577–1593.

Seiler, R.L., S.D. Zaugg, J.M. Thomas, and D.L. Howcroft. 1999. Caffeine and Pharmaceuticles as Indicators of Waste Water Contamination in Wells: *Ground Water*, May–June 1999, Vol. 37, No.3, p. 405–510.

Shelton, J.L., I. Pimentel, M.S. Fram, and K. Belitz. 2008. Ground-water quality data in the Kern County subbasin study unit, 2006—Results from the California GAMA Program: U.S. Geological Survey Data Series 337, 75 p. http://pubs.usgs.gov/ds/337/pdf/ds337.pdf

Singleton, M.J., B.K. Esser, J.E. Moran, G.B. Hudson, W.W. McNab, and T. Harter. 2007. Saturated Zone Denitrification: Potential for Natural Attenuation of Nitrate Contamination in Shallow Groundwater Under Dairy Operations: *Environmental Science & Technology*, Vol. 41, p. 759–765.

Spalding, R.F., D.G. Watts, J.S. Schepers, M.E. Burbach, M.E. Exner, R.J. Poreda, and G.E. Martin. 2001. Controlling Nitrate Leaching in Irrigated Agriculture: *Journal of Environmental Quality*, Vol. 30 p. 1184–1194.

Standley, L.J., R.A. Rudel, C.H. Swartz, K.R. Attfield, J. Christian, M. Erickson, and J.G. Brody. 2008. Wastewater-Contaminated Groundwater as a Source of Endogenous Hormones and Pharmaceuticals to Surface Water Ecosystems: *Environmental Toxicology and Chemistry*, Vol. 27, Issue 12, p. 2457–2468.

Stewart, I.T., and K. Loague. 2004. Assessing Ground Water Vulnerability with the Type Transfer Function Model in the San Joaquin Valley, California: *Journal of Environmental Quality*, Vol. 33 p. 1487–1498.

Suen, C.J. 2008. Using Isotopic Ratios and Major Minerals Data to Identify the Sources of Ground Water and Ground Water Nitrate in Relation to Pesticide Residues: California Department of Pesticide Regulation, Environmental Monitoring Branch, June 24, 2008.

Tesoriero, A.J., D.A. Saad, K.R. Burow, E.A. Frick, L.J. Puckett, and J.E. Barbash. 2007. Linking ground-water age and chemistry data along flow paths: Implications for trends and transformations of nitrate and pesticides: *Journal of Contaminant Hydrology*, 94 (2007), p. 139–155.

Thiros, S.A., 1999, Quality of shallow ground water in areas of recent residential and commercial development in Salt Lake Valley, Utah, 1999: U.S. Geological Survey Fact Sheet 106-00.

Tomer, M.D., and M.R. Burkart. 2003. Long-Term Effects of Nitrogen Fertilizer Use on Ground Water in Two Small Watersheds: *Journal of Environmental Quality*, Vol. 32 p. 2158–2171.

Townsend, M.A., and D.P. Young. 1995. Factors Affecting Nitrate Concentrations in Ground Water in Stafford County, Kansas: Kansas Geological Survey, Current Research in Earth Sciences, Bulletin 238, part 1.

USEPA. 1998. Office of Water Standards and Applied Sciences Division Environmental *Impacts of Animal Feeding Operations, December 31, 1998.*

USEPA. 2002. Onsite Wastewater Treatment Systems Manual, Chapter 3, page 3–11, EPA/625/R-00/008. February. Available: http://www.epa.gov/nrmrl/pubs/625r00008/html/600R00008chap1.htm

USEPA. 2002. Chapter1: Background and Use of Onsite Wastewater Treatment Systems, EPA600/R-00/008.

USGS. The Reston Chlorofluorocarbon Laboratory, $^{3}H/^{3}He$ Dating Background: Online at http://water.usgs.gov/lab/.

Van der Schans, M.L., T. Harter, A. Leijnse, M.C. Mathews, and R.D. Meyer. 2009. Characterizing sources of nitrate leaching from an irrigated dairy farm in Merced County, California: *Journal of Contaminant Hydrology*, Vol. 110, Issue 1–2, 3 November 2009, p. 9–21.

Wakida, F.T., and D.N. Lerner. 2005. Non-agricultural Sources of Groundwater Nitrate: A Review and Case Study: *Water Research*, Vol. 39, Issue 1, January 2005, pages 3–16.

Wakida, F.T. 2008. Sources of Nitrate in Urban Groundwater: *Science Topics*, 22 August 2008.

Wallace, J., and M Lowe. 1998. The Potential Impact of Septic Tank Soil-Absorption Systems on Water Quality in the Principal Valley-Fill Aquifer, Ogden Valley, Weber County, Utah—Assessment and Guidelines: Utah Geological Survey, Report Investigation 237, May 1998.

Watanabe, N., T.H. Harter, and B.A. Bergamaschi. 2008. Environmental Occurrence and Shallow Ground Water Detection of the Antibiotic Monensin from Dairy Farms: *Journal of Environmental Quality*, Vol. 37 p. S-78-S-85.

Widory, D., E. Petelet-Giraud, P. Negrel, and B. Ladouche. 2005. Tracking the Sources of Nitrate in Groundwater Using Coupled Nitrogen and Boron Isotopes: A Synthesis: *Environmental Science and Technology*, Vol. 39, p. 539–548.

Wiederholt, R., and B. Johnson. 2005. Nitrogen Behavior in the Environment: North Dakota State University, NM-1299, November.

Wilkison, D.H. 1998. USGS research at Management Systems Evaluation Areas, 1991–95: USGS Fact Sheet 042-98, 4 p.

Williams, A.G., J.F. Dowd, D. Scholefield, N.M. Holden, and L.K. Deeks. 2003. Preferential Flow Variability in a Well-Structured Soil: *Soil Science Society of America Journal*, Vol. 67, p.1272–1281.

Xu, Y., L.A. Baker, and P.L. Johnson. 2007. Trends in Ground Water Nitrate Contamination in the Phoenix, Arizona Region: *National Ground Water Association, Ground Water Monitoring & Remediation*, Vol 27, No.2, Spring 2007, p. 49–56.

Zhao, C., C. Hu, W. Huang, X. Sun, Q. Tan, and H. Di. 2009. A Lysimeter study of Nitrate Leaching and Optimum Nitrogen Application rates for Intensively Irrigated Vegetable Production System in Central China: *Journal of Soils and Sediments*, Online First, Article 43, 28 March 2009.

APPENDIX C

SMALL COMMUNITY WATER SYSTEM NITRATE EXCEEDANCES—BALAZS'S (2008) REVIEW OF DEPARTMENT OF PUBLIC HEALTH DATA FOR 2005–2008 QUARTERLY SAMPLING AND DEPARTMENT OF PUBLIC HEALTH 2009 THIRD QUARTER NITRATE EXCEEDANCES

APPENDIX C

Small Community Water System Nitrate Exceedances—Balazs's (2008) Review of DPH Data for 2005–2008 Raw Quarterly Sampling Results and DPH 2009 Third Quarter Nitrate Exceedances

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Century Mobile Home Park	Stockton	50	16	No Completed Source Water Assessments	NA	
Cherry Lane Trailer Park	Stockton	100	43	No Completed Source Water Assessments	NA	
Country Western Mobile Home Park	Modesto	120	60	No Completed Source Water Assessments	NA	
El nido Mobile Home Park	El Nido	250	49	No Completed Source Water Assessments	NA	
Fawcett Farms	Los Banos	50	18	No Completed Source Water Assessments	NA	
Md#43 Miami Creek Knolls	Oakhurst	100	37	No Completed Source Water Assessments	NA	Yes (84), $3,000,000 Consolidation

[72] List indicating total number of potential quarterly nitrate exceedances. List generated by Carolina Balazs for CWF & Community Water Center as consultant (Balazs', 2008). System name, connection, and population from DPH databases. Variable on whether the system had any nitrate exceedances from 2005-08 is based on calculations from Balazs' 2008 dissertation work. Time period is 2005–2008. Systems may be in valley floor, foothills or sierras. If a system is not listed here it may be because there were no exceedances, or because there was no sampling data, or because of some combination of these factors. These numbers may or may not match DPH's Annual Review numbers, as Balazs's 2008 method of determining whether there was an exceedance is based on using raw samples to back-calculate violations may differ from DPH's tracking methods. Systems with "no data" violations are not listed in this list, as this document reflects systems that had nitrate exceedances.

[73] DPH's Drinking Water Source Assessment program possible contaminating activity (PCA)

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Md#85 Valeta Mutual Water Company	Madera	45	19	No Completed Source Water Assessments	NA	Yes (84), $1,000,000 Nitrate removal & System replacement
Turlock Industrial Park Ltd	Turlock	60	NA	No Completed Source Water Assessments	NA	
American Avenue Landfill	Kerman	29	NA	No Completed Source Water Assessments	NA	
Truckers Mini Mart	Porterville	25	NA	No Completed Source Water Assessments	NA	
Turlock Industrial Park Ltd	Turlock	60	NA	No Completed Source Water Assessments	NA	
Brock Mutual Water Company	Bakersfield	500	156	Septic systems—high density [>1/acre]	No	
Buehner Houses	Patterson	25	13	Septic systems—low density [<1/acre]	No	
Buehner Water System—Weber Complex	Patterson	100	35	Automobile—Gas stations Chemical/petroleum processing/storage Injection wells/dry wells/sumps Underground storage tanks—Confirmed leaking tanks	No	
Canyon Meadows Mutual Water	Bodfish	325	144	Septic systems—high density [>1/acre] Housing—high density [>1 house/0.5 acres]	No	
City of Modesto, De East Turlock	Modesto	500	38	Photo processing/printing sewer collection systems	No	

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Del Oro River Island #2	Visalia	87	29	Known contaminant plumes	No	Yes (84) $200,000 (2 Projects) and $350,000 Correct Nitrate MCL Violation
Ducor CSD	Ducor	850	125	Chemical/petroleum processing/storage Historic gas stations Known Contaminant Plumes Septic systems—high density [>1/acre] Underground storage tanks—Confirmed leaking tanks	No	
El monte Village M.H.P.	Clovis	100	49	Septic systems—high density [>1/acre]	No	
Gooselake Water Company	Rosedale	102	31	Septic systems—low density [<1/acre]	No	
Green Run Mobile Estates	Turlock	100	46	Septic systems—low density [<1/acre] Underground storage tanks—Confirmed leaking tanks	No	
Hillview Water Co-Raymond	Weldon	243	82	Septic systems—low density [<1/acre]	No	Yes (84) $2,000,000 Compliance for Nitrate and Arsenic
Kern Valley Mutual Water	Lake Isabella	100	35	Automobile—Repair shops Septic systems—low density [<1/acre]	No	Yes (84), $400,000 Consolidation with Erskine Creek Water Co. to correct arsenic and uranium problem

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Lsid—Tonyville	Tonyville	400	50	Septic systems—high density [>1/acre] Wastewater treatment plants and disposal facilities	No	Yes (84) $1,038,000 Interconnection (50) $1,038,000 Interconnection
Modesto Mobile Home Park, LLC	Modesto	200	150	Injection wells/dry wells/sumps	No	
Oasis Property Owners Association	Bakersfield	80	36	Septic systems—low density [<1/acre]	No	Yes, (84) $1,500,000 Consolidation with East Niles CSD
Patio Village Mobilehome Park	Ceres	75	49	Injection wells/dry wells/sumps Septic systems—high density [>1/acre]	No	
Wilson Road Water Community	Bakersfield	72	19	Septic systems—low density [<1/acre]	No	Yes (84), $97,000 Regional project to consolidate with East Niles CSD
Beef Packers	Fresno	950		Wastewater treatment plants	No	
Akin Water Co.	Akin	50	22	Known Contaminant Plumes Septic systems—high density [>1/acre]	Yes	Yes (84), $250,000 Consolidation to fix Nitrate exceedances
Beverly-Grand Mutual Water	Porterville	108	28	Septic systems—high density [>1/acre]	Yes	Yes (84) $2,500,000 Consolidation with Porterville to fix nitrate problem (50) $425,000 Source Water Consolidation

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Central Water Co.	Porterville	170	42	Automobile—Gas stations Chemical/petroleum processing/storage Historic gas stations Known Contaminant Plumes Septic systems—high density [>1/acre] Underground storage tanks—Confirmed leaking tanks	Yes	
East Wilson Road Water Company	Bakersfield	35	14	Septic systems—low density [<1/acre] Crops, irrigated [Berries, hops, mint, orchards, sod, greenhouses] Fertilizer/Pesticide/ Herbicide Application	Yes	Yes (84), $97,000 Regional project to consolidate with East Niles CSD
Edmundson Acres Water System	Arvin	550	84	Agricultural Drainage Septic systems—low density [<1/acre] Crops, irrigated [Berries, hops, mint, orchards, sod, greenhouses, Fertilizer/Pesticide/ Herbicide Application Housing—high density [>1 house/0.5 acres] Sewage sludge/biosolids application	Yes	
Enos Lane Public Utility District	Calder Corner	250	0	Grazing [> 5 large animals or equivalent per acre] Septic systems—low density [<1/acre]	Yes	Yes (84) $1,500,000 Consolidation with Vaughn Water Company

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Fairview Water Company, LLC	Bakersfield	100	49	Crops, irrigated [Berries, hops, mint, orchards, sod, greenhouses] Fertilizer/Pesticide/ Herbicide Application	Yes	
FCSA #32/Cantua Creek	Cantua Creek	230	35	Agricultural Drainage	Yes	
Fcwwd #42/Alluvial & Fancher	Clovis	257	103	Septic systems—low density [<1/acre]	Yes	
Harvest Moon Mutual Water Co	Rosedale	180	44	Septic systems—low density [<1/acre] Crops, irrigated [Berries, hops, mint, orchards, sod, greenhouses] Fertilizer/Pesticide/ Herbicide Application	Yes	
Josephina and Enrique Water System	McFarland	32	8	Septic systems—high density [>1/acre] Lagoons/liquid wastes Fertilizer/Pesticide/ Herbicide Application	Yes	
Lemon Cove Water Co	Lemon Cove	200	50	Known Contaminant Plumes	Yes	Yes (84). (2) Projects $1,000,000 and $250,000 Lemon Cove Safe Drinking Water Project and Feasibility Study To Find Clean Water Source for Lemon (50) $1,000,000 and $250,000 Safe Drinking Water Improvement Projects

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Monterey Park Tract Community Service District	Keyes	186	50	Animal Feeding Operations as defined in federal regulation 2 Concentrated Animal Feeding Operations [CAFOs] Septic systems—high density [>1/acre] Underground storage tanks—Confirmed leaking tanks	Yes	Yes (84), $400,000 Monterey Park Tract Safe Drinking Water Project (50) $1,426,000 Well Replacement Project
Norseman M.H.P.	Kingsburg	70	31	Known Contaminant Plumes	Yes	Yes (84) $180,000 Nitrate & radiological contamination project
Rainbird Valley Mutual Water Company	Weldon	188	83	Grazing [> 5 large animals or equivalent per acre] Septic systems—low density [<1/acre] Fertilizer/Pesticide/ Herbicide Application	Yes	
Rodriquez Labor Camp	Delano	110	35	Known Contaminant Plumes Septic systems—high density [>1/acre]	Yes	Yes (84), $500,00 Consolidation with Richgrove CSD (50) $532,000 Well replacement
San Joaquin Estates Mutual	Bakersfield	220	62	Grazing [> 5 large animals or equivalent per acre] Septic systems—low density [<1/acre]	Yes	Yes (84) $150,000 Regional consolidation project with East Niles CSD
Seventh Standard Mutual	Bakersfield	110	22	Other Animal operations Sewer collection systems	Yes	Yes (84) $400,000 Consolidation with Oildale MWC to correct nitrate problem

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Sierra Mutual Water Co	North Fork	39	15	Known Contaminant Plumes	Yes	Yes (84) $1,000,000 Sierra Breeze—Consolidation
Son Shine Properties	Edison	400	100	Septic systems—low density [<1/acre]	Yes	Yes (84) $1,500,000 Consolidation with Arvin CSD
Soults Mutual Water Co.	Tulare	100	36	Known Contaminant Plumes	Yes	Yes (84), $820,000 Safe Drinking water Project
Sunnyside Convalescent Hosp	Fresno	116	3	Known Contaminant Plumes	Yes	
Tooleville Water Co.	Exeter	300	75	Known Contaminant Plumes	Yes	Yes (50), $954,000 Source Water Consolidation (50) $2,000,000 Safe Drinking water Wheeling through Exeter
Traver Water LLC	Traver	500	180	Historic gas stations Known Contaminant Plumes Underground storage tanks—Confirmed leaking tanks	Yes	
Triple R Mutual Water Co.	Springville	400	130	Known Contaminant Plumes	Yes	
Valley View Estates Mutual Water Co	Keene	81	39	Septic systems—low density [<1/acre] Other Animal operations	Yes	Yes (84), $58,000 System high nitrate levels—need for new well
Westlake Village M H P	Visalia	350	139	Agricultural Drainage Sewer collection systems Wells—Agricultural/Irrigation	Yes	

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Wheeler Farms Headquarters	Saco	25	13	Pesticide/fertilizer/petroleum storage & transfer areas Septic systems—low density [<1/acre] Crops, irrigated [Berries, hops, mint, orchards, sod, greenhouses] Fertilizer/Pesticide/ Herbicide Application Crops, nonirrigated [e.g., Christmas trees, grains, grass seeds, hay]	Yes	Yes (84),$500,000 Treatment for arsenic and nitrate
Zonneveld Dairy	Laton	141	34	Animal Feeding Operations as defined in federal regulation 2 Concentrated Animal Feeding Operations [CAFOs]	Yes	
Charlies	Porterville	150	NA	Agricultural Drainage Septic systems—low density [<1/acre]	Yes	
El monte Village M H P	Dinuba	100	NA	Septic systems—high density [>1/acre]	Yes	
Fairmont School	Sanger	540	NA	Fertilizer/Pesticide/ Herbicide Application Wells—Agricultural/Irrigation	Yes	Yes (84), $158,000 Treatment to remove nitrate
Gleanings for the Hungry	Sultana	31	NA	Agricultural Drainage Fertilizer/Pesticide/ Herbicide Application	Yes	
Lake Success Mobile Lodge	Porterville	20	NA	Known Contaminant Plumes	Yes	Yes (84), $324,000 Nitrate exceeds MCL (50), $324,000 Well Replacement
Lemon Cove-Sequoia Camp	Lemon Cove	100	NA	Known Contaminant Plumes	Yes	

Small Drinking Water System Name 2005–2009 Nitrate MCL Exceedance (From Balazs 2008[72] and DPH)	City	Population	Connection	Type of Activity Most Vulnerable to Source (DPH) Associated with MCL exceedance	Agriculture PCA[73]	Proposition 84 or 50 Funding
Prince Mart	Lemon Cove	25	NA	Known Contaminant Plumes	Yes	
Sequoia Union School	Lemon Cove	400	NA	Known Contaminant Plumes	Yes	
Sierra View Jr Academy	Exeter	160	NA	Fertilizer/Pesticide/ Herbicide Application	Yes	
Styrotek	Delano	36	NA	Known Contaminant Plumes	Yes	
Sunnyside Union Elementary	Strathmore	550	NA	Agricultural Drainage Pesticide/fertilizer/petroleum storage & transfer areas Septic systems—low density [<1/acre] Wells—Agricultural/Irrigation	Yes	
Visalia-Fresno South Koa	Goshen	150	NA	Agricultural Drainage	Yes	
Waukena Market	Waukena	140	NA	Historic gas stations Known Contaminant Plumes Underground storage tanks—Confirmed leaking tanks	Yes	
Fairways Tract Mutual	Porterville	250	58	Sewer collection systems	Yes	
Watertek—Grandview Gardens	Porterville	350	102	Known Contaminant Plumes	Yes	Yes (84), $250,000 Nitrate contamination project
Lake Express Market	Porterville	25	NA	Automobile—Gas stations Chemical/petroleum processing/storage	Yes	

APPENDIX D

RECOMMENDED IRRIGATED LANDS REGULATORY PROGRAM SURFACE AND GROUNDWATER QUALITY MANAGEMENT PLAN REQUIREMENTS

APPENDIX D

Recommended Irrigated Lands Regulatory Program
Surface and Groundwater Quality Management Plan Requirements

Surface Water Quality Management Plan Requirements

The Surface Water Quality Management Plan (SQMP) prepared by third-party groups must include the following elements.

1. Identification of the watershed areas and associated parameters addressed by the management plan. For exceedances in a water body that is representative of other water bodies/watersheds, those areas represented by the water body monitored must be identified in the management plan.

2. A summary and assessment of the available water quality data for surface waters and parameters addressed by the management plan.

3. Identification of irrigated agriculture source(s)—general practice(s) or specific location(s)—that may be the cause of the water quality problem. If the potential sources are not known, a study design must be included to determine the source(s) or to eliminate agriculture as a potential source. Source identification can include more intensive sampling in the watershed or field studies to quantify the relevant waste discharge from irrigated lands. In lieu of conducting additional source analysis, the management plan can focus on ensuring that all growers are implementing practices that achieve BPTC for the parameter(s) of concern.

4. Identification of practices to address the constituents of concern. The practices that growers will implement must be identified, along with an estimate of their effectiveness or any limitations on the effectiveness of the practice. Practices identified may include those that are required by local, State, or federal law.

5. Evaluation of management practice effectiveness. The approach for determining the effectiveness of the management practices implemented must be described. Acceptable approaches include field studies of management practices at representative sites and modeling or assessment to associate the degree of management practice implementation to changes in water quality.

6. Description of outreach to growers. The strategy for informing growers of the water quality issues that need to be addressed and relevant management practices must be described. The outreach strategy must describe the methods that will be used to inform growers and how the effectiveness of the

outreach efforts will be evaluated. The third party may conduct outreach efforts or work with the assistance of the County Agricultural Commissioners, U.C. Cooperative Extension, Natural Resources Conservation Service, Resource Conservation District, or other appropriate groups or agencies.

7. Tracking of management practice implementation. The process for tracking implementation of management practices must be described. The process must include a description of how the information will be collected from growers; the type of information being collected; how the information will be verified[74]; and how the information will be reported.

8. Monitoring plan to track changes in water quality. A monitoring plan for the constituent(s) of concern must be prepared to determine whether the management plan is improving water quality. The monitoring plan may need to include other sites or different timing or frequency of sample collection to adequately assess the effectiveness of the management plan. The monitoring plan must include an associated Quality Assurance Project Plan, and the data must be submitted electronically in a format required by the Central Valley Water Board.

9. Schedules and milestones. Milestones and schedules must be described for the actions to be taken (e.g., outreach, management practice implementation), as well as for the anticipated improvements in water quality (e.g., milestones for reduced frequency of exceedance; anticipated date for achieving water quality objectives). The schedule for achieving compliance with water quality objectives must be consistent with any compliance dates established in the relevant water quality control plan.

If the SQMP addresses multiple exceedances of different types of wastes at multiple locations, a prioritization of the water quality problems to be addressed may be developed. The prioritization may include considerations such as extent, magnitude, and duration or be based on a design that assumes that resolution of one type of contaminant (such as sedimentation) may help resolve other types of measured exceedances (such as pesticides, toxicity, dissolved oxygen, and pH). The assumptions and prioritizations will be developed in coordination with the Central Valley Water Board and must be included as part of the management plan to be approved by the Executive Officer.

At least annually, the third party must prepare a report that summarizes the progress in implementing the management plan. At a minimum, the report must include: (1) a summary of the grower outreach conducted; (2) results from evaluation of management practice effectiveness; (3) a summary of the degree of implementation of management practices; (4) an assessment of the monitoring

[74] The intent of data verification is to provide confidence that the information being reported is accurate. This may include field visits to a subset of growers reporting their data or other methods to confirm data validity.

data collected; and (5) a summary of progress in meeting milestones and schedules and any recommendations for changes to the management plan.

The Executive Officer of the Central Valley Water Board must approve the management plan. Changes to the management plan may be implemented by the third party only after approval by the Executive Officer.
At the request of the third party or upon recommendation by the Central Valley Water Board, the Executive Officer may exempt a third party from the development of a management plan. Such an exemption may be issued only if sufficient evidence is provided indicating that the implementation of management practices by growers will not result in water quality improvements. The Executive Officer also may require the third party or its members to develop a management plan or to take additional actions if monitoring data or other information indicates that water quality may be jeopardized. The Executive Officer also may increase the monitoring requirements where monitoring results, pesticide use patterns, or other indicators suggest that the increase is warranted.

Groundwater Quality Management Plan Requirements

The groundwater quality management plan prepared by third-party groups must include the following elements.

1. Identification of the groundwater quality management areas and associated constituents of concern addressed by the management plan. For exceedances in a groundwater basin or aquifer that is representative of other basins/aquifers, those areas represented by the aquifer monitored must be identified in the management plan.

2. A summary and assessment of the available water quality data for the aquifers and parameters addressed by the management plan. Available data from existing groundwater quality programs can be used, including but not limited to the State Water Board's Groundwater Ambient Monitoring and Assessment, USGS, DPH, DPR, DWR, and local groundwater management programs.

3. Identification of irrigated agriculture source(s)—general practice(s) or specific location(s)—that may be the cause of the water quality problem. If the potential sources are not known, a study design must be included to determine the source(s) or to eliminate agriculture as a potential source. Source identification can include more intensive sampling in the relevant aquifer or field studies to quantify the relevant waste discharge from irrigated lands. In lieu of conducting additional source analysis, the management plan can focus on ensuring that all growers are implementing practices that achieve BPTC for the constituent(s) of concern.

4. Identification of practices to address the constituents of concern. The practices that growers will implement must be identified, along with an

estimate of their effectiveness or any limitations on the effectiveness of the practice. Practices identified may include those that are required by local, State, or federal law. Where an identified constituent of concern is a pesticide that is subject to DPR's groundwater protection program, the GQMP may refer to DPR's regulatory program for that pesticide and any requirements associated with the use of that pesticide.

5. Evaluation of management practice effectiveness. The approach for determining the effectiveness of the management practices implemented must be described. Acceptable approaches include field studies of management practices at representative sites and modeling or assessment to associate the degree of management practice implementation to changes in water quality.

6. Description of outreach to growers. The strategy for informing growers of the water quality issues that need to be addressed and relevant management practices must be described. The outreach strategy must describe the methods that will be used to inform growers and how the effectiveness of the outreach efforts will be evaluated. The third party may conduct outreach efforts or work with the assistance of the County Agricultural Commissioners, U.C. Cooperative Extension, Natural Resources Conservation Service, Resource Conservation District, or other appropriate groups or agencies.

7. Tracking of management practice implementation. The process for tracking implementation of management practices must be described. The process must include a description of how the information will be collected from growers, the type of information being collected, how the information will be verified[75], and how the information will be reported.

8. Monitoring plan to track changes in water quality. A monitoring plan for the constituent(s) of concern must be prepared to determine whether the management plan is improving water quality. The monitoring plan may need to include other sites or a different depth to groundwater (e.g., monitor first encountered groundwater versus supply wells) or frequency of sample collection to adequately assess the effectiveness of the management plan. Monitoring may include focused studies of selected agricultural management practices, constituents, or physical settings to inform refinement of GMA and constituent prioritization, or of practices that provide needed groundwater protection from degradation by constituents of concern. The monitoring plan must include an associated Quality Assurance Project Plan, and the data must be submitted electronically in a format required by the Central Valley Water Board.

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[75] The intent of data verification is to provide confidence that the information being reported is accurate. This may include field visits to a subset of growers reporting their data or other methods to confirm data validity.

9. Schedules and milestones. Milestones and schedules must be described for the actions to be taken (e.g., outreach, management practice implementation), as well as for the anticipated improvements in water quality (e.g., milestones for declining trends in concentrations of constituents of concern). The schedule for achieving compliance with water quality objectives must be consistent with any compliance dates established in the relevant water quality control plan.

The GQMP would not include or address issues related to groundwater supply, including issues regarding the volume of groundwater pumped or used by growers within a GMA.

If the GQMP addresses exceedances in multiple aquifers or for multiple constituents of concern, a prioritization of the water quality problems to be addressed may be developed. The prioritization may include considerations such as the threat to drinking water supply wells, aquifer condition; risk of contamination because of soil type, known agricultural practices/crops grown, and likelihood of irrigated agricultural contribution to the water quality problem. The assumptions and prioritizations will be developed in coordination with the Central Valley Water Board and must be included as part of the management plan to be approved by the Executive Officer.

At least annually, the third party must prepare a report that summarizes the progress in implementing the management plan. At a minimum, the report must include: (1) a summary of the grower outreach conducted; (2) results from evaluation of management practice effectiveness; (3) a summary of the degree of implementation of management practices; (4) an assessment of the monitoring data collected; and (5) a summary of progress in meeting milestones and schedules and any recommendations for changes to the management plan.

The GQMP may rely wholly or in part on a local groundwater plan to the extent that plan includes the required elements described above. The Executive Officer of the Central Valley Water Board must approve the GQMP, including any elements of the plan that rely on an existing local groundwater plan. Changes to the management plan may be implemented by the third party only after approval by the Executive Officer.

At the request of the third party or upon recommendation by the Central Valley Water Board, the Executive Officer may exempt a third party from the development of a management plan. Such an exemption may be issued only if sufficient evidence is provided indicating that the implementation of management practices by growers will not result in water quality improvements. The Executive Officer also may require the third party or its members to develop a management plan or to take additional actions if monitoring data or other information indicates that water quality may be jeopardized. The Executive Officer also may increase the monitoring requirements where monitoring results, pesticide use patterns, or other indicators suggest that the increase is warranted.

Individual FWQMP Requirements

At a minimum, plans would describe those practices needed or currently in use to achieve ground and surface water quality protection. Growers would be encouraged to work with technical service organizations such as resource conservation districts and the University of California Cooperative Extension in the development of FWQMPs.

FWQMP content at a minimum would include (1) name and contact information of owner/operator; (2) description of operations, including number of irrigated acres, crop types, and chemical/fertilizer application rates and practices; (3) maps showing the location of irrigated production areas, discharge points and named water bodies; (4) applicable information on water quality management practices used to achieve general ranch/farm management objectives and reduce or eliminate discharge of waste to ground and surface waters; (5) measures instituted to comply with California Code of Regulations, Title 3, Section 6609 requirements for wellhead protection (from pesticide contamination) along with methods for wellhead protection from fertilizer use; and 6) identification of any potential conduits to groundwater aquifers on the property (e.g., active, inactive, or abandoned wells; dry wells; recharge basins; ponds) and steps taken, or to be taken, to ensure all identified potential conduits do not carry contamination to groundwater.

In addition to the minimum elements described above, the Executive Officer may require ground or surface water quality monitoring to evaluate the effectiveness of the practices implemented by the grower. Any such monitoring requirements will be issued as an order under 13267 of the CWC.